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**WHY ARE WE FAILING IN EFFECTIVE KNOWLEDGE
MANAGEMENT? A CASE STUDY OF AN
INTERNATIONAL IT ORGANIZATION**



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ABSTRACT

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Why are we failing in effective knowledge management? A case study of an international IT organization

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Knowledge is considered to be one of the most important individual resources for organizations in knowledge-intensive fields such as software development. Organizations possess knowledge in form of expertise, skills, and specialized knowledge that can be used to create a competitive advantage in today's highly competitive markets. However, possessed knowledge still needs to be managed and applied correctly to provide any kind of benefit for the organization. A common view among practitioners seems to be that both knowledge sharing and knowledge management are regarded as extremely important. Interestingly, this perception of importance is not reflected in practice as organizations are failing to benefit from possessed knowledge. This tendency leads to issues such as poor cooperation, low work efficiency, and the loss of valuable knowledge with departing employees.

This thesis suggests that it is crucial to identify the reasons behind this gap. The main objective of this thesis is to identify hindering factors that can prevent or discourage individuals from effectively sharing and managing knowledge. Furthermore, the thesis strives to understand how the effects of these hindering factors can be lowered or even eliminated in practice.

As this study is looking into a specific phenomenon, an interpretive case study was selected as the research method to provide an understanding of a topic with very limited prior literature. Empirical data was collected through semi-structured group interviews in an international large IT organization where several employees from different teams and positions were interviewed.

This study confirms that there is a gap between the perceived importance of knowledge management and how little it is reflected in practice. Multiple hindering factors were identified that can explain this observed gap. These factors are grouped into personal social topics, organizational social topics, technical topics, environmental topics, and interrelated social and technical topics. Social factors were notably more common than technical or environmental ones, indicating that most often issues with effective knowledge sharing and management originate from human values, motivations, decisions, and habits. Presented recommendations for easing or eliminating these hindering factors are thus focused on improving employees' actions for example by offering training and guidelines to follow.

Keywords: knowledge, knowledge management, knowledge sharing, hindering factors, software development, distributed teams

TIIVISTELMÄ

Koivisto, Kalle

Miksi emme onnistu tehokkaassa tiedonhallinnassa? Tapaustutkimus kansainvälisessä IT organisaatiossa.

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Tietoa pidetään yhtenä tärkeimmistä yksittäisistä organisaatioiden resursseista tietointensiivisillä aloilla, kuten ohjelmistokehityksessä. Organisaatioiden tietämys esiintyy monessa muodossa kuten asiantuntemuksena, taitona, ja erikoisosaamisena, joilla voidaan luoda kilpailuetua suhteessa muihin. Tätä tietämystä täytyy kuitenkin pystyä hallitsemaan ja soveltamaan oikein, jotta siitä olisi mitään hyötyä organisaatiolle. Ammatinharjoittajien keskuudessa näyttää vallitsevan yleinen näkemys, että sekä tietämyksen jakamista ja hallintaa pidetään erittäin tärkeänä. Mielenkiintoista tässä on se, että tämä käsitys tärkeydestä ei heijastu käytännössä; organisaatiot eivät osaa hyötyä omistamastaan tietämyksestä. Tämä taipumus johtaa ongelmiin, kuten heikkoon yhteistyöhön, työn tehottomuuteen, ja arvokkaan tietämyksen menettämiseen.

Tämä tutkimus esittää, että syyt tutkimusaukon takana täytyy tunnistaa. Tutkimuksen tärkeimpänä tavoitteena on tunnistaa haitallisia tekijöitä, jotka voivat estää tai lannistaa yksilöitä jakamasta ja hallitsemasta tietämystä tehokkaasti. Lisäksi tutkimuksessa pyritään ymmärtämään, kuinka näiden haitallisten tekijöiden vaikutuksia voidaan käytännössä vähentää tai jopa poistaa.

Tutkimuksen tarkastellessa tiettyä ilmiötä, tutkimusmenetelmäksi valittiin tulkitseva tapaustutkimus, joka mahdollistaa sellaisten aiheiden ymmärtämisen, joista ei ole huomattavaa aiempaa kirjallisuutta. Empiirinen data kerättiin puolistrukturoiduilla ryhmähaastatteluilla, jossa haastateltavat edustivat useita tiimejä ja tehtäviä.

Tämä tutkimus vahvistaa, että koetun tiedonhallinnan tärkeyden ja sen käytäntöön heijastumisen välillä on aukko osoittaen käytännön keinojen vähäisen realisoitumisen. Useita haitallisia tekijöitä tunnistettiin, jotka voivat olla kyseisen aukon aiheutumisen takana. Kyseiset löydetyt tekijät on ryhmitelty henkilökohtaisiin sosiaalisiin aiheisiin, organisaation sosiaalisiin aiheisiin, teknisiin aiheisiin, ympäristöön liittyviin aiheisiin, sekä yhteen kietoutuneisiin sosiaalisiin ja teknisiin aiheisiin. Sosiaaliset tekijät olivat huomattavasti yleisempiä kuin tekniset tai ympäristöön liittyvät tekijät, mikä osoittaa, että useimmiten ongelmat tiedon hallitsemisessa ja jakamisessa johtuvat inhimillisistä arvoista, motiiveista, päätöksistä, ja tavoista. Esitetyt suositukset näiden haitallisten tekijöiden lieventämiseksi tai poistamiseksi keskittyvät lähinnä työntekijöiden toiminnan parantamiseen esimerkiksi tarjoamalla koulutusta ja ohjenuoria.

Asiasanat: tieto, tiedonhallinta, tiedon jakaminen, estävät tekijät, ohjelmistokehitys, hajautetut tiimit

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1 INTRODUCTION

Organizations' most important strategic resource in today's highly competitive environment is knowledge and the ability to transfer it well (Ružić & Benazić, 2021). Managing knowledge effectively enables organizations to avoid mistakes and redundancy (Rafiq & Ahmed, 2006), increase organizational performance and effectiveness, strengthen their ability to match customer needs (Kim & Lee, 2006), and gain competitive advantage (Hume & Hume, 2015). Managing knowledge effectively – the most important strategic resource – is a prerequisite to competing in today's markets and should thus be carefully studied and understood both by practitioners and researchers.

As a knowledge-intensive intellectual activity, software development is one of the fields where knowledge is the single most important resource influencing both the success and performance of IT teams and organizations (Ryan & O'Connor, 2009, 2013). Knowledge management literature has emphasized that it is knowledge sharing that enables organizations to develop a competitive advantage and enhance employees' capacity to innovate creative solutions (Jackson et al., 2006). In fact, it's the individual's knowledge-sharing behavior that helps organizations to make quick decisions that are effective and resilient during crises to keep the organization operational at all times (Wang & Noe, 2010). Considering that the individual's choice and behavior with knowledge can define a big part of how well an organization is performing, researchers should focus their efforts in understanding the reasons behind these choices and behavior whether they are promoting knowledge sharing or hindering it.

Practical observations and conversations with employees and managers in an international IT organization worrying about the effectiveness of knowledge management motivated a more thorough look into the topic. Knowledge management was considered very important but for some reason, this perception was not reflected in practice. Several explanations were given, but it was evident that a more systematic approach to the topic would be required. This thesis is the result of this more systematic inquiry into the topic.

Prior research has mostly focused on investigating the most common challenges in knowledge management and best practices to meet these challenges.

These existing challenges and practices are widely documented and explained but it seems that much less attention, if at all, has been paid to understanding why these practices are not being implemented, integrated, and used effectively. What hinders or prevents individuals, teams, and organizations to use these identified practices effectively? Prior research confirms that software development organizations and their employees do perceive the benefits and importance of knowledge management and sharing, yet their efforts to share and manage knowledge effectively are poorly planned, inconsistent, and often of poor quality (Dingsøyr et al., 2009; Aurum et al., 2008; Prikladnicki et al., 2003). This thesis argues that factors preventing and hindering effective knowledge management need to be identified so that this phenomenon can properly be addressed. Merely listing possible practices to improve knowledge management efforts will do no good to anyone, if they are not being implemented and used effectively. Understanding and identifying the reasons for this situation are crucial because the only way to address the situation properly is to understand the underlying factors that are hindering individuals from effectively sharing, acquiring, applying, and managing knowledge.

The aim of this thesis is to address the discovered gap through an interpretive case study where the data is collected by conducting semi-structured group interviews. 22 teams in total were included to capture data from all the possible functions within the case organization. The goal is to discover, identify, and understand any possible factors that might hinder or prevent the adoption of already documented knowledge management practices and thus effective knowledge management. This thesis focuses on knowledge being shared and managed within and between teams related to software development. This thesis also attempts to provide a few recommendations on how to address the identified hindering factors. These two objectives are reflected in the research questions this thesis attempts to answer:

1. Which factors hinder and complicate knowledge sharing and knowledge management within and between globally distributed cross-functional teams?
2. What kind of measures can be taken to solve hindering factors in knowledge sharing and knowledge management within and between globally distributed cross-functional teams?

Following the introduction, chapter 2 acquaints the reader with the concept and types of knowledge, knowledge management, and known challenges and practices in knowledge management. Next, in chapter 3, the methodology of this study and data collection is presented together with the case description. In chapter 4 the results based on empirical data are introduced briefly and further discussed in chapter 5. Finally, in the conclusion of the thesis, chapter 6 ponders possible limitations and provides suggestions on future research topics.

2 THEORETICAL BACKGROUND

2.1 Knowledge

Knowledge is a difficult word to define and still to this day there's no one dominant definition of the word. Knowledge is the key concept in this thesis and thus needs to be defined and separated from other concepts that are often mixed with knowledge in different contexts. This chapter first focuses on defining data, information, and knowledge and providing a picture of their interconnected relationships and how knowledge differs from the other concepts. After highlighting the concept and definition of knowledge this chapter focuses on the different types of knowledge that previous literature has pointed out.

2.1.1 Data, information, and knowledge

Data, information, and knowledge have been studied in many different contexts, both together and one by one. In some cases, it's argued that the words can be used as synonyms depending on the context and point of view. At the very least, these concepts are interrelated, and thus focusing on only one of them calls for a brief discussion on the relationship and differences between these concepts, especially in the business context.

Cambridge dictionary offers brief definitions of data, information, and knowledge in business English. Data is defined as: "*information, especially facts and numbers, collected to be examined and considered and used to help with making decisions*" (Dictionary.cambridge.org, 2022). Even in this definition of data, the word information is used which indicates the high interrelationship between the concepts. Information, in turn, is defined as: "*facts or details about a person, company, product, etc.*" and knowledge is defined in business English as: "*skill in, understanding of, or information about something, which a person gets by experience or study*" (Cambridge.dictionary.org, 2022). Based on these basic definitions, it seems that the concept of information is the one connecting these three concepts together. This

doesn't mean that knowledge should be confused as mere information or data. To be able to distinguish these concepts as separate ones a more thorough examination is needed. Figure 1 presents the relationship between these three concepts.

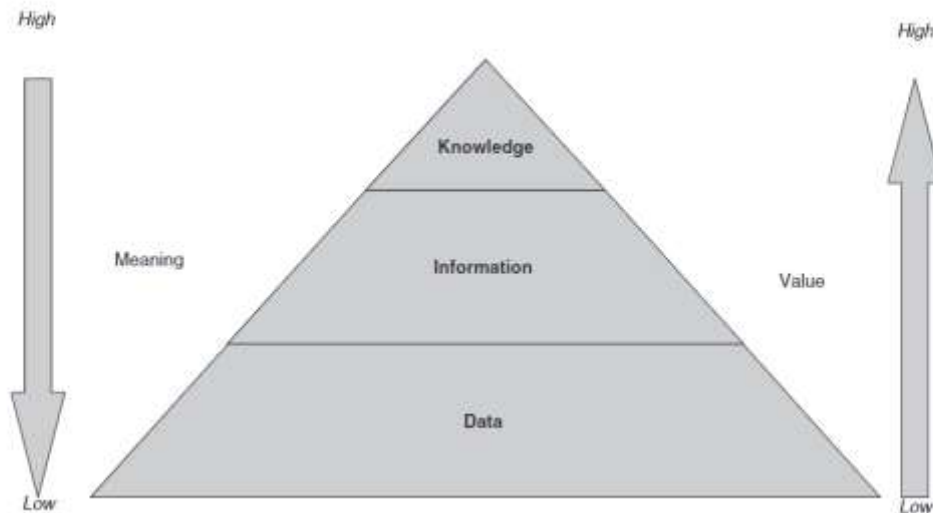


Figure 1 The relationship between data, information, and knowledge (adapted from Chaffey & Wood, 2005)

In Figure 1, data is presented at the bottom of the triangle as it usually offers the base for the concepts above it. Data being the largest block in this figure also illustrates the relationship of quantity compared to other concepts presented. Data was previously defined as facts that are collected for different reasons, but Rowley (2007) offers a complementary definition for data to be either observations or facts that are without discipline and processing, meaning that data by itself cannot express any meaning or explanation. However, data was defined by using the word information earlier indicating a strong relationship. Both Rowley (2007) and Braganza (2004) agree that data can be processed from mere observations or facts without the discipline to create information, which means that information can thus be seen as descriptions or deductions of data, giving context to the data. The relationship between knowledge and information is intriguing as well. The figure illustrates how one can only achieve knowledge through the information that is processed from the data. Knowledge is seen as a combination of data and information that utilizes skills, experiences, understanding, and expert opinions and thus enables predictive decision-making and the possibility to guide actions (Rowley, 2007; Donate & Sánchez, 2015; Siltaoja, 2014). Rather than just transferring information, knowledge is about using information creatively and thus requires elaboration (Braganza, 2004; Siltaoja, 2014).

However, conveying and benefitting from knowledge requires certain capabilities from both sides, the recipient, and the donor. Chaffey and Wood (2005) state that as the meaning of the data, information, or knowledge is high, so is the value of it. Knowledge has the highest value out of the three concepts, but it also has the highest meaning. To achieve that higher meaning and thus higher value,

the recipient needs to be capable of embracing and interpreting the information because information itself being data-based description of the knowledge is not sufficient to convey guidance (Braganza, 2004). Sarvary (1999) highlighted that knowledge is information with casual links that help to understand that information. Those casual links can be created by the recipient's own experience and study, or they can be elaborated on and explained by the donor of the information. Either way, eventually knowledge is formed from the information that is reflected against one's personal experience, expert opinion, skills, and understanding. For the purposes of this study, drawn from the previously presented explanations, knowledge is considered to be a specialized way of using attained information for one's benefit through the skills, understanding, experience, and expertise possessed.

2.1.2 Types of knowledge

Although knowledge was defined for the purposes of this thesis rather simply as one concept, there are several types of knowledge that are included into this definition provided. Acknowledging the differences and discerning the types of knowledge is crucial because it enables us to deepen our understanding on the potential effects of knowledge sharing drivers (Hau et al., 2013). In literature, knowledge is predominately divided into two different types: tacit and explicit knowledge. Tacit knowledge was first introduced as a concept by Polanyi (1966) several decades ago. Originally tacit knowledge was simply defined as knowledge that cannot be explained or communicated to others. This idea was based on the assumption that we are able to know more about something than we can talk about. A good example of this is driving a car, since it's impossible to just tell someone all about it because it needs to be experienced first-hand to actually learn how to drive a car. Like in this example, even when trying to explain everything, some parts will not be communicated or shared (Polanyi, 1966.) Tacit knowledge has later been described as an individual having intangible factors like one's personal values, beliefs, perspectives, and behavior embedded (Gao et al., 2018; Rowley, 2007; Boiral, 2002).

The knowledge that can be communicated in a tangible form like documents, training courses, company policies, and reports is called explicit knowledge (Chion et al., 2019; Gao et al., 2018; Nonaka & Takeuchi, 1995). Explicit knowledge can be codified and recorded, it can be expressed in formal language and usually is a bit more general compared to tacit knowledge which usually focuses on a specific context (Nonaka & Takeuchi, 1995). Although recording and codifying knowledge is seen as valuable, there are also contradicting opinions on the worth of codifying knowledge. Our need to produce explicit knowledge comes from our desire to share and apply knowledge better (Farhadi & Rezaee, 2017; Preuss & Córdoba-Pachon, 2009; Boiral, 2002;). Boiral (2002) raises a concern about codifying knowledge as it often requires expenditures and might even lead to unnecessary documentation. However, multiple studies over the years have proved that pursuing knowledge is a key factor in gaining a competitive advantage (Braganza, 2004; Farhadi & Rezaee, 2017; Siltaoja, 2014)

lowering the risk to use time and money for knowledge documentation efforts. Still being a genuine concern companies will need to balance between providing competitive advantage through explicit knowledge and codifying redundant knowledge.

Stenberg et al. (2000) conducted extensive research on tacit knowledge and concluded that tacit knowledge is rather the knowledge of how than the knowledge of what. It usually is acquired through personal experiences and is strongly related to some kind of action, thus being very practical and useful. Many times, we can acquire tacit knowledge without even recognizing it. Stenberg et al. (2000) observed that people might be learning things while doing normal activities and are not even aware of what they have learned. This can best be described as learning by doing. Our ability to learn through experiences and apply what we have learned is a prime example of tacit knowledge and illustrates why tacit knowledge is seen as so valuable in business. Because tacit knowledge is most often acquired through personal experiences, it is extremely hard to copy or imitate and hence can provide a considerable competitive advantage. (Stenberg et al., 2000.)

Polanyi (1966) originally stated that tacit knowledge cannot be articulated, but this view has been challenged over the years by multiple researchers. Still to this day, many researchers are agreeing with Polanyi's (1966) original view, but others believe that at least parts of tacit knowledge can be communicated and articulated (Nonaka & Takeuchi, 1995; Stenberg et al., 2000; Ryan & O'Connor, 2009, 2013; Busch, et al., 2003;) These researchers have proposed a concept between tacit knowledge and explicit knowledge. Ryan and O'Connor (2009; 2013) named this concept as implicit knowledge which describes the parts of tacit knowledge that can be communicated and articulated. In the context of this thesis, implicit knowledge is considered as the part of tacit knowledge that can be communicated and articulated and any references to tacit knowledge will refer to implicit knowledge in this thesis because this study focuses on knowledge that can be communicated, articulated, and thus shared with others. The term tacit knowledge will be used instead of implicit knowledge because of its familiarity and more frequent use in prior literature.

The concept of implicit knowledge is also supported by the well-known SECI model by Nonaka (1994), also known as knowledge conversion, which illustrates knowledge creation and transfer. This model was initiated from Nonaka's claim that organizational knowledge stems from the constant interaction of tacit and explicit knowledge. These interactions are divided into four modes presented in Figure 2.

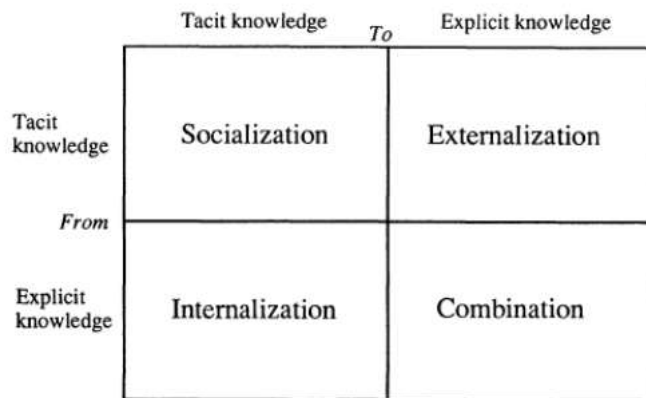


Figure 2 Modes of knowledge creation (Nonaka, 1994; Nonaka & Takeuchi, 1995)

In this model, Nonaka and Takeuchi (1995) call tacit-to-tacit flow socialization, tacit-to-explicit flow externalization, explicit-to-explicit flow a combination, and explicit-to-tacit flow internalization. Mathrani and Edwards (2020) elaborated a bit more on what the different modes mean in practice. Socialization refers to sympathized knowledge, externalization refers to conceptual knowledge, a combination refers to systemic knowledge and internalization refers to operational knowledge (Mathrani & Edwards, 2020). Notable here is that Nonaka and Takeuchi (1995) suggest that it is indeed possible to transfer tacit knowledge to explicit knowledge (externalization) and vice versa (internalization), indicating that implicit knowledge can be regarded as a type of knowledge.

2.2 Knowledge management

Any existing knowledge won't do any good to any company without proper management of it. Managing knowledge enables the sharing and applying of knowledge in the right environment and setting. This chapter provides the current view on the importance of managing knowledge, especially in software development companies, and what role knowledge sharing has in it. Also, individual motivations to share knowledge with others are discussed. Knowledge management and sharing practices will be discussed in a later chapter and in more detail.

2.2.1 The importance of managing knowledge

Knowledge or intellectual capital is the main element of successful software development organizations (Rus & Lindvall, 2002). In today's competitive environment, knowledge is the main strategic resource that needs to be protected and if transferred successfully and correctly it provides countless benefits to companies (Ružić & Benazić, 2021). Effective transfer of knowledge can ensure benefits such as avoiding mistakes and redundancy (Ahmed & Rafiq, 2006), strengthening

entrepreneurial orientation (DeClerq et al., 2013), and gaining competitive advantage (Hume & Hume, 2015). In addition to these examples, it reduces the time to market (Ahmed & Rafiq, 2006), affect organizational effectiveness and performance as well as strengthens the ability to meet customer needs (Kim & Lee, 2006).

However, as stated above, knowledge needs to be correctly handled to provide any benefits to companies. Choi et al. (2010) observed to their amazement that the mere existence of knowledge or even knowledge sharing is not affecting team performance in any positive way unless it is somehow effectively applied. This need to somehow manage knowledge to one's benefit has been at the forefront of many management studies and prior research agrees that the effective and efficient management of knowledge for organizational performance is a relevant and accepted issue (Andreeva & Kianto, 2012).

Knowledge management typically is divided into two sides: knowledge processes and capabilities or management activities that support the processes. Knowledge processes consist of knowledge creation, acquisition, transfer, sharing, and application whereas knowledge management practices support the effective and efficient use of knowledge for organizational benefit. (Lee and Choi, 2003; Gold et al., 2001.) These knowledge processes like knowledge sharing, naturally exist in organizations and are thus out of direct executive or managerial control. These processes can paint a knowledge-based picture of the organization but don't give answers on how to improve those processes. In order to draw value from and understand how to improve these processes effective knowledge management practices have to be in place. (Andreeva & Kianto, 2012.) Alavi and Tiwana (2002) emphasized that nowadays it's not about how much the organizations know but how well they use what they know in the long run.

In software development tasks are done in teams and the teams have a big responsibility in strengthening the knowledge processes while being supported by the management activities. Team members learn from each experience and project but if they keep that new knowledge or understanding to themselves the team and the organization will miss an opportunity to benefit from that (Rus & Lindvall, 2002). To uncover those possibilities, it's pivotal that team members have the opportunity to coordinate that knowledge (Faraj & Sproull, 2000). This need to coordinate is highlighted with knowledge workers like software developers because working with intangible products and services requires special kinds of skills and expertise (Ryan & O'Connor, 2009), and thus the teams need to realize where this expertise is found (experiences of other team members) and where it is then required (Faraj & Sproull, 2000). Sharing knowledge within the team is especially important because it is seen as the most important source of knowledge for each team member. This is because knowledge received from a colleague is more likely to be relevant for that environment and usually is more attainable than information from other sources. (Aurum et al., 2008.)

2.2.2 Knowledge sharing

Managing knowledge according to Gooijer (2000) is an organizational tool to achieve goals through acquiring, creating, integrating, and sharing information, wisdom, inductions, insights, experiences, and thoughts of all members. Knowledge sharing is just one of those factors mentioned but sharing knowledge is particularly important in the context of software development. Jackson et al. (2006) noted that prior literature has suggested for years that knowledge sharing enhances the employees' capabilities and helps organizations to create a competitive advantage. Aurum et al. (2008) argued that software development teams have to work in a cross-functional environment, and because of this situation, effective knowledge sharing between them is a crucial success factor.

Knowledge sharing is defined by Bartol and Sirvastra (2003) as: "the process of transferring explicit knowledge to the other members of the organization". As proven before, more valuable tacit knowledge can be codified into explicit knowledge so in this context sharing knowledge means every kind of knowledge that can be reasonably shared with another person. Even though team members have the most influential role in knowledge sharing within their team and across other teams, managers can have an enabling effect on this matter. Bailey and Clark (2008) emphasized that a manager's responsibility in knowledge management is to improve knowledge sharing between team members, teams, and across the whole organization.

Lin (2008) provided a model where three factors were named to have an effect on knowledge sharing. The first factor is the organizational structure including its complexity and the centralization of employees. The second factor is the organizational culture which consists of but is not limited to supportive, innovative, creative, and bureaucratic cultures. The third factor is the interaction between other departments. Abili et al. (2011) suggested in their study that power should be given to the lower levels of the organization because centralization in the organization prevents effective knowledge sharing. This hints that effective knowledge sharing happens when employees have the necessary power to avoid centralization and can thus more freely share knowledge. Abili et al. (2011) also suggested knowledge sharing is only possible when a knowledge culture in the organization has been created. They claim that culture is the key factor in knowledge sharing and cultural values affect knowledge sharing tremendously. Values mentioned in their study are creativity, trust, execution, and coordination. They propose that by improving those values organizations can use knowledge sharing to boost their performance. (Abili et al., 2011.)

2.2.3 Motivations behind knowledge sharing

Although knowledge sharing is recognized as a pivotal knowledge process, it is quite often a rarity in organizations rather than a common occurrence. Bock et al. (2005) stated that we are not prone to share knowledge which leads to thinking of ways to support individuals' intentions to share knowledge. Szulanski (1996) stated that there are multiple studies that have found out that knowledge sharing

is in fact the opposite of natural behavior and thus needs to be somehow promoted to make it happen. Motivation has been identified as the key role in explaining one's intention to share knowledge (Gressgård, 2015). Prior research has recognized several motivational drivers that affect our willingness and intention to share knowledge, even if we are not naturally prone to do so. This chapter briefly discusses these drivers.

In a systematic literature review supported by qualitative interviews Bock et al. (2005) identified three categories of knowledge-sharing drivers that influence an individual's motivation to share knowledge. The three introduced categories are economic, social-psychological, and sociological where the economic category refers to anticipated extrinsic rewards, the social-psychological category refers to a sense of self-worth and anticipated reciprocal relationships, and the sociological category refers to innovativeness, affiliation, and fairness. In the middle of those categories is the subjective norm which describes the individual's subjective feeling on how much others are expecting the individual to share knowledge. The outcome and results of this study are presented in Figure 3. (Bock et al., 2005.)

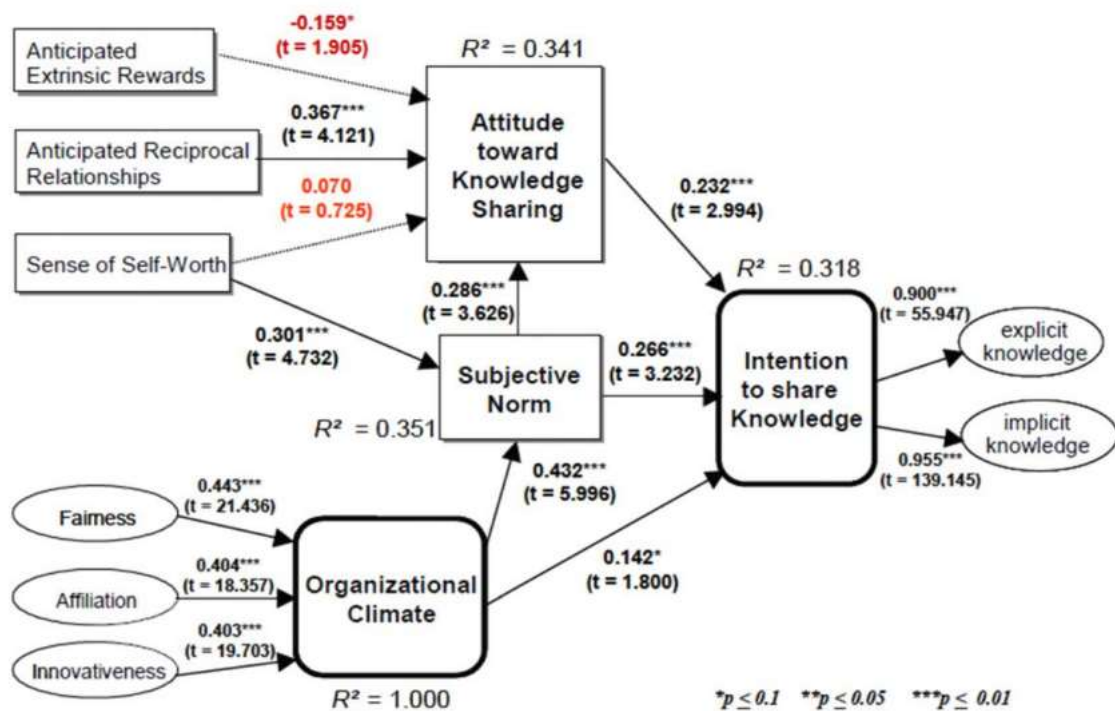


Figure 3 Knowledge sharing drivers (Bock et al., 2005)

The first driver, the economic driver, introduced as anticipated extrinsic rewards refer to an individual's expectations to get some kind of reward in return for their knowledge sharing. These rewarding strategies can be both tangible with one-off rewards and bonuses or intangible with recognition, status, and

career progression (Scarborough, 2003; Aurum et al., 2008). Thus, these rewards can be either monetary or non-monetary (Husted and Michailova, 2002). These rewards and incentives are usually granted to the knowledge provider by the organization's reward system as an external reward based on the knowledge exchange between the employee and employer (Seba et al., 2012).

Getting people to share their knowledge through reward mechanisms has been debated with mixed arguments. Some researchers claim that knowledge sharing must be reflected in rewarding mechanisms or knowledge sharing is very unlikely to happen in organizations and that these extrinsic incentives motivate knowledge sharing (Husted and Michailova, 2002; Kankanhalli et al., 2005; Hansen et al., 1999; Severinov, 2001; Bonner et al., 2000; Kwok & Gao, 2005; O'Dell & Grayson, 1998). Kulkarni et al. (2007) proposed that the best way to encourage knowledge sharing is through multiple types of incentives, which has been the common opinion on the matter. Aurum et al. (2008) doubted the long-term effects of rewarding, especially monetary rewarding, but noted that non-monetary career progression was proved to be a strong motivator for knowledge sharing. Other studies have reported that extrinsic incentives have no effect on an individual's knowledge-sharing intentions (Hung et al., 2011a; Seba et al., 2012; Lin, 2007). A third group of research states that these incentives can have negative effects on knowledge sharing (Hau & Kim, 2011; Bock & Kim, 2002; Bock et al., 2005). In their study, Bock et al. (2005) offered multiple explanations for this observation. Different views on appropriate rewards, the temporary nature of rewards, and the negative impact on one's intrinsic motivation were discovered in previous studies. Their paper suggested that extrinsic rewards should not be promoted as the main motivational driver to encourage knowledge sharing. (Bock et al., 2005.) Instead, communicating knowledge-sharing practices, building better relationships, and developing learning capabilities would be a better way to go about it (Szulanski, 1996).

Social-psychological drivers like anticipated reciprocal relationships and a sense of self-worth can be included under the umbrella of intrinsic motivational factors. Research has concluded that intrinsic motivation has a positive influence on knowledge sharing (Kim & Han, 2009; Vera-Munoz et al., 2006; Cynthia & Sage, 2006; Wasko & Faraj, 2000). Hau et al. (2013) described intrinsically motivated employees comprehensively. These kinds of employees feel enjoyment and pleasure in being involved with knowledge sharing and these feelings stem from within of the knowledge provider. It is like an internal stimulus based on the exchange relationship between the knowledge provider and his own ego. They concluded that this represents a psychological driver like pleasure in knowledge sharing. (Hau et al., 2013.)

Maintaining and improving relationships with knowledge-sharing activities (anticipated reciprocal relationships) was detected to have the greatest effect on one's attitude towards knowledge-sharing (Bock et al., 2005). Aurum et al. (2008) detected that some employees were motivated to participate in knowledge-sharing activities because they wanted to help others be more effective and avoid frustration among employees. They would anticipate that this

behavior could lead to closer relationships and a better working environment (Aurum et al., 2008). Similarly, Lin (2007) found that employees' personal enjoyment in helping others had an extensive effect on intentions and attitudes toward knowledge sharing.

Bock et al. (2005) also raised the sense of self-worth to be a big influence on knowledge-sharing intentions. Rather than focusing on helping others and feeling good about it, self-worth refers to an individual's personal feeling of how valuable and useful one is or can be when participating in knowledge-sharing activities (Bock et al., 2005). Hung et al. (2011b) suggested that knowledge-sharing intentions can at least in part be explained by intrinsic motivation and a healthy sense of self-worth. This sense also has a positive effect on the subjective norm because this supports behavior where the one possessing knowledge beneficial for others, will most likely share it and is expected to do so (Bock et al., 2005).

The sociological category representing the organizational climate had also interesting influences on both subjective norms and the intention to share knowledge. Three separate factors in organizational climate were raised: innovativeness, affiliation, and fairness. Innovativeness refers to tolerance to mistakes and failures of new efforts and that changes and creativity are supported. Affiliation refers to one's feeling of belonging with colleagues and to the organization. Fairness refers to an environment of trust which was the most influential factor in organizational climate. Organizational climate factors proved to have a strong influence on the subjective norm meaning that they are both expected and supported in the organization. Interestingly, the organizational climate had a much weaker influence on intentions to share knowledge than it had on the subjective norm. (Bock et al., 2005.) One possible explanation for this is that motivation is one of the strongest influences on any intention, and organizational climate doesn't directly influence one's motivation (Vera-Munoz, Ho & Chow, 2006).

Knowledge sharing needs to be promoted through employees' motivations, it cannot be forced or mandated by management. Any knowledge-sharing initiatives won't do any good before the organization emphasizes enhancing social relationships, supporting internal communities, and providing appropriate feedback to invoke knowledge-sharing culture within peers. The organization's responsibility is to empower the facilitating factors around knowledge sharing and use surfacing motivational drivers to promote effective knowledge sharing. (Bock et al., 2005.)

2.3 Distributed teams in software development

Due to the current way of working, advances in technology, and increasing globalization physical collaboration and geographical proximity within teams are not as important as they were before. Working in virtual teams distributed to

different locations around the world is now a much more feasible option for organizations, but it requires efficient management to actually produce value and realize potential benefits (Desouza et al., 2006; Griffith et al., 2003).

Virtual teams and distributed working models within teams are being used for multiple reasons. Several organizations are trying to lower their cost by hiring from markets with a lower cost of labor (Boden et al., 2009; Prikladnicki et al., 2003; Ebert & De Neve, 2001). In some instances and situations, it is highly beneficial or even crucial to be culturally or geographically close to the customers which motivates organizations to distribute the workforce closer to customers in increasingly globalizing markets (Ebert & De Neve, 2001; Damian & Moitra, 2006). Ebert and De Neve (2001) also suggested that professionals from different cultures and educational backgrounds working together might lead to new innovations and improved problem-solving capabilities. Acquisition of qualified, professional workers is increasingly difficult in today's world and thus organizations deal with this shortage of labor by accessing a global pool of professionals through distributed and virtual teams (Battin et al., 2001; Herbsleb & Moitra, 2001).

Although there seems to be a large variety of expected and anticipated benefits, there are also multiple constraining factors that come along with distributed working models. These factors can negatively influence the anticipated benefits or even completely overcome them if not taken care of. Alawi and Tiwana (2002) stated that even though needed knowledge might be existing somewhere within the team, the physical distance between team members causes challenges in the accessibility of knowledge because it is harder to distribute and utilize that knowledge. Desouza et al. (2006) pointed out that knowledge workers don't work in isolation and their projects require them to integrate and coordinate multiple knowledge sources under budgetary and resource restraints and severe time pressure. These issues become more salient in global software development efforts where best practices, expertise, ideas, and insights – the requisite knowledge – are spread across different locations. Without a robust knowledge management system this leads to issues such as delays in knowledge transfer, poor integration procedures for knowledge synthesis, and inability to seek out relevant knowledge. There's also a risk of reinventing the wheel if knowledge is not found quickly enough from a repository or from close contacts. (Desouza et al., 2006.) Based on these factors Ebert and De Neve (2001) have suggested that organizations should not form virtual teams but rather collocated teams and relocate experts from other countries as long as possible.

Several software developing organizations develop software in projects which causes slightly different challenges. Project management institute (2008) has defined a project as a "temporary endeavor incorporating the work of heterogeneous professionals undertaken to create a unique product, service or result." The temporary nature of projects creates issues in effective knowledge sharing and integration not only within projects but between them as well. The challenge is to avoid repeating past mistakes and reinventing the wheel. (Pemsel & Wiewiora, 2013.) In other words, one of the main objectives for project-based

organizations is to capture and capitalize on what has been learned from each project and use that knowledge for constant improvement (Almeida & Soares, 2014). Trying to achieve this objective has proven to be very difficult and there are multiple obstacles in capturing and reusing organization-wide knowledge (Jackson & Klobas, 2008). Project workers are often working under severe time pressure and are quickly recruited into the next project which leads to situations where project workers are rarely able to undertake a systematic review of the finished project and document any experiences or learned lessons from the project (Ajmal & Koskinen, 2008).

2.3.1 Distances

Besides the physical geographical distance between teams and individuals mentioned in the previous section, there are also socio-cultural and temporal distances between cooperating colleagues that can create challenges in daily work. These distances can hinder collaboration, communication, and coordination. Ensuring that all the team members in a dispersed team share a common understanding of the work is the ultimate challenge to focus on. (Ågerfalk et al., 2005; Carmel & Agarwal, 2001.)

Geographical distance means the physical distance between colleagues (Ågerfalk et al., 2005; Carmel & Agarwal, 2001). In their study Koskinen et al. (2003) noticed that knowledge was considerably easier to share through conversations, and trying to motivate workers to write down potentially valuable knowledge for later was extremely difficult. Physical distance also would prevent direct and immediate feedback so that common understanding could be checked, interpretations could be corrected, and the number of misinterpretations could be lowered. (Koskinen et al., 2003.) Ågerfalk et al. (2005) claim that overcoming the negative consequences of physical distance is a matter of reliable ICT. Expanding on the idea of physical distance, they proposed that it's not only the distance in kilometres but rather how challenging it will be to get from site A to site B. Factors that influence this can include travel time, border crossings, visa requirements, and transportation options. (Ågerfalk et al., 2005.)

Socio-cultural distance refers to factors that separate colleagues for example in work ethics, values, culture, and language (Ågerfalk et al., 2005; Carmel & Agarwal, 2001). Klitmøller and Lauring (2013) observed during their case study that differences in language and culture can create major misunderstandings and issues. They studied a Danish company that had outsourced some of its operations to India. They noted that different slang was used about the products and operations in the two different countries which caused misunderstandings. Cultural differences in working mentality also caused confusion because Danes would always prefer to finish any given task immediately whereas Indians would add the task to the bottom of their to-do list. (Klitmøller & Lauring, 2013.)

Temporal distance refers to the dislocation of co-workers in terms of time. Especially due to different time zones and/or work habits. (Ågerfalk et al., 2005; Carmel & Agarwal, 2001.) Time zone differences are a significant hindering factor and have been well-known for quite some time. Ågerfalk et al. (2005) also note

that co-workers in close time zones (+/- 2 hours) can have difficulties having multiple common hours in a day to communicate and cooperate synchronously. There might be differences in lunch break timing, the usual time to start a workday, and the usual time to end a workday. (Ågerfalk et al., 2005.)

2.3.2 Knowledge sharing in and between distributed teams

Tacit knowledge is most likely shared through informal social interactions like ad hoc discussions and observations on-site which is a luxury that distributed teams don't often have. This limited amount of direct social interaction discourages knowledge-sharing intentions and abilities – especially tacit knowledge-sharing. (Ryan & O'Connor, 2009; Griffith et al., 2003.) Bias to prefer local knowledge sharing might also put remote site colleagues in an unequal position where they are left in the dark in terms of tacit knowledge (Taweel et al., 2009; Herbsleb et al., 2001).

On-site teams mostly share tacit knowledge with each other and they do so via social interactions while working together side-by-side whereas distributed and virtual teams tend to be depending on explicit knowledge which is shared through technological means (Griffith et al., 2003). Andreeva and Kianto (2012) highlighted that a mere ICT system is not enough to ensure that people will use it for the benefit of the organization and thus the system needs to be coupled with a motivational push and guidance on usage. Creating new knowledge in virtual teams is reduced by the fact that social interactions are limited and the means to convey that knowledge are limited to current ICT systems. Mohrman et al. (2002) described the relationship between ICT systems in knowledge management accurately: *“it is behaviors, not IT systems, that generate new knowledge, apply it in new settings, embed it in improved processes, yield shared meanings and common knowledge, and underpin the ability of the organization to derive value from knowledge”*. Understandably, when colleagues' behavior is limited in any way – like not being able to interact face-to-face on a regular basis – knowledge sharing is also limited. Virtual team members have to transform tacit knowledge into explicit knowledge so that it could better be stored and transmitted (Griffith et al., 2003). This transformation of knowledge can cause risks to the validity and reliability of knowledge.

However, this situation with virtual teams can create a positive outcome. Transforming tacit knowledge into explicit knowledge and using IT solutions to overcome knowledge distribution issues can lead to the creation of permanent repositories which contain easily accessible knowledge. It is suggested that despite the challenges linked with distributed work, extensive use of IT systems to distribute knowledge and transform tacit knowledge into explicit knowledge has possible benefits. (Griffith et al., 2003.) Transferring knowledge from one team to another creates an additional challenge because it's a different scenario than sharing knowledge within just one team (Szulanski, 1996). Like having a different language between colleagues creates communication issues and additional work to explain what was meant, transferring knowledge from one team to another with different functions might require additional work to explain a certain piece

of knowledge (Klitmøller & Lauring, 2013). For example, the sales team might not understand the technical vocabulary used by the development or testing team which creates communication issues and requires additional work to have a common understanding.

2.4 Knowledge sharing challenges

As illustrated above, knowledge management and knowledge sharing are complex themes with multiple possible challenges. These challenges are emphasized in globally distributed software development as knowledge is distributed across different locations (Desouza et al., 2006). The potential challenges of global software development have been acknowledged ever since globally distributed software development was accepted as a popular approach (Herbsleb et al., 2001). Wendling et al. (2013) reminded us that knowledge-sharing challenges should be carefully considered if organizations want to successfully utilize the workforce around the world. The following sections below will introduce key challenges in knowledge management and sharing in organizations that have been identified by prior research on the topic.

2.4.1 Communication challenges

Communication in teams and between teams is usually separated into local and remote communication. Local communication can be in a form of face-to-face interaction whereas remote communication solely relies on ICT systems (Ågerfalk et al., 2005). Taweel et al. (2009) found that the geographical distribution of the teams negatively influences the teams' knowledge. This was because the information that would normally be exchanged during informal local interactions wasn't successfully distributed to remote team members or teams in general. (Taweel et al., 2009). No matter if communication is local or remote, internal communication has to be the first priority for organizations looking for productivity (Mazzei, 2010). Differences in culture and language also strongly influence knowledge-sharing efficiency. Face-to-face interaction enables the use of non-verbal signals and the moving and touching of objects which clarifies the communication between colleagues with different cultural and lingual backgrounds. (Klitmøller & Lauring, 2013.)

Herbsleb et al. (2001) found that in distributed teams communication was more frequent and usual with local colleagues than with remote colleagues because local communication was perceived to be more effective. Lack of remote communication can lead to weakened communication within or between teams which can be a threat to realizing the possible benefits of distributed working models. This doesn't only concern global distances, but even small distances between team members or teams can significantly affect the quality of communication. (Herbsleb & Moitra, 2001.) Sometimes in local communication, but especially in remote communication, knowing whom to contact and knowing how to

reach certain individuals in time through official communication channels can be extremely difficult (Herbsleb et al., 2001) and its difficulty increases when the person looking for that information is a rookie or novice (Desouza et al., 2006). These findings indicate that gaps between the different parts of distributed teams can cause issues with social relationships and mutual trust.

2.4.2 Documentation challenges

Gunnlaugsdottir (2003) provided a view that information only becomes knowledge when it is put into an understandable and logical context that we can recall from our personal experience or when it meets the need to solve a problem. This view would be consistent with the fact that transforming tacit knowledge into explicit knowledge is crucial. Explicit knowledge can be presented in different kinds of documents through the codification of knowledge. Acknowledging that virtual teams are strongly depending on explicit knowledge (Griffith et al., 2003), this knowledge should carefully be documented and stored somewhere where it can be (re)used and accessed by other employees of the organization. This should mainly be done using the “people-to-document” approach where knowledge is provided and made independent by the one who has the knowledge in question so that others can use that knowledge for different purposes. This kind of approach enables other employees to search and retrieve documented, codified knowledge themselves and don’t need to contact the person who originally stored the information. (Hansen et al., 1999.)

Given the fact that virtual teams and organizations must rely so much on explicit knowledge, there’s a need for a centralized platform or repository because without one it would be extremely difficult to search, find, and retrieve knowledge for further use (Almeida & Soares, 2014). The most common way to handle this is to have a knowledge management system (KMS) which is a technology-supported information system that enables the documentation, distribution, and transfer of explicit and tacit knowledge between employees (Voelpel et al., 2005; Noe et al., 2003). KMSs are meant to provide a way for the organization to better utilize internal knowledge resources and transfer that into competitive advantage but there are some factors that could hinder the productivity of such a system implemented (Aurum et al., 2008).

During the software development cycle, knowledge evolves constantly. Knowledge in repositories thus has to be kept up-to-date, especially in distributed software development, to avoid incorrect assumptions and misunderstandings (Herbsleb & Moitra, 2001). This constant revisioning and updating could be taken care of by setting up processes to do so, but Aurum et al. (2008) pointed out that updating the already existing knowledge can be seen as difficult and thus might not be given a high priority by the organization. Markus (2001) found that the experience of those who look for information affects their perception of the KMS and thus not having this repository up-to-date might then lead to lower quality content and trust issues in the KMS, which in turn becomes a discouraging factor for the individual, team, or organization as a whole to share knowledge with others.

This would be incredibly challenging for the novice members of the teams because they are the ones that most often rely on knowledge from the KMS there should be no need to question the reliability of the source and it doesn't require assistance from other employees. (Desouza et al., 2006.) More experienced employees are less likely to search for knowledge from a KMS but are more likely to store and share internalized knowledge there (Ko & Dennis, 2004). This might also explain why novice team members prefer to rely on the KMS. However, sometimes it might be difficult to understand or identify outdated information or even be overwhelmed because of the amount of knowledge available (Desouza et al., 2006). It might also be challenging to understand because it might also be challenging for the knowledge provider to explain certain pieces of knowledge. These issues might drive employees to prefer the public internet as the main knowledge source, instead of the organization's KMS. (Aurum et al., 2008.)

Storing the knowledge to a system doesn't bring the wanted benefits from KMS. These benefits can only be realized if the shared knowledge is then retrieved and applied by others. If the knowledge is not retrieved or cannot be retrieved and is only stored in a repository, that repository might become an information graveyard which means that information stored there will quickly become obsolete (Dingsøyr & Smite, 2013; Dingsøyr et al., 2009; Prikladnicki et al., 2003). Systems' usability issues and design flaws can prevent the retrieval of information from the KMS. Multiple studies have also found that several KMSs are either missing or have an insufficient search function which is vital for locating wanted information from large repositories (Manteli et al., 2011; Dingsøyr & Smite, 2013; Aurum et al., 2008).

2.4.3 Employee turnover challenges

The current IT job market is fiercely competitive at the moment and has been for a while now. IT organizations are constantly looking for and going after capable professionals, which on the other hand means that organizations are having challenges to keep their own professionals within the organization. Even though this migration of capable workforce is increasingly more common and natural, it causes some issues for organizations. Rus and Lindvall (2002) pointed out that when an employee leaves the organization, not only the human resource is lost, but also all the skills, experiences, expertise, and knowledge they possessed. Leaving employees, especially the experts in their domain, often leave a gap of knowledge that requires others in the organization to take more responsibility (Taweel et al., 2009). Even when a new highly capable professional is hired to fill that gap with experience in the same technology, that person still needs to learn the context and domain knowledge only attainable through experiences, and all that time spent learning is the time taken away from the actual profitable work (Battin et al., 2001).

This issue however is not just in the field of IT nor is it a recent one. Davenport and Prusak (1998) wrote a book about knowledge and knowledge management where they introduced some known international companies that were having the previously described issue. They proposed that employees with

valuable knowledge leaving the organization created a higher interest in knowledge and knowledge management because organizations only realized the value of that employee's knowledge once, they were gone and the consequences of that were left to deal with. (Davenport & Prusak, 1998.)

2.4.4 Organizational challenges

The organization itself, the procedures, and its management of it can also cause some challenges. Aurum et al. (2008) perceived that there are multiple studies that have raised the importance of organizational culture in relation to knowledge sharing and management. For example, Lee and Choi (2003) observed that a lot of organizations lack adequate metrics to measure the success of knowledge management initiatives. This illustrates a lack of effective knowledge management culture on their behalf. Besides the responsibility of creating a fitting culture for knowledge management, organizations have to be able to establish protocols for knowledge-related activities because each project, product, service, and the team is different and unique and thus knowledge relevant to one project, site, or team can be applied in other settings without any loss of knowledge (Desouza et al., 2006).

The size of the organization is also an important factor that influences the effectiveness of knowledge management activities in and between teams (Connelly & Kelloway, 2003). Wu and Chiu (2015) point out that the size of the organization can be a moderator that influences the organization's IT competency and performance, which in turn can influence the effectiveness of knowledge-sharing initiatives. Size can create structural inertia and break down interpersonal relationships and communication channels which notably limits individuals' capability to participate in knowledge sharing (Forés & Camisón, 2016; Bontis et al., 2007). Leiblein and Madsen (2009) suggest that as organizations grow, they develop formal structures, administrative systems, values, and norms that just slow their capabilities to recognize the changing conditions and adjust to them.

A recent challenge in global software development affecting the documentation of knowledge is the tendency to develop software using Agile methodologies. Agile methodology itself is not the problem but it does encourage team members to share knowledge by interacting with others directly instead of documenting that knowledge (Beck et al., 2001) which proves to be a challenge for virtual teams that cannot interact the same way as local teams can. This can cause outdated documents to be stored in a repository and an uneven concentration of knowledge to be located where most of the team members or the most important team members are (Manteli et al., 2011).

2.4.5 Social challenges

Social relationships between colleagues are extremely important to both sides of knowledge transfer. Strong relationships encourage positive knowledge-sharing behavior (Wendling et al., 2013; Alavi & Tiwana, 2002) and help the receiver to absorb knowledge better (Wendling et al., 2013). Nonaka (1994) perceived that

social interactions are necessary for successful tacit knowledge sharing. This is in line with the social capital theory which suggests that employees' own willingness to share knowledge is affected by social capital (Nahapiet & Ghoshal, 1998). The reason for this is that workers tend to share their knowledge when those social interactions are friendly and close (Hau et al., 2013). However, Wendling et al. (2013) suggest that a strong emphasis on relationships in knowledge management can be limiting for colleagues with weak relationships if this emphasis is not supported by other means.

In distributed software development, these social interactions are harder to organize, and thus infrequent interactions can only result in weak relationships between colleagues (Alavi & Tiwana, 2002) which in turn discourages knowledge transfer (Szulanski, 1996). In some instances, global software development organizations implement offshore arrangements which contribute to a few issues regarding knowledge management. These arrangements might inflict fear and resistance in people because they can perceive their remote colleagues as threats because they might feel that they could lose control or even their position. This tendency occurs more often with remote colleagues from countries where the cost of labor is cheaper. (Herbsleb & Moitra, 2001.) Even with the fear of losing their jobs, the "expensive" workers might have to train or are forced to train their remote colleagues representing that very threat, which creates controversy (Ebert & De Neve, 2001). Battin et al. (2001) also argued that on top of these challenges, offshoring arrangements could cause trust issues regarding the competence of those remote colleagues.

Szulanski (1996) stated that certain individuals don't want to share any knowledge because they are afraid of losing their superior position, privileges related to that position, and the ownership of that knowledge. Where the previously mentioned issues mostly happened with remote colleagues that usually have weak relationships with locals, this particular issue can occur with local colleagues that have a strong relationship with the individual. Even if sharing knowledge doesn't pose a threat to one's position in the organization but poses a threat to just those benefits one is enjoying, it might be enough for one to hold out on sharing their knowledge with others. (Szulanski, 1996.) Even strong relationships and frequent social interaction with colleagues cannot ensure the willingness to share one's knowledge but they can be very helpful factors.

2.4.6 Technical challenges

Information and communication technology (ICT) has a pivotal role in the communication and collaboration of distributed teams especially because of the lack of face-to-face interactions (Wendling et al., 2013; Griffith et al., 2003). Even though ICT systems are a major enabler in global software development, technological challenges can be seen as knowledge-sharing barriers (Lekhawipat et al., 2018). During the first years of global software development efforts organizations would suffer from network connection issues (Herbsleb & Moitra, 2001), but these issues are mostly dealt with thanks to recent advances in technology. Even with these developments, merely an effective ICT solution is not enough to

ensure successful knowledge sharing and management but is best achieved through a socio-technical approach to knowledge management (Pan and Scarbrough, 1998; Meso and Smith, 2000; Bhatt, 2001). Dedrick et al. (2003) suggested that to benefit fully from IT investments, complementary management practices like human resource management is needed. This indicates that even the most complete ICT systems would be useless without proper behavior from the ones using the systems.

Effective ICT systems intended for knowledge work have to be carefully planned and have multiple aspects considered. Hasanali (2002) listed some key aspects to consider when planning an ICT system for knowledge management purposes. The focus should be on building common and easy-to-use platforms, giving enough training to users, concentrating on user needs, giving sustainable maintenance to the system, and focusing on both tacit and explicit knowledge management. (Hasanali, 2002.) This highlights the fact that both social and technological aspects need to be considered.

Previous research has concluded that employees' use of IT applications is a crucial factor in their knowledge-sharing efficacy (Kim & Lee, 2006). Riege (2005) supports this by suggesting that the inappropriate use of technology can lead to reluctance to use technology at all. Studying technological barriers to knowledge sharing Lekhawipat et al. (2018) concluded that these technological barriers have a definite influence on the perceived low ability and perceived lack of effort, which indicates the absolute importance of technology in providing the needed motivation for an individual to participate in knowledge sharing. In other words, all the above-mentioned barriers can influence the employee's motivation to engage in knowledge sharing whether it is locally or remotely.

2.5 Knowledge-sharing practices

As noted in the previous chapter there are and have been multiple knowledge-sharing challenges over the years and they have resulted in multiple emerged practices to address those challenges. Szulanski (1996) stated that if knowledge sharing requires ad hoc solutions and cannot be routinely handled, it is perceived as too difficult. Having effective practices to ensure knowledge-sharing in organizations might enhance knowledge-sharing activity and reduce the perceived difficulty (Szulanski, 1996). This chapter introduces several knowledge-sharing and management practices from previous studies. The purpose of this chapter is not to provide an extensive list of all known knowledge-sharing practices but to introduce some of the common practices. It is acknowledged that all introduced practices are not applicable in all situations, environments, or organizations due to differences in methodologies, team arrangements, and individual employees for example.

2.5.1 Agile methodologies

Agile methodologies were mentioned in an earlier chapter as a potential problem-causing factor for knowledge sharing. A common argument about agile methodologies is that it prohibits documentation, which is not completely true. Agile methodologies place less emphasis on documentation, but documentation is still created and maintained when the team sees it as suitable. (Dorairaj et al., 2012.) Despite this guideline, adopting agile methodologies can also bring knowledge-sharing benefits to organizations, and thus following agile methodologies are seen as a known knowledge-sharing practice. In *the Manifesto for Agile Software Development*, the importance of interactions and individuals is emphasized (Beck et al., 2001) which would speak in favor of local teams when it comes to software development. Ryan and O'Connor (2009) found that social interactions were an excellent way to share tacit knowledge, which in turn positively influences team performance. This indicates that following agile methodologies can be a good knowledge-sharing practice if the situation and environment enable social interactions between teams and team members.

2.5.2 Communication practices and tools

In distributed teams, communication has to be done mostly through technological means. As remote working has increased, different communication tools have become increasingly popular. One of these communication channels is audio and video conferencing. This type of tool is generally used in distributed software development for coordinating work, holding regular meetings, and discussing ideas and proposals. Studies have noticed that we prefer textual communication over audio when we deal with simple, repetitive matters, but are more likely to have audio involved when we are discussing more complex topics. (Niinimäki et al., 2010.) It is notably faster to discuss an idea with someone for 15 minutes than trying to read a written document for 50 minutes and trying to internalize the content (Almeida & Soares, 2014). However, using audio or video conferencing tools in one-to-one discussions can be perceived as intrusive, and thus quite inefficient unless the case is urgent and necessary to deal between two people. Video conferencing tools also enable the presenter to share their screen which has been proven beneficial in different customer settings and pieces of training for example. (Niinimäki et al., 2010.)

Another widely used communication channel that has already been used for years is email and mailing lists. Compared to other means of communication, emailing has a much more formal appearance and nature. Email can also be used as a permanent storage location for different documents and communication. (Manteli et al., 2011; Niinimäki et al., 2010.)

Nowadays one of the most used communication channels used by distributed teams is an instant messaging tool, more commonly known as the chat (Wendling et al., 2013; Manteli et al., 2011; Niinimäki et al., 2010). Research has found several factors that explain the popularity of chat in distributed settings. Chat tools can be used easily to make quick decisions on simple matters.

Compared to email, chat is perceived as a much more efficient tool because of its informality. In more formal communication we consider grammar rules, spelling mistakes, etc., whereas in more informal interactions those things are not limiting our communication. (Niinimäki et al., 2010.) Manteli et al. (2011) conducted a case study where a chat tool was introduced in the case environment. The introduction of a chat tool was perceived as a remarkable improvement in communication because it allowed employees to see when remote colleagues were available and interaction between colleagues was faster (Manteli et al., 2011).

Niinimäki et al. (2010) focused their study on how communication practices and tools can help in overcoming distances in globally distributed software development. They highlighted the importance of communication tools and processes fitting the team and project in question both socially and technically. They recommended there would be mutually agreed terms and rules for used tools. These would include agreements on where to store information long-term, being available for communication when at work, logging in to the chat tool in place when working, response time for emails, and how a tool is used, and for what purpose. (Niinimäki et al., 2010.)

2.5.3 Informal meetings and sessions

As we have stated earlier, tacit knowledge is most likely efficiently gained through experiences (Polanyi, 1966; Stenberg et al., 2000). These experiences are not easy to gain and thus one of the best ways to do so is to learn by performing various daily activities (Stenberg et al., 2000). Aurum et al. (2008) detected that practitioners also recognize the learning-by-doing method as one of the most common sources of knowledge for them. As this has been identified as one of the best methods to acquire knowledge, several practices have been invented to replicate this learning by doing. To simulate learning by doing organizations are encouraging practitioners to seek novel assignments, be mentored by experienced colleagues, assign specific tasks, and enable job rotation (Stenberg et al., 2000).

Another setting for acquiring knowledge from team members and colleagues is team meetings. During these meetings team members can be allowed to discuss future progress together, give advice to each other, present new ideas and proposals, and help each other in problem-solving. This creates an ideal setting for informal discussions and casual knowledge transfer between colleagues. Besides team meetings, formal training can contribute to knowledge transfer as well. However, formal training can be seen as irrelevant if the content of the training cannot be directly applied to one's daily work. (Aurum et al., 2008.)

Besides informal team meetings and formal training, some organizations have organized info sessions that are led by experts in their own fields. These experts share their experiences and knowledge about interesting topics. Through these kinds of sessions, organizations can support informal communication, facilitate knowledge sharing, and discover knowledge networks. (Aurum et al., 2008.) A similar type of expert info session was observed by Dorairaj et al. (2012) where an agile coach shared his technical expertise with an audience. It was

noted that storing presentation material in a knowledge management system for later re-examination was extremely beneficial (Dorairaj et al., 2012).

2.5.4 ICT practices in knowledge management

Alavi and Leidner (2001) proposed that the application of ICT can create an environment and infrastructure that contributes to knowledge management by supporting and augmenting a variety of knowledge processes. The concept of a knowledge management system (KMS) is widely mentioned in different knowledge-related studies and is considered a basic tool for organizations to enhance their knowledge management processes (Alavi & Tiwana, 2002; Aurum et al., 2008; Dingsøy & Smite, 2013; Dorairaj et al., 2012; Prikladnicki et al., 2003; Taweel et al., 2009). The reason for this is most likely the fact that knowledge management systems draw on flexible ICT capabilities that extend beyond the traditional storage and retrieval of knowledge, thus enabling various forms of knowledge management support (Alavi & Leidner, 2001). IT organizations seem to prefer wiki-based knowledge management systems where knowledge can be stored in an organized way with comprehensive search capability and document versioning (Dorairaj et al., 2012; Taweel et al., 2009). Recently, arguably because of the worldwide pandemic, digital platforms like knowledge management systems have increased their importance even in local teams. Because of the recent pandemic most of the internal and external knowledge sharing was dependent on digital platforms and is now as relevant as ever in knowledge management practices. (Tønnessen, Dhir & Flåten, 2021.)

ICT contributes to knowledge management in several ways. First, ICT supports the creation of knowledge by combining fresh sources of information as well as by decreasing the time delay of knowledge-sharing between colleagues which facilitates organizational learning. Second, ICT provides a platform for valuable knowledge that the organization has gained. It also provides assistance in storing and retrieving that knowledge efficiently. Third, ICT supports knowledge sharing by offering more communication channels, which is especially important for distributed teams. And finally, ICT assists knowledge application by merging knowledge into routines and habits within the organization. (Alavi & Leidner, 2001.)

Investing in the mere existence of KMS is not going to be enough. Aurum et al. (2008) recommended that knowledge repositories should be kept relevant and updated as well as possible. Maintaining the updated state of any knowledge repository requires investments in resources and the design of the system. Paying attention to the design of the system and its maintenance of it facilitates efficient knowledge sharing and helps to avoid known issues such as turning the knowledge repository into an information graveyard because of the lack of use (Dingsøy & Smite, 2013).

2.5.5 Onboarding and training practices

Employee turnover was previously mentioned in the chapter dealing with knowledge management issues. This is a very common challenge that many organizations face especially in the IT sector. When experienced workers or experts leave the company, they are very often replaced by individuals that have less experience and a lot of knowledge to be acquired especially at the start of the new employment (Rus & Lindvall, 2002). The start of the new employment very often contains an onboarding process where the new employee is given the necessary skills and knowledge to be able to become a productive member of the organization. Documented knowledge, usually in some sort of KMS, is also widely used and highly beneficial for new employees because they are able to access a lot of information at once (Dorairaj et al., 2012; Taweel et al., 2009) from a location that is perceived as reliable (Desouza et al., 2006).

One possible part of this onboarding process can be mentoring. Mentoring can of course be implemented later on in the employment as well, but it is common to start mentoring from the beginning of one's employment. Mentoring as a practice means having an expert supporting and assisting less experienced colleagues by sharing their expertise and knowledge. Bjørnson and Dingsøyr (2005) were focusing on improving a case company's mentoring program and discovered that the existing mentoring in the organization has been perceived very positively. Employees regarded the mentoring program as very important because they perceived many benefits from it: the possibility to create new relationships, have consultation on solving problems, and effective competence transfer. Employees thought that every new employee should automatically be offered to have someone as their mentor at the start of employment and the mentors, on the other hand, should voluntarily accept that role if needed. Accepting this role as a mentor would then allow that person to have allocated time for mentoring. Before the study, the existing mentoring program mostly focused on helping with practical issues rather than having discussions and reflections. The researchers claimed that to improve the learning effect, the mentors should focus on discussing and reflecting with the "student" rather than giving direct answers to practical issues. Mentors were encouraged to ask open-ended questions and being proactive to support the students' individual thinking and learning process. (Bjørnson & Dingsøyr, 2005.)

2.5.6 Organizational practices

Organizations' management plays a crucial role in the success of organization-wide knowledge management practices. Several studies have reported that current knowledge management practices are not sufficient. Prikładnicki et al. (2003) studied two organizations that were both missing a consistent and formal knowledge management process causing notable challenges in knowledge sharing. Dingsøyr et al. (2009) conducted a survey where the current situation of knowledge management was compared to the targeted future situation and

found that practitioners see a lot of room for improvements in knowledge management practices.

Successful knowledge management in the global arena requires a concerted global knowledge management strategy (Desouza et al., 2006). Witherspoon et al. (2013) suggested that this strategy should be built upon attitudes and intentions, rewards, and organizational culture. Interestingly, they also proposed that gender could be taken into consideration as well when considering knowledge sharing (Witherspoon et al., 2013). Many knowledge management practices have been structured around the above-mentioned factors.

Based on Szulanski (1996), attitudes and intentions toward knowledge sharing can be positively affected by routines and guidance that lower the perceived difficulty of the knowledge-sharing process. Lowering the perceived difficulty is key because it has been found that knowledge sharing within organizations is dependent on individuals' behaviour (Bock et al., 2005) and their ability to share knowledge (Gressgard, 2015). Managers can also lower the perceived difficulty of knowledge sharing by making sure that proper knowledge management activities are included in daily processes and that appropriate tools are available for knowledge sharing. This ensures that knowledge management is not just a side activity done by a few diligent individuals but motivates all team members to be a part of knowledge management activities. (Aurum et al., 2008.)

According to Aurum et al. (2008) promoting knowledge-sharing practices and thus creating a knowledge-sharing culture is considered crucial in software development organizations. Szulanski (1996) pointed out that the organizational environment influences the initiation, implementation, and outcomes of knowledge transfer and thus needs to be considered when creating and maintaining organizational knowledge-sharing culture. By investing in appropriate tools and practices, organizations can encourage knowledge sharing and reduce perceived obstacles to knowledge sharing (Prikladnicki et al., 2003).

In some instances, and situations, a general knowledge management process model is not enough. Different projects or teams might have their own processes for knowledge management for convenience. Aurum et al. (2008) actually suggest that each project and team should have its own knowledge management process. In the formation of this process model, teams should recognize knowledge management needs, barriers, and challenges and then define what is shared where, and how it is shared (Dingsøyr & Smite, 2013). Whether it's a dedicated role in the team responsible for knowledge management or the responsibility is shared evenly with all the team members to manage their own knowledge, it is pivotal that the responsibility is clearly stated and understood by all involved (Aurum et al., 2008).

2.5.7 Social practices

The same social practices promoting local knowledge sharing, like informal discussions with colleagues, are the ones that make global knowledge management challenging (Desouza et al., 2006). Kotlarsky and Oshri (2005) studied if social ties and knowledge sharing in global software development teams support

collaboration. Social ties referred to trust and rapport whereas knowledge sharing referred to collective knowledge and transactive memory in this study. Not much attention was paid to the social aspects of globally distributed collaboration or its influence on coordination when the study was initially conducted. Most of the existing solutions at the time were technical by nature rather than social. Researchers claimed that collaboration could be improved in globally distributed software development teams through knowledge sharing and social ties. They suggested that organizations should support and help in the creation of social ties between team members distributed globally and use necessary resources to ensure that the human aspects of collaboration are addressed. (Kotlarsky & Oshri, 2005.)

Generally speaking, frequent interactions and communication are necessary for successful collaboration in any team, especially in globally distributed ones. Dorairaj et al. (2012) stated that team members' daily collaboration promotes knowledge creation. They also found that physical visits and face-to-face interaction with colleagues promote knowledge sharing between team members (Dorairaj et al., 2012). Organizations with distributed teams might use short visits to remote sites to promote social interactions on-site (Boden et al., 2009) but others might avoid that kind of traveling because of the time and money it takes (Battin et al., 2001).

Globally distributed teams might experience cultural and lingual issues as well as a lack of trust in the professional qualities of a remote colleague. These issues can be addressed by more frequent interactions, like team meetings. (Battin et al., 2001.) Ebert and De Neve (2001) suggest that international teams and rotating management responsibilities across remote sites are other means to build common trust and understanding with colleagues. Battin et al. (2001) observed in their study how a case company had implemented social practices in their processes. Software engineers were relocated to the main site for a few months to participate in planning activities, learn the system in place, and build relationships with main site colleagues. In this case project these liaisons (software engineers) were identified as key success factors to transfer knowledge between the sites and colleagues. (Battin et al., 2001.)

2.6 Summary of the theoretical background

Chapter 2 introduced important concepts and terms for this study and provided a theoretical background comprised of prior literature. The following empirical research is motivated by and founded upon the theoretical background presented above. Definitions of data, information, and knowledge were discussed and clarified in the context of this study. It was decided that knowledge is considered the specific use of attained information for one's benefit. Different types of knowledge were introduced and discussed. The definition of tacit knowledge has created controversy regarding whether tacit knowledge can be communicated and transferred to another person. This study decided to focus on forms of

knowledge that can be communicated whether tacit, implicit, or explicit. Then, the importance of managing knowledge was explained, highlighting the pivotal role of knowledge sharing in the practice of knowledge management. Motivations for knowledge sharing were reviewed through knowledge-sharing drivers by Bock et al. (2005). Next, distributed software development was discussed from the organizational point of view and different challenges with these distributed teams were introduced. Geographical, socio-cultural, and temporal distances are creating unique challenges in knowledge management in globally distributed software development that virtual teams are trying to solve with different ICT solutions. Finally, knowledge management challenges and current knowledge management practices reported by prior research are discussed. The reported practices have been created to respond to reported challenges over the years. The review of the current situation provides an overview of the recent knowledge management challenges and practices in use. Literature introduces multiple challenges and also multiple practices on how to cope with those challenges but doesn't provide sufficient reasons on why organizations still to this day struggle with these reported issues and are not implementing knowledge management practices that have been found successful. The following chapter will introduce the methodology of the empirical research that strives to provide insights into why organizations still suffer from identified challenges, are not implementing proven practices, and what could be done about it.

3 METHODOLOGY

This chapter introduces the objectives and research questions of this study and the methodology that was selected to answer them. After presenting the objectives, research questions, and the selected approach to this study, the case company and environment is being discussed. This is followed by descriptions of how the data was both collected and analyzed. Finally, some ethical limitations concerning the research are introduced.

3.1 Objectives and research questions

Prior research has identified practices to improve knowledge sharing and management within firms. Researchers as well as case company employees recognize the importance of knowledge sharing and management. Yet, many companies (case company included) struggle with implementing efficient knowledge management practices. When asking for a reason, a very common answer is that nobody wants to do it. This study aims to understand why practitioners are not effectively sharing and managing possessed knowledge. Simply put the main question here is: *Why they are not doing it?*

This thesis strives to answer the following research questions:

1. Which factors hinder and complicate knowledge sharing and knowledge management within and between globally distributed cross-functional teams?
2. What kind of measures can be taken to solve hindering factors in knowledge sharing and knowledge management within and between globally distributed cross-functional teams?

The focus of this study is on the knowledge shared and managed between internationally distributed cross-functional teams. Sharing knowledge within a company, between multiple teams, is a much more complex situation than

knowledge sharing within one team. This complexity brings additional factors to consider, like the applicability of knowledge outside of its original context (Szulanski, 1996). Based on the more pressing frustrations and issues identified in the case company the focus of this study will be on knowledge sharing and management. Managing knowledge better is considered to be more valuable for the company than merely managing information.

3.2 Selected methodology

Research methods in the information systems (IS) field can predominantly be divided into two main streams: qualitative and quantitative. Quantitative research aims at generalizing or validating selected theories and most often works with quantity. Qualitative research focuses on understanding human perceptions, human understanding, and experiences within a specific cultural or social context. (Myers & Avison, 2002; Stake, 2010.) The importance of qualitative research methods has increased significantly in the IS field recently due to a shift from technology-focused topics to human-technology interaction and organizational issues (Myers 1997). When compared to quantitative methods, the sample sizes in qualitative methods are smaller. Also, data collection methods are different. The most typical data collection methods in qualitative research are interviews, questionnaires, observations, document analysis, etc. (Myers & Avison, 2002; Stake, 2010.) This research aims to understand the hindering and complicating factors in information sharing and managing practices within one IT company. In other words, this research dives into why employees are not active in sharing and managing possessed information and thus also knowledge. In order to understand these issues, a qualitative research approach is the most suitable approach.

The need for this study initiated from practical needs that arose from practitioners noticing an issue with the company's information sharing and managing practices. Despite recognizing this issue, for some reason, they are unwilling to be active in this process. Considering the exploratory nature of this research, the objectives of this study, and the fact that existing theory and research literature on this particular phenomenon is limited, there is a need to collect rich data from practitioners' points of view without preconceived hypotheses. Based on the reasons mentioned above, the content analysis research approach is chosen. The goal of the content analysis is "to provide knowledge and understanding of the phenomenon under study" (Downe-Wamboldt, 1992; Hsieh & Shannon, 2005). Content analysis is usually used when the aim of the study is to study and describe a phenomenon with a limited amount of prior literature on the topic. Researchers are to avoid using preconceived categories because the categories and the names of the categories will stem from the data. The researcher's task is to immerse himself in the data to obtain a comprehensive understanding of the whole topic and thus allow new insights to appear from the data. (Hsieh & Shannon, 2005; Kondracki & Wellman, 2002.)

In the field of IS, the most common method of qualitative study is a case study that usually investigates a phenomenon in its natural environment and context (Eisenhardt, 1989; Myers & Avison, 2002). There are multiple reasons why a case study is such a feasible research method in the field of IS. Let's look at three distinctive reasons for this provided by Benbasat, et al. (2002). First, it's a fitting strategy for topics where little to no research has been conducted because this enables coping with the rapidly shifting views of the IS field. Second, it usually answers questions like 'why' and 'how' better than other methods. And third, phenomena are studied in their natural environment and context which enables the observance of current practices and generating models or theories from practice rather than theory. (Benbasat et al., 2002.) In this study, a case study was chosen to be the best approach for several reasons. Firstly, there is a very limited amount of previous research done on the topic, and the different factors around information sharing and management are constantly changing. Secondly, this study strives to understand and give a plausible answer to *why* practitioners are not effectively sharing or managing the information they possess and *how* this issue could be solved in practice. Thirdly, the information and knowledge possessed by employees, relationships and cultural differences between teams, reasons why they choose not to be active in the information-sharing process, and other motivations behind their behavior are all tied to the natural context of the phenomenon at hand.

As mentioned above, interviews are among the most used methods to collect data in qualitative research. Interviews are seen as the best method to collect data when the aim is to have the interviewees' views, perceptions, and opinions on a selected topic (Walsham, 2002). Qualitative interviews can be conducted in various forms depending on the nature of the study. Examples of these interviews are structured interviews, semi-structured interviews, unstructured interviews, and theme interviews. The interview types mostly differ in how much improvisation can be allowed and how set-in-stone the questions are. For this study, a semi-structured interview is chosen because it gives the flexibility to improvise (Myers & Newman, 2007), which is needed for this study in order to best gain understanding from the employees of the case company. This means that some of the questions are written and set beforehand, but in the interview situation, additional questions can be asked if something needs to be clarified or specified.

3.3 Case description

The empirical data for this study were collected within one company by conducting semi-structured interviews with the company's employees. Although having several goals, the main ones were to better understand how knowledge management is viewed in the company and what kind of hindering and discouraging factors were to be found through conducted interviews. Also, possible solutions to overcome mentioned hindering factors were discussed during the interviews.

The case company in hand is a large international IT company with an extensive history in the field. The company has transformed from a hardware company to a software company over the years and has an open policy to modern and agile methods which are in use for several parts of the operations. The case company has offices and employees all over the world and even most of the teams are geographically distributed.

Representatives from the company were contacted during the summer of 2022 introducing the idea of doing research on knowledge management and thus providing them with recommendations on how to improve the company's knowledge management. First, a meeting with 2 managers was organized and the topic was discussed, and the scope was set. Both expressed high interest in the topic and agreed to provide their support in naming key individuals to interview from each team that was introduced. It was decided that in order to gain the best possible view of knowledge management, all the functional teams within the company needed to be included in these interviews. All of these teams don't necessarily all work together on the same topic, product, service, or project but they all contribute to knowledge management as they all provide knowledge and require knowledge from others to successfully function. The motivation for the company to participate in this study was to improve its knowledge management practices and the culture around knowledge management, especially between cross-functional teams distributed around the world.

This obviously means that the interviewed teams differ from each other remarkably and in multiple ways. In total, 22 teams were interviewed, and their functions varied from sales to HR and from operations to legal. To ensure confidentiality, further details on the teams cannot be disclosed. The aim was to have 3 employees from each team in each of the interviews, but this was not always possible for example due to tight schedules, unexpected higher-priority meetings, and sick leaves. The lowest number of representatives from a team participating in an interview was one and the most were six. Although the interview invitations were sent to only three employees that were carefully selected in cooperation with the managers initiating this case study in the company, some teams invited more members to participate in the interviews for various reasons. Some teams invited extra participants just to observe and listen out of interest and some of them invited employees that they felt had good insights related to the topic. This was accepted on the researcher's behalf.

The approach to interviewing the most suitable employees was to contact the head of each department and ask for their opinion on the most suitable candidates to participate in these interviews from each team. The criteria that were indicated to the heads of departments were to have a good variety when it comes to years in the company, experience in the field, position in the team, and availability to participate in the interviews during the fall of 2022. The heads of the departments and their line managers were really helpful in promoting these interviews and motivating their colleagues to participate in this study. No rewards were promised on the researcher's behalf or the company's behalf, meaning that

most likely the motivation to participate in this study came from a genuine interest in the topic.

An interview invitation was sent to 60 people out of which 50 people participated in the interviews which is a very good turnout. This provided very thorough coverage and a large variety of years in the company, professional experience in the field, and position in the team. The least number of years in the company was under one whereas the greatest number of years in the company was over 25 years. Professional experience in the field ranged from several months to over 30 years and the positions in the team varied from managers to trainees. The split between sexes participating in the interviews was 38 men and 12 women, which is a reasonably fair illustration of the ratio between men and women not only working in the case company but in general when it comes to IT companies. The reason for interviewing very different employees in terms of years in the company, experience in the field, and position in the team was to avoid elite bias and gain the most accurate picture of the topic from each of the teams.

3.4 Data collection

As mentioned above, semi-structured interviews were conducted in this study. A few main areas of interest were prepared ahead as a frame for the interviews, but interviewees were encouraged to discuss the topics at hand freely. This also allowed the interviewer to ask clarifying questions and ask further questions related to the ongoing discussion. The order of the topics was quite regularly followed, but on some occasions, the order would change for several reasons. The main topics to be discussed were sent with the interview invitation via email and interviewees would sometimes bring certain topics up first at the beginning of the interview which normally would be discussed later during the interview, or they would accidentally answer another topic which was then questioned more on. The used interview structure is attached to the study as Appendix 1 and was designed based on previous research, the literature review conducted above, observations from the case company, and their needs. During the initial discussion with two managers, it was decided that the scope of the research on knowledge management would be wider than the one discussed here in this thesis. Some of the aspects of the interview structure were predominately recorded and analyzed only for the company's purposes and thus were left out of this study to keep the set scope. All of the interview material was available for analysis for this study also and did give some valuable insights but were not as carefully analyzed as the parts that were planned completely to provide insights for this study.

Interview participants were initially informed about the interview practicalities and topics via email invitation. At the beginning of each interview, that invitation was referred to and the practicalities and goals of the interview were discussed. The interviewer presented himself at the beginning of each interview after which privacy matters, data collection and analyzing methods, and the use of data were rehearsed. Before starting the actual interview, the participants were

offered the chance to ask questions related to the interviews and the practicalities around them. Most of the time, everything was clear, but on a few occasions, some extra questions were asked concerning the use of data, anonymity, and the outcomes of the interviews. All questions were answered before the interviews started.

Four main themes were discussed during the interviews. The first topic would concern any information or knowledge that the interviewed team would own or produce. The second topic would in part concern the information or knowledge that the team needs from another team or function. These two themes provide an understanding of what kind of knowledge the company is dealing with when it comes to knowledge management and which teams are closely connected to each other through certain information. These topics provided insights into current knowledge management practices in use which were very helpful even though these topics were mainly designed to answer questions that are not included in this thesis. The third topic concerned the issues that the teams have noticed in knowledge management practices like knowledge sharing, knowledge creation, and knowledge transfer. This topic provided an understanding of hindering factors of knowledge management on an individual level as well as a team level. Finally, the fourth topic concerned the possible solutions to solve the mentioned hindering factors and thus provided insights on what kind of measures could be taken to overcome the hindering factors of knowledge management.

The interviews were conducted during September and October 2022. All of the interviews were conducted using Google Meet software which allows recording the meetings held online. Face-to-face meetings were not considered because interviewees were based in multiple different sites all around the world and having all of the participating team members present during the interview would have been impossible without the video conferencing tool. All of the online sessions were recorded using the recording feature in the tool. In addition to this, the company provided the researcher with a tool developed in-house that transcribed everything that was said during the interviews. This tool was in its pilot phase, so the recordings acted as a backup in case of technical difficulties with the transcribing tool. The recordings were also used to check the transcriptions and their validity.

The researcher had reserved an hour for each of the group interviews and this was sufficient for each time. The interviews lasted from 36 minutes to 55 minutes and the average duration was 48 minutes. It was observed that the time was used very efficiently, and the topics were covered within the given time. On some occasions, interviewees wanted to provide some additional material that was sent to the interviewer later via email. This material mostly concerned those topics that are out of this thesis' scope. The interviewees were also offered the option to have additional meetings where these topics would be discussed further. A few of these kinds of meetings were also conducted, but not recorded. Some notes were taken during those discussions where appropriate for the sake of the thesis and its scope so that those insights could also be included in this study.

3.5 Data analysis

The interview data was automatically transcribed by a digital assistant still being in its testing phase. These transcriptions were then compared to the recordings that were recorded simultaneously during the interviews. Some adjustments had to be made to the automatically produced transcriptions from the basis of interview recordings. The transcriptions were also cleaned based on a clean verbatim transcription style which allows removing non-speech sounds, repetition of the same word, false starts, etc. This makes the transcribed text easier and faster to read without compromising the precision or reliability of the transcriptions.

This transcribing process resulted in 114 pages of text, and it was decided to be analyzed manually, without any qualitative research software, which could have provided more structure and faster analysis. Because of the sensitive nature of the interviews and the topics discussed, the case company decided that no external tools will be used to avoid any conflicts in data security. Thus, per their request, the coding and analysis of the interview data was done completely manually, within the company's premises on their servers and network.

As mentioned before, this research initially gained its motivation from perceived observations of practical challenges. The purpose of this research is to better understand and discuss a phenomenon that is poorly or not at all studied by previous literature. This approach provides the perfect opportunity to use conventional content analysis. In this method, the categories and the names of the categories flow from the data instead of being thought of beforehand. This allows the researcher to have an unbiased view of those categories and the names of the categories and is not limited or influenced by categories that have been provided by possible previous literature. (Hsieh & Shannon, 2005.)

The coding process started with the researcher reading through the transcripts at once to achieve a better overall understanding and to gain impressions. Then the transcripts were carefully studied iteratively as the coding cycles revealed an increasing number of initial codes. During this part of the process naming the codes would be in constant development since codes were merged and renamed based on the transcripts. Nearly 700 issues were found in the transcripts that were then codified into 44 codes. These 44 codes represented the hindering factors in knowledge management within and between teams in the context of software development. Identifying these factors was the main objective of this thesis. These 44 factors were then grouped into 5 themes based on their estimated origin and to give clarity to the results.

3.6 Research ethics

The topic itself, knowledge management, might have resulted in a few limitations that could have an effect on this study. The heads of departments

recommended employees to be interviewed and motivated them to participate in this study. Some people might have felt forced or strongly persuaded to be a part of the study rather than participating out of pure interest in the topic. It's possible that some people might have felt obligated to participate in the interviews and thus their answers could have been affected by that state of mind. This seems highly unlikely based on the fact that the interviews were presented as voluntary, and interviewees were very motivated to discuss the topics given to them.

Another issue with the topic is that it might be sensitive in some cases. In the interviews, interviewees were asked to discuss issues in the company, issues with other teams and issues with their own effort, and current practices related to knowledge management. It was evident that knowledge management was seen as an important theme within the teams and regarded as something that would be expected or even asked of them. Having to explain the hindering factors, or in other words, the reasons why they might not be doing what they are supposed to do or what is expected of them could have affected the honesty of interviewees. Interviewees were ensured before the interview that there would be no judging, no reporting to their managers and that the interview data would be dealt with anonymously and the recordings would be deleted once the analysis was done. The overall feeling of honesty was very high, and many sensitive issues were discussed. This could be a result of the interviewees' high motivation to improve knowledge management practices and the culture related to it.

Manual analysis and coding per request of the company might also have an effect on the results and insights found from the data. A computer-aided software could have improved the accuracy and reliability of the data. Friese (2019) stated that having that kind of qualitative research software in support of the analysis phase enables the researcher to find insights that otherwise he wouldn't have found and improves the whole research process in general. This was not an option for previously stated reasons, so diligent effort was put into the coding phase and the data was read through multiple times to ensure the best outcome.

4 RESULTS

This chapter introduces the results of the conducted qualitative study. These factors that might influence knowledge management and knowledge sharing in globally distributed teams working around software development were identified from the transcribed interviews by codifying different themes. These themes are divided into five different groups for clarity based on their estimated root cause, i.e., legal demands that affect organizational knowledge management are caused by external environmental restrictions rather than individuals' motivations or the organization's technical capabilities. Table 1 presents the grouping of the themes as well as the themes themselves. Despite the grouping of themes as will be presented below, all these themes can be interrelated, dependent on one another, and affecting one another, thus this grouping is not definite, but advisory for the purposes of this study. All the themes will be discussed in detail in this chapter.

Some of these themes are already negative by nature, hindering and distracting knowledge sharing and management in the organization. Other themes are more positive by nature but can affect knowledge sharing and management negatively because there are insufficient resources, lack of attention paid, or insufficient presence of those themes. Some of the themes have not been considered at all in the organization, other themes have been considered for years still waiting to be taken actions on, and some other themes have been fully recognized and measures have been implemented to solve them, but results are not yet meeting the expectations.

Personal social topics	Organizational social topics	Technical topics	Environmental topics	Interrelated social and technical topics
Time and effort used	Governance, guidance, rules	Tool related issues	Distributed teams and regions	Location of information
Information not documented	Ownership, responsibility	Access issues	Security and sensitivity of documents	Information status issues
Issues in sharing	Culture, habits	Issues with externals, third parties, and customers	Compliance, legal, regulatory demands	Fragmented, scattered information
Duplication	Asking others	Lack of automation	Project vs. product business	Structure related issues
Information overflow	Common way of working	Bad search functionalities	Slow processes	Email
Willingness, laziness	Communication		Complexity of organization	Digital transformation
Motivation	Purpose of documentation		Historical data	Better visibility to other functions
Issues with tacit knowledge	Language, vocabulary			Forms of documentation
Lack of confidence	Training			Tags, labels
Familiarity with tools	Management issues			Chat
	Onboarding			
	Remote working			

Table 1 Possible hindering factors in knowledge management

4.1 Personal social topics

Personal social topics represent the themes that are dependent on an individual's actions, capabilities, motivation, and feelings on knowledge sharing and management. Personal social topics were mentioned by every team across the organization when asked about factors that are or could be hindering knowledge sharing and efficient management within the organization.

The most common theme in this group is *time and effort used* in relation to knowledge management. The majority of the interviewees expressed that they value their time highly and thus choose their tasks based on what is a good use of their time and is certain effort worth the time invested in it. It was recognized that sharing knowledge quite often means documenting it somehow and then sharing it with others. However, transferring knowledge into documents that others can find and understand was seen as burdensome because it requires unnecessary effort from both the owner and the receiver of knowledge.

Sometimes the data needs to be put in a document and this takes time and effort from both sides.

It was assumed before the interviews that documenting knowledge would be seen as 'too much effort', but it was evident that also finding that knowledge was extremely time consuming in many instances.

Today I have to search in [different tools], wherever and it takes hours to find the correct information.

Some interviewees valued their time so highly that they didn't see the purpose to participate in knowledge sharing if it was not a part of their job description.

Nobody wants to use their time on that [knowledge management] if that's not their job.

Another common theme mentioned in multiple interviews was the fact that lot of *information is not documented* for number of reasons. Interviewees were often asked about soft knowledge (tacit knowledge) and how that is collected, transferred, stored, and retrieved. Common view to this is that tacit knowledge is not documented because it is hard or impossible to do so. However, this was not seen as the primary reason soft knowledge is not consistently documented in the case organization. Talking about sharing knowledge in general within the organization, it was highlighted that employees might not know what kind of information or knowledge they are expected to capture, store, and share.

People need to understand, depending on their job, what information they are expected to capture and where they should feed the information.

Even if everyone would know what kind of information they are expected to capture and turn into knowledge, lot of it would still stay in the heads of individuals, which drives employees to constantly turn to those who might possess that knowledge. This is especially evident among experts who most likely possess most knowledge in their area of expertise.

Typically, we can get information, but we have so much information in the heads of people, so we go and ask the experts because there are so many things that are not documented.

Codifying process also identified *issues with sharing* when it comes to individuals. This is closely related to individual behavior where knowledge is kept from others for one reason or another. Most often this was not seen as intentional withholding of knowledge but rather as lack of motivation to be active about sharing knowledge. It was recognized that a lot of information is attainable and acquirable all the time, but the process of sharing that acquired knowledge is faulty.

We don't share the information that we collect from the field enough.

Couple of the teams felt like teams have developed a habit where knowledge is not openly shared without a reason. This was explained by the fact that it would be very wearying to share everything or to know all the people to share with.

This company [is] only sharing information when it's needed or requested.

Duplication of information was also mentioned multiple times. Same information is stored to different locations and then possibly updated in different instances

and times, which causes a lot of confusion. Finding the correct information seemed to be a major challenge for many.

[The information is] somewhere and the challenge is to know where it is. We have several sources of information on the same topic.

Duplicating the information is due to a lack of knowledge on where to store which information, but also due to access issues and usability of tools. Different stakeholders are using different tools for different purposes and want to have information relevant to them in the tools they use, which automatically causes duplication. This tendency has increased in the past years due to changes in the organization and its tools.

We went from one central place, the shared disk, to multiple spaces which causes duplication of data.

A lot of the mentioned issues above are related to the lack of something. This is not always the case though. Software development is very knowledge-intensive, and a lot of the information and knowledge acquired is shared one way or another. Sometimes the issue is that with all the cumulating information spread across different tools and colleagues' minds, there's an *overflow of information*. There are so many sources where knowledge can be gained that it turns extremely difficult to know which source and which information is really relevant to a single individual.

For me it's maybe too much information and finding what kind of information is valuable for me.

When it comes to people's intentions to act, personal *motivation* and *willingness* to actively play a role in that equation. The reason for contacting a colleague rather than looking the information from available databases was asked in several interviews. Most of the time the interviewees saw that asking a colleague is faster and more efficient, but one participant went a bit deeper with the question and thought that plain laziness could be the underlying reason why colleagues get contacted more often than they maybe should.

Sometimes it's about people really not knowing where to go and asking sincerely and sometimes people are just lazy and prefer contacting people for direct answers.

Improving knowledge management and sharing within the organization seemed to be a common view among interviewees, but some concerns were raised when it comes to motivating colleagues to actively participate in the change. Some issues were seen in the current way of communicating and willingness to support change and addressing these motivational issues were seen as key objectives.

The will of changing things and the will of better communicating, not just through digital platforms, are prerequisites for me in order for the change to work in the future.

The question is how we could get the people to support this initiative of having better sharing and having common rules and having common ways of working.

The case organization has undergone some major changes in the past decade and that still affects the way of working and doing things. Some are still finding the older ways of working better whereas others prefer the new ways of working, which can create arguments and motivational issues between teams and colleagues. One participant noted how this is poor from a motivational point of view.

Especially from the motivational point of view, this is pure horror to cook those old things, old files rather than doing the things which are our future.

Talking about *tacit knowledge*, which is acquired through discussions, informal meetings, personal experiences, etc., interviewees recognized the importance of such knowledge but felt like the perceived importance of tacit knowledge doesn't match the actual efforts to benefit from such knowledge.

In many cases that info is more important than the official information. It's a big challenge to not miss this valuable information.

Lack of confidence was mentioned by a few individuals when asked about factors affecting knowledge sharing and management negatively. Sometimes this has to do with not knowing how to do something, but more often not knowing if something is allowed. Distributed software development is dependent on different teams and stakeholders working together, and very often some of the work is done outside of the organization by third parties like suppliers. Although collaboration is promoted, encouraged, and often necessary, some things have to keep within the organization for various reasons. Making the decision on whether something can be shared at any given time or not seems to cause issues in knowledge sharing.

People are sometimes afraid that we share externally some information that we should not share because is not ready or because it's purely internal. People should also be more confident.

Sometimes I feel that people are a bit scared of doing things.

Related to confidence, *familiarity with the tools* in place was also identified in the coding process. As mentioned earlier, recent changes in the organization have included the introduction of new tools. Getting a handle on how to use any new tools can be difficult with limited time on hand, and this is why even the tools implemented long time ago can cause challenges for employees that are not regularly using them. One interviewee admitted that even though some tools have been used for years, they are so complex that one doesn't have enough time to thoroughly learn to use those tools.

It's also your own competence on how you use the tools, how to filter etc. I have some improvements to do on that regard.

The case organization also has some regional functions that act as first contact points to customers in those areas. These so-called regions have slightly different set of tools than their colleagues in the main sites. Regional colleagues use common tools so rarely that they tend to forget how to use them and instead come up with ways to collaborate that might be unofficial. This increases the amount of work colleagues at the main sites have to do when handling these unofficial requests and communication attempts.

People [in the regions especially] are not regularly using our tools, our databases, our information pages and those kinds of things and so they are basically forgetting how to use the things and they are often starting as a newcomer even when they have been in the company for years.

Other themes discussed later in the chapters were closely connected into this theme such as lack of training on how to use the tools, complexity of organization affecting the abilities to be familiar with the tools, and the on-going digital transformation causing reduced number of interactions with some of the tools. Similar dependencies can also be drawn between other themes mentioned above and the themes introduced below.

4.2 Organizational social topics

Organizational social topics are similar in nature to previously introduced personal social topics. These themes, however, are most visible in collaborative organizational settings where multiple individuals are involved at once. These themes are more affected by the actions and decisions of multiple individuals rather than one single individual as could be the case with personal social topics.

The most commonly mentioned theme on organizational social topics was the lack of *governance, guidance, and rules* related to information management. The size of the organization dictates that rules need to be agreed on to enable successful business activities. This also applies to knowledge management. It was acknowledged that there are some guidelines and rules related to information management, but they were not commonly followed or even recognized by different team members. A need for overarching guidelines and governance to unite teams and team members with knowledge management was often asked for in the interviews.

What we lack are some recommendations about how we should handle each type of data to have something homogeneous between teams and have similar ways of working and have some rules because today anyone is allowed to do whatever they want.

Clearly, the changes in the business as well as in the technologies and tools have made it more difficult to set up binding rules. A constantly evolving landscape demands dynamic solutions that can be adapted to changes. With the rapid pace of changes, it has been challenging to keep rules and guidelines up to date

throughout the organization and some of this lack of governance has been intentionally done to give more freedom and agency to employees to define new guidelines and rules. The challenge in this method is that everyone is coming up with rules of their own and there has been close to no success in uniting these rules and guidelines over one governance.

We really didn't have any training how to do so and now, people are just making up the rules as they go.

And now, nowadays, we don't have as clear rules with the good and bad consequences, of course.

In some modern organizations, there are data owners or data custodians whose job is to look after the data possessed by the organization. In some organizations these responsibilities are embedded into job descriptions of people that deal with other responsibilities as well. Sometimes the *responsibility* for data, information, and knowledge that an organization possesses is unclear and falls unto those that are willing to put in the extra effort to act as data custodians of sorts. One participant asked quite rightly the key question that couldn't be answered at that moment:

Who is the owner of data in the company?

That very same question was asked in different ways by each team in the interviews. Interestingly many interviewees stated that they don't know or that it's uncertain. Eventually, it came to the conclusion that information should be owned and thus also managed by the functions themselves dealing with that information. Even if the precise owners of data are not clear, the first thing would be to recognize that the responsibility lies with the functions (teams) and not on anything or anyone else.

We are still struggling a little bit in making it clear that it's not the tool that makes the ownership of data but really the functions.

Every organization has its own *culture and habits* which can only be learned in practice. Organizational culture and developed habits have a strong influence on knowledge sharing behavior as well as managing knowledge. Participants felt like some of the habits teams have developed are going against the nature of knowledge sharing. For example, knowledge is rarely freely shared, but only in cases it is seen as absolutely necessary.

From my side I'd say, it's not shared at all or in very few cases and very specific cases.

On the other hand, habits often sprout from a prevalent culture that has been molded through the years. The dynamic working environment and software development in general encourage changes and improvements and these influence the organizational culture. However, effects in organizational culture have been

more ad-hoc rather than systematic when it comes to intelligence culture. Intelligence culture promotes the capabilities and abilities to acquire, share, and benefit from possessed intelligence. A notable number of participants expressed their desire to promote an intelligence culture where reacting to market changes, competition's new features, and customer preferences would be rapid and knowledge-based. However, one participant speculated that maybe the value of intelligence culture is not yet fully recognized in the organization.

At the end of the day, I'm pretty much convinced that this is primarily a cultural problem that we are lacking the intelligence culture. We are not used to do that kind of work, we don't maybe think that it's important, we haven't built that kind of work in the job descriptions and so on.

Cultural changes don't happen overnight, but they can be streamlined through a systematic approach. Including tasks related to knowledge management in job descriptions could be a concrete example of how to bring the importance of the topic forward and start creating an intelligence culture. Some steps have been taken within the organization to support this, but the predominant culture still seems to be one major obstacle in creating a culture that supports effective knowledge management.

Asking others for information and knowledge is common in knowledge-intensive fields, but quite often it might go to extremes. Understandably some knowledge is only available by asking the experts but asking your colleague for certain information can often turn into a habit. Constantly contacting someone instead of getting the information for example from a public database or company wiki page might take less time from the one asking, but it does take extra time from the one answering these requests and questions. Several participants acknowledged that too often colleagues are asked about things that are easily available and documented in a database or wiki page etc. The easiest explanation for this would be that asking others for knowledge saves time and effort and that's why one does so.

That's probably because people know that I'm the key contact person for [a certain tool] so it's easy to get the answer quick.

Interestingly, another perspective was proposed in the interviews where one already has the information, they are looking for but is after confirmation to share the responsibility with the one they ask that from.

Quite often actually there are that kind of simple questions asked that okay where this document is, where is the right document, where is this chapter from one single document just to make sure that the responsibility is then shared.

However, when most employees prefer to contact colleagues directly when looking for information about something, it becomes increasingly difficult for

newcomers and part-time workers to find the information they are looking for. When sharing knowledge is just between people, one is required to know enough people to find the answers needed. When employees understand that keep being asked about the information rather than searching for it from any of the tools it is stored, they prefer to keep their knowledge just in their heads, rather than documenting them anywhere else. This is dangerous because knowledge-possessing employees can be on vacation, on sick leaves, or leave the company when someone would need specific knowledge from them. This situation is extremely challenging for newcomers in the company as illustrated by one of the participants in the interview.

What's also difficult for me today is that I don't know the people enough, you know what I mean?

One of the challenges with globally distributed teams is to have *common ways of working*. Different restrictions in different countries can cause difficulties to have similar ways of working to be unified with the processes. Working with different products, services, and technologies in different countries and regions makes it difficult, if not impossible, to have common ways of working. Simply put, this is the situation in the case organization as well.

So, we don't have a common way of working.

One could question whether the common way of working is even necessary. Based on the interviews the answer is both yes and no. Similar documentation methods and tools would be beneficial even if different projects or product developments wouldn't link to each other otherwise. Sometimes successful completion of tasks requires measures that differ from everything else going on in the organization as one participant described the situation when having a common way of working would be foolish.

I think it's not easy because there's nothing homogeneous in a lot of different ways of working.

Communication plays a crucial role in sharing knowledge. A lot of situations require instant action to inform appropriate stakeholders, when documenting the information to public sources is not enough. Last-minute changes, crisis situations, tightened schedules, or changes in the teams could be instances where information needs to be conveyed effectively to all appropriate stakeholders through direct communication channels. Unfortunately, in a large organization, it's hard to keep track of all of the employees that would need or benefit from the communicated information. On top of natural mistakes, a lot of information is communicated unofficially which means that being out of the office or being at the wrong coffee table or wrong part of the office could mean that one misses information that should be communicated to that person one way or another.

It's not communicated through official channels; you might only hear about it from someone else.

Multiple participants raised a worry about internal communication. They stated that in general internal communication is working, but because of the spread-out nature and size of the company, many important pieces of information are not communicated officially internally and the only option to acquire that information is to be at the right discussions with the right people at the right time, which is in no measure effective or reasonable.

If I could add my view, the way we get information and communicate is crucial and we are not yet doing it completely. There are many things to consider. There is the repository and the documentation that is produced in the context of the project. Then there is internal communication we need to do further.

Documenting information and knowledge can be considered more difficult than sharing it via direct interactions. When interacting with someone directly, one can focus on only that aspect of things and that individual's needs, whereas documented information could be read by not only multiple colleagues but multiple different teams from different functions that don't share the same understanding as others might do. One of the hindering factors to knowledge management is recognizing the *purpose of documenting* every piece of information. Who might need this document? What kind of understanding others might have about the topic? How accurately do different topics need to be explained? Software development is a joint effort with multiple different functions having their own expertise, opinions, and understanding of the work, which is why understanding the purpose and audience of each document is so pivotal.

So maybe they need to understand that not everyone has an understanding of the process because it is a bit complex.

And this is now the learning curve also for us, and we need to improve the quality of such documents because we are, we have understood that this is not only for us. This is not only, let's say, an R&D document, it is also a document that is more widely available inside our company.

Most of the, if not all, big international companies have some kind of issues related to differences in *language*. Many international companies have decided to have English as their language of choice while many of the employees are not native English speakers. Nowadays having English as the main language in the case organization causes only minor issues in communication but having smaller languages in the regions of the business is another story. Most of the material and communication is translated into English but there are certain things with specific languages in the regions that are causing some difficulties in transparent knowledge sharing.

We have other countries [...] that have their own national language so the information sharing, the soft information locally is absolutely not possible.

Another factor related to language is the internal *vocabulary* within the company. Even if the organization's official language is English, people tend to name things differently - especially when using a language that is not their first language. New products, projects, services, technologies, systems, etc. need to be named and the naming of things is not as easy as it might seem. Sometimes using the wrong keyword to search for information might be the reason why no information is found on that specific topic.

Exactly, a big issue with naming. The same thing can be named in several ways and when you're trying to search for something you have to imagine how someone else could have named it.

When thinking about knowledge management, we often focus on the one producing, sharing, and transferring knowledge. It's a valuable skill to be able to acquire knowledge and share it with others that can be learned. On the other side of knowledge management is the person searching, receiving, and using the knowledge provided by someone else. This side has to be considered as well to thoroughly address knowledge management. Providing *training* that considers both sides of knowledge management is something that the participants thought that was missing from all of the employees, especially the newcomers.

I have not seen training about data and information management, data sharing, good practices, or guidelines. It goes both ways; it goes from the people that look for data as well as the people who make this data available.

Knowledge management isn't something one individual or even a group of individuals can effectively promote in a large organization, but it requires a strong commitment from the *management*. Lack of support from the management level often causes poor individual efforts to improve the situation. Few managers stated that the organization has all the needed capabilities to improve knowledge management but is missing a concrete plan on how to do so and the driving force from management.

Actually, I don't see it difficult to gather that information but structuring and keeping it up to date all the time would be difficult. There could be a way to organize that information, but I don't have an idea of how this could be done in practice.

Some participants were worrying about the *onboarding* experience for newcomers. Whenever a newcomer starts working, there's a large amount of information to be absorbed to handle daily tasks. Knowledge management isn't the first thing coming to mind when trying to grasp new responsibilities. Few of the participants stated that providing an induction to newcomers where knowledge management-related issues would be addressed would be a must. Introducing tools in use, the way information should be stored, the best way to search for information, and the purpose of each tool. Currently there's no guidance on these matters during the induction process, which causes the newcomers to creatively come up with ways on how to find information fast and how to store information

effectively. This causes discrepancies on how things are done in the organizations, duplication of data and mixed locations of data.

And the reality is that what I have seen is that we are so busy with what we do that whenever newcomer comes in or even if the person has more experience the fact is that we don't have any training, or instructions on how to use... we don't start the induction in the organization by telling how to use the tools.

On top of working in globally distributed teams and organization, COVID-19 pandemic caused a massive increase in remote working. This option is still allowed and enabled even though the pandemic has eased. Similar to working in different countries, *working remotely* can cause issues in communication and knowledge sharing.

[...] you might miss something especially now working kind of hybrid from home and so on. I think in that case sometimes there might be some missed information.

4.3 Technical topics

Tool related issues were most mentioned among all the themes presented in table 1. There were several different perspectives to these issues. Globally distributed software development requires extensive knowledge sharing and effective communication that has to be completed through different tools because face to face interactions is limited. This dependency and importance of tools is reflected in the number of concerns directed to tool related issues. First, large organization has a vast variety of tasks, teams, and responsibilities, which require a variety of tools to be in place. Even though the need for multiple tools was acknowledged widely among participants, many felt like having so many tools distract knowledge sharing.

Couple of other issues are that we have so many tools and as said you don't know which tool the team is using. There's no way of using any kind of search capabilities because you don't know the tool.

Some others argued that correct tools are in place for successful performance, but the issue it with the synchronization between the tools. Having important information in several tools will only take you so far, if those tools are not communicating together but require lot of manual work.

I think we have all relevant components to do offers but they are not in sync. We are missing a lot of data due to that. The info is really scattered everywhere. We cannot base our decisions on historical data and there's absolutely no sync between the tools.

However, despite having multiple tools for knowledge management, they don't always perfectly fit a certain purpose or task. Thus, existing tools need to be used creatively and to the best of their capabilities. Sometimes this causes issues

because using tools for what they are not meant to be used will eventually result in problems like poor structure of information or validity of information.

We have a lot to do and that's why we use [an internal wiki tool] for what is not meant to be.

In order to use these technical tools, one needs *access* to them. This might seem obvious, but the reality is that several factors might restrict access that individual employee has to different tools. When asked about accessing relevant information the interviewer has reminded that all data cannot be accessible to everyone.

I think there's an assumption in your question that is not validated yet and it's that all the data is accessible by everyone for any kind of purpose, and this is not the case.

Some information is classified as confidential or to be seen only by certain teams or project members which causes restrictions on access rights. Other access restrictions are due to budgetary reasons; every license to access certain tools costs money and thus access is only given to those who have an absolute need to access information in that tool regularly. Sometimes getting access simply takes some time or access rights are not requested immediately for newcomers.

Something that I have experienced during the past few months is that I don't have access to certain tools or even to certain [internal wiki] pages.

It's also possible that the creator of documents restricts the availability of them either on purpose or by accident. One participant noted that especially as a newcomer it seems to be a lot more difficult to access documents created by someone else than some general company documents.

It's more difficult to access data that has been created by somebody else.

Organizations often work with customers, suppliers, and other third parties regularly and need effective ways to collaborate and cooperate with those stakeholders. Having a robust system to collaborate and communicate with *external stakeholders* can be a challenge because all parties have their demands and requests. Sharing information with these parties can be extremely difficult, especially if the shared information is classified or for certain eyes only.

Another point is that sharing external data is very difficult and at least this is my experience.

Modern organizations base their ability to benefit from intelligence on automation. Automated collection of data, analysis, and conclusions drawn from those. Automation in knowledge management is not simple or easy, but the *lack of automation* forces organizations to invest in people who manually provide reports and analysis for decision-makers, which takes time and money. Creating these

supportive materials for decision-making is no longer a question of 'should we' but a question of 'how'.

Everything now is based on us asking and being active. It's very much like manual or human work we need to do.

The quest of finding information from available sources and tools requires the use of the *search functionalities* provided. The issue with these functionalities is that finding specific information can be challenging for several reasons. Using the wrong wording, searching from the wrong tool, using the functionality wrong, not using searching filters, or searching for information that is restricted can all be reasons why finding the correct information can seem to be impossible. Participants gave a few examples of this frustration. If one seeks information from an internal tool that is restricted, it won't even pop up in the search, leaving the person to think that the document doesn't exist when it's only restricted for the time being. Another example is that one is not sure for which tool information should be searched and because there's no search engine that would search from all the tools, one must manually go through all the possible options. Wrong wording was briefly discussed earlier, but even with the correct keywords one might find tens of thousands of results only to be confused about the correct information.

You'll have 16 000 search results, but you don't find what you need because there's no answer related to the thing you are looking for.

4.4 Environmental topics

The organizational environment is something quite static and challenging to change. These topics related to organizational environment share similar attributes where they are relatively static themes that are challenging to change. The nature of these topics means that changing these situations directly is likely not an option but rather having workarounds to ease knowledge management surrounding the following topics.

Distributed teams and regions around the world are working together to plan, produce, sell, and maintain software products and services. They communicate and collaborate daily in different ways and settings. The benefits of distributed teams were discussed in an earlier chapter as well as the possible challenges. Clearly, the biggest challenge with working remotely with colleagues is the fact that casual information sharing and brainstorming during coffee breaks and hallway conversations are almost non-existent.

My opinion on this is that having a shared team across the globe causes challenges in information sharing.

I think this is the throwback of working remotely, these casual conversations and brainstorming doesn't exist.

Another downside of working in distributed teams across different sites and countries is that collaboration between sites could suffer. When a team or a site has to work remotely with others it's easier to come up with own ways of working and stop sharing things that feel small or insignificant. This creates a snowball effect where these teams and sites develop a self-sufficient way of working where others are not necessarily needed. This directly affects knowledge sharing and cross-team collaboration.

Those are somehow by default quite self-sufficient, and this is a bit of creating a setup where we have many different islands. Or maybe island is a wrong word but anyhow that kinds of teams that are at least a little bit in isolation from other teams.

Working with different customers and stakeholders sometimes cause restrictions on the information that is passed around. The *security and sensitivity* of documents and information need to be taken seriously from both sides of the interaction. In particular cases access to certain information needs to be restricted, information transfer needs to be encrypted, and communication needs to be secured. These restrictions cause additional work, but also pose requirements to the tools being used and the way of working.

We have a lot of sensitive information that we cannot put everywhere. This causes additional spaces and locations, and this is very complex.

Then of course, there are some sensitive data, also, nationally sensitive or atomized information, which is secret and thus handled in a different way. They're, of course, the information is much more restricted.

Related to the sensitivity of the information, there are *legal and regulatory demands*, like compliance rules, that need to be obeyed in everything – including knowledge management. For example, some product information cannot be shared across country borders, or certain customers want to limit access to a minimum when it comes to solution integration or implementation to their current systems. Also, sharing confidential information about competitors or their products and services, even if attained by accident from competitors, can be seen as corporate espionage and thus break compliance rules. Breaking these rules or legal regulations can cause heavy punishments for the organization and that's why these demands and requirements are taken very seriously. However, these cause hindering factors to knowledge sharing and management and might motivate individuals to keep information to themselves rather than sharing it, because they are not sure if it can be shared or not.

We have very limited access to only certain people, in order not to breach the confidentiality obligations.

As we know there are sometimes regulatory and legal reasons why some things just can't be shared.

Software projects have been common in the past years where software is designed to fit set requirements from the customer and then modified and maintained according to customer preferences. Nowadays, however, the *project-based approach* is challenged by the *product-based approach*. The product-based approach means that software development is focused on developing the product according to the markets, not just individual customers. This is a more permanent way of thinking about products and services because software is not developed to match clients' needs but to match the market domain's needs. This enables a one-fit-for-all approach and changes are initiated from market and domain changes rather than the client's request. However, the case organization is still in the middle of a transformation coming from a project-based organization to a product-based organization, which causes issues with knowledge management and sharing. Clarifying the approach was seen as essential for the future success of the organization.

Yeah, and the focus is too much on the project because we still have a product. We are in a mix of two cultures.

I don't know if this is unique for us, but we are kind of as a company a combination of project and product business.

Technology, markets, and software development is changing fast, and organizations are doing their best to stay up to date. Larger organizations struggle with this more because larger organization often means *slower processes*. Participants agreed that many things could be more up-to-date, but at the same time, several participants stated that it's nearly impossible to stay up-to-date in all domains. Some even claimed that staying up to date in all domains is not necessary but couldn't really define the domains where being updated would be most important. Updates are constantly made but the reality is that there will always be a gap between the current situation and the state-of-the-art.

First, we are talking about data and digital which are quickly moving themes, new technologies coming in every day, and new concepts, cultures, and approaches. Of course, there is a gap between the situation and the state-of-the-art is something that is evolving every day. That's why it's hard to maintain a reasonable gap regarding the best of breed and the current situation as we experience it.

The complexity of the organization was also seen as a discouraging factor in knowledge management. This view would be understandable if this idea comes only from newcomers who haven't had enough time to get acquainted with the organization and teams. However, a participant who has been working in the organization for years said that one of the issues with knowledge management is the fact that complex organization causes confusion on who has what information and what should be shared with whom.

So, the setup is quite complex. And this is making this data management a complex exercise because there's no clear consolidation point and not always clear roles who is providing the needed information.

The case organization has been operational for a considerable amount of time and has collected a lot of data and information during the years. One of the issues for knowledge management is the question on what to do with the historical data. It's hard to define how long documents should be updated or maintained, when they should be moved into archives, and where they should be stored in case they are needed somewhere in the future. Few of the participants noted that historical data cannot be just deleted but needs to be stored somewhere. However, historical data would have to be separated from the data that is currently up to date and doesn't pop up so easily in searches. This issue is still under process and causes issues in decision-making.

We cannot base our decisions on historical data.

4.5 Interrelated social and technical topics

As mentioned in the beginning of chapter 4, all of these found topics can be interrelated and have an influence on one another. Interrelated social and technical topics discussed in this chapter illustrate themes where both technology and humans have a distinct effect on the topic or creates the issue itself. Technical restrictions and attributes mixed with human decisions and social surroundings create these kinds of factors that can hinder effective knowledge management.

Location of information is dependent on both the technical capabilities of tools and human action. The technical side of things might cause restrictions on what kind of information can be stored where and when, whereas practitioners can decide which tool to use when storing and sharing their knowledge. On the more social side of things, one of the major issues with knowing the location of the information is effective informing. One participant expressed frustration on how information is stored somewhere for sure, but the location is not informed in any way, which then discourages information search because one doesn't know where to begin.

The problem with this is that we have [internal wiki] pages that are not communicated, the links are not being shared, and we don't know where to go.

Multiple participants indicated that their main issue with locating information is the fact that they cannot find the necessary information from one location. New employees store information in new places, new tools are being introduced with new needs and procedures, and different colleagues store information about products and services in different locations. These locations are not effectively communicated, so it's up to the seeker to find information.

But now there are plenty, and you know, each time there is something new, there's a new [internal wiki page], there's new something, so for sure people are missing where to find the information.

But with our products and services, you are never going to find all the information in one place so you need to access multiple places in your search for information.

Decision-making is, or at least should be, based on information that is available. Decisions, however, need to be made based on accurate, up-to-date information to be as accurate as possible. Keeping information updated is thus absolutely vital for effective decision-making, but at the same time, it's one of the biggest challenges in knowledge management. Almost all of the participants answered that *information status* is a topic that crosses their minds regularly when dealing with knowledge and information. Participants have difficulties in identifying which information is the most recent and up-to-date which forces them to track down a colleague that might know something about it.

Right now, this information is spread in different places and it's extremely difficult to know where the information is, where the accurate information is, and be sure that it's up to date. Typically, we can find something in a collaboration tool. It's fine but we don't know if it's the last information if it's the reference information, if it's working information... sometimes we are totally lost.

It is very hard to understand is this really the latest version is this really the latest place and there's no kind of or not easy way how to recapture and basically find out.

This also has a lot to do with the choices practitioners are making with their knowledge and possessed information. Some see documentation as a waste of time, because it becomes historical data instantly, whereas some others will stick to old information out of a habit or because they don't know where to find the latest information or care to request that information when it's needed.

I don't believe in documents because they are outdated the moment they are written.

Okay, what is the latest document? I have one stored on my hard disk. I'm using that one. I know it's from 2018, but is this really the latest one? I don't know. If you ask me where to find the newest template, for NDA I don't know. Who has stored it? Is it somewhere? Yes. But I don't know where to search from.

The possibility to store similar information to multiple different tools and the ability to choose freely which tool to use and when has resulted in *scattered information*. Participants felt like too much of the information is spread out to different tools and when asked about the reason, introduction of new tools and a lack of global overarching vision seemed to be the main causes of fragmented information.

I mean, we introduced a lot of new tools. Yeah. Excellent. And it was easy going and so on but that way of course I mean at that time we were in operation we said already,

be careful if we if we go with all those tools because there is a risk to fragment the data, and this is where we are.

The information is spread in different places, but we don't have this global vision.

When knowledge is shared in person, it can be considered quite informal. When knowledge is conveyed through a document that can be read at any given time, it requires some kind of format. When asked about hindering factors related to knowledge management, information *structure* came up multiple times. They then explained that documentation must have some kind of structure so that it would be understandable to the reader and the information would be comparable. Having no structure means that everyone stores and shares information how they like and that causes difficulties.

I agree that information exists, but it's gathered and presented in different ways. For this reason, it's challenging to compare the info because it's not stored/structured in a similar way. Not sure if the info is compatible because different sources present the facts differently.

One of the potential reasons for not having a solid structure for storing and sharing information is the fact that information rarely stays static. Can something be structured if it's always changing and moving?

Some information is becoming obsolete, but you still want to keep it for historical purposes but it should not be as visible as it was before and so on and it's an effort to put information publicly in a wiki, but people can do that, but then to update and to maintain, how the information is organized is an effort that a few people are doing and I don't think that's a priori that will solve it because there is no final state. So, there is no final structure.

Most organizations around the world are using email as one of their tools. *An email* has proven to be very effective for communication regardless of time and location. A lot of information is shared via emails daily as it's an effective tool to communicate both internally and externally. Despite the undeniable benefits, many participants mentioned emailing as part of the problem in enhancing knowledge management. One participant described how emailing can be used for the wrong purposes, which would later cause issues in finding the made decision.

I think the email is quite useful for technical discussions of things like that. But when there is decision making and there are usually not the right tool and sometimes, they are used for decision making while decisions should be made on more as a stable environment. This is not always the case.

When asked for a reason why email is sometimes used too much and on the wrong things, answers were quite similar. Emailing is a faster option than other alternatives or there's no other alternative.

Sending emails takes a few seconds whereas putting files into my content and asking the customer to download them from there takes a lot more time.

They are working in a project mode, meaning that they exchange emails, rather than have a platform while working together [...] today we would use email, because I don't think we have another tool to do so.

Digital transformation has been happening in the last decades and the case organization has been going through its own transformation during the past decade. These kinds of transformations change the way technology is used, the way work is being done, and the purpose of employees. Understandably these changes also affect knowledge management on many levels. New tools to be used and new ways of working to be familiarized is something that participants felt like would affect the way knowledge management is both perceived and promoted because it gives an opportunity to get rid of the old habits.

And the nature of the business has been changing over the last 5-6 years a lot, so it's quite the opposite now what it used to be 10 years ago.

Another factor that discourages employees to share knowledge with their colleagues is poor *visibility to other functions*. Teams around software development need to work together tightly and be able to collaborate. This can become challenging with remote teams if there's no clear visibility between the teams and functions. Cross-functional collaboration is key for successful software development and delivery. One participant noted that it was difficult to know whom to contact about a certain thing because there wasn't enough visibility from the other function.

It's difficult to find with whom to discuss case by case. For example, no visibility from [a certain function], no idea whom contact from there.

Some participants expressed that documentation in part is useless. They were worried if certain reports and documents are even read by anyone even though they have to be produced for standardization purposes. This kind of thinking often leads to broken telephone tendency where information is passed along and told from memory. Having the right *form of documentation* can be useful in instances like these and promote better knowledge management in a long run.

I'd have it properly written down because of this broken telephone tendency. There are a lot of people who have the need to have written documentation of the information that they need.

A few people found current labeling tendencies within the organization poor and thus also discouraging from a knowledge-sharing point of view. *Labeling or tagging* documents and information would help in narrowing down searches, creating a structure for documents, and classifying the importance of documents

easily. This is apparently something that is under consideration for all employees. One participant clearly stated his opinion on whether this should be the case.

Yes, all the documents should be tagged internal/external every time.

Along with the email, *chat* services have been more popular in recent years. Chat is a useful tool for quick messaging and communication, but similarly to the emailing situation, several participants were worried that chat is used for the wrong purposes and people keep losing information because of it. Chat is a very difficult tool to find discussions after they have happened because it's difficult to search and the messages might be deleted after a certain period of time. Having multiple different chat tools available was seen as a hindering factor because too often important information was lost in chats and time was lost when looking for past conversations that were then later needed.

It's easy to ask it through the email or in the chat [...] but for example [...] the messages are stored there for a couple of months so not forever. Then it's lost. When looking at the history of what has been done and what's the current status and then we are trying to see the information from the chat and it's not visible to everyone, it might not be found anymore or in the emails and that's a problem.

5 DISCUSSION

This chapter summarizes the previously introduced results, compares them to prior research, provides discussion on found results, answers the research questions, and draws implications for both practice and theory.

The theoretical section of this thesis examined knowledge management in software development teams and organizations. Researching and understanding knowledge management is important because nowadays knowledge is the most important strategic resource any company can have to gain a competitive advantage and experience success in increasingly more competitive markets (Rus & Lindvall, 2002; Ružić & Benazić, 2021). The theoretical section focused on defining the most important terms and concepts, understanding the different types of knowledge, and identifying knowledge management challenges and used practices. Prior research does provide an understanding of what would need to be done, but insufficiently answers why it is not done in practice when it comes to successful knowledge management. There's a lack of understanding of the hindering and discouraging factors that demotivate individuals to share and manage knowledge.

The empirical part of this thesis studied knowledge management in an international organization. More specifically the studying focused on hindering and discouraging factors that appear in and between globally distributed teams working around software development. The data collection exploited qualitative research methods in a form of 22 group interviews and casual conversations about the topic with the case organization's employees before and after the group interviews. Case organization also allowed access to the organization's knowledge bases and storage for additional information and material for this study. Analysis was conducted in a form of content analysis drawing codes and themes directly from transcribed interviews.

The main findings of the empirical study suggest that the importance of knowledge management is recognized widely across functions, but that recognition rarely turns into actual actions to improve knowledge management. It was discovered that personal social topics, organizational social topics, technical topics, environmental topics, and interrelated technical and social topics are

hindering knowledge management improvement initiatives and actions. Solving these pain points would be crucial for the case organization to enable efficient improvements related to knowledge management and increase employees' motivation to participate and promote actions to improve organizational knowledge management.

The following sections provide a more detailed interpretation of the research results by comparing them to prior research results. Discussion on the findings is followed by a section answering the research questions in detail. Finally, implications for both practice and theory are provided.

5.1 Discussing the findings

The findings of this study indicate that managers and practitioners alike recognize the importance of knowledge management, knowledge sharing, and knowledge itself. This supports multiple studies conducted during the years (Aurum et al., 2008; Rus and Lindvall, 2002; Ryan & O'Connor, 2009, 2013). Even though the participants admitted that knowledge management and sharing are important for them and for the organization, they also agreed that this perceived importance is not sufficiently reflected in the organization nor in the everyday activities of an employee. This finding reinforces the perceived situation of the case organization which originally motivated to conduct this study to find out why that is the case. Despite considering knowledge sharing and management important, participants admitted that sharing, finding, and managing knowledge rarely match their perception of the importance of the matter. This aligns with the study conducted by Aurum et al. (2008) except their statement was focused on the organization's passivity whereas this study focuses more on the individual's passivity in knowledge sharing and management.

Interviews indicated that sharing knowledge was a contradicting theme. On the other hand, participants felt like knowledge is openly shared to help colleagues, but others saw that sometimes knowledge is withheld for an unknown reason. The study indicates that the willingness to share knowledge was not considered an issue, because sharing knowledge was seen as a way to help one's colleagues and team. Prior literature suggests that globalization in the IT sector has enabled offshore arrangements and partnerships with countries where the cost of labor is lower, which could in turn make employees withhold important knowledge in purpose as a way to ensure their employment (Ebert & De Neve, 2001; Herbsleb & Moitra, 2001). Study results do not support this claim, as participants indicated their sincere willingness to share knowledge with their colleagues and didn't express worry about losing their position or employment because of doing so. Participants highlighted the organization's team mentality where individuals feel that the only successful way forward is together, and this is why knowledge and expertise should be shared. However, some participants reported issues with knowledge sharing, and these issues were mainly related to the time and effort sharing takes. Few participants stated that some individuals

and teams might only share knowledge when they are asked to share and suspected that it might have something to do with the culture of those withholding knowledge. When asked about this tendency, participants that recognized this claim said that they are often so busy with their daily tasks that they don't have the time to think about what knowledge should be shared with whom, so they rather wait for the questions to come in. This means that it is easier to pin down what is asked, and who is needing this knowledge and less time is wasted in transferring that knowledge. Asking and answering questions was indicated to be one of the main ways to acquire knowledge and giving answers was considered important even if it takes a few days. In conclusion, withholding of information happens not because of unwillingness to share but the lack of time to give accurate sufficient answers without information on who needs the knowledge and for what.

Several participants were able to point out the practical benefits knowledge sharing brings to them, to their team, and to other teams around the company, meaning that the perception of importance is based on practical observations. These can be traced back to individuals' motivations to share knowledge and expect knowledge to be shared with them. The main motivations mentioned were saving time from others searching for specific knowledge, helping colleagues to do their tasks, enhancing team performance, and avoiding misunderstandings. All of the mentioned motivations can be classified as intrinsic factors, whereas anticipated extrinsic rewards were not mentioned during the interviews as was observed by Aurum et al. (2008) and Bock et al. (2005). According to their studies, anticipated extrinsic rewards have an effect on the motivations to share knowledge and thus could be seen as a point of improvement for the case organization. However, other studies have stated that extrinsic rewards don't have a significant influence on motivation as intrinsic factors (Szulanski, 1996), meaning that recognizing intrinsic factors in the case organization instead of extrinsic ones can be seen as a good sign as well.

As noted earlier, knowledge plays a crucial part in the success of any IT company and is very highly valued. Value brings along responsibility which was indicated to be one of the main factors why knowledge sharing, and knowledge management is not as efficient as they could be. Wegner (1987) noted claimed that when an organization doesn't have clear responsibilities, the chance of losing important information is significantly higher. The results from this study would seem to support this idea as it is seen in multiple ways. Some are scared to share their knowledge with others because they don't know if it can be shared because they don't feel responsible for that information. Others keep asking reassuring questions from colleagues because they want someone else to take the responsibility for the validity of that information. Others don't know which information is valid because they don't know who is responsible for telling whether or not that information is still valid and up to date. Having clear responsibilities that are effectively always communicated and available still remains a point of development for the case organization, and it also indicates that effective knowledge sharing, and management are partially based on clear responsibilities.

Nothing beats social interactions when it comes to sharing knowledge. Multiple studies have shown that keeping a wide personal network, preferring social interactions, and locating colleagues with possessed knowledge is an effective way to share tacit knowledge (Aurum et al., 2008; Bock et al., 2005; Ryan & O'Connor, 2009), and thus managers should support the development of those relationships between colleagues and teams. However, participants indicated that sometimes this kind of approach to knowledge sharing and acquiring could be causing issues in a globally distributed setting. Having colleagues around the world means that personal social interactions are rare in person and mostly happen via phone calls or video meetings which don't compare to in-person meetings. Sometimes a colleague is not available for a call or meeting when information is needed as soon as possible, and these instances happen quite often in a hectic software development environment. It would be important to have other means to gain information when it is needed that is not dependent on one individual or even a team. Only resorting to personal connections can discourage sharing and acquiring information to and from digital tools made for that exact purpose. Some participants admitted that asking their network for information is usually their go-to strategy and that's why they are not that familiar with the tools that store the very same information they are looking for. A better balance between these two sides was hoped for by colleagues in the interviews.

Changing knowledge management procedures and practices often requires time and effort that very few employees have, especially if the organization has been operational for years and these procedures and practices have existed for a long time. The size of the organization can hamper any changes planned for knowledge management because existing research suggests that as an organization grows, it develops formal systems, structures, and norms that slow its capacity to recognize changing conditions and react to them efficiently (Leiblein & Madsen, 2009). This study supports the idea of losing the ability to make quick adjustments to respond to shifting environmental factors when an organization grows. Participants admitted that the size and complexity of the organization make it harder to perform changes that require a lot of time and attention. The only way to succeed in an effort to change the way knowledge management is handled is to have that initiative led by top management which can provide necessary resources. Although the size of the company can break down interpersonal relationships and communication (Bontis et al., 2007; Fores & Camison, 2016), creating a sustainable structure to promote knowledge management is a possibility when it's based on the organization's values and norms.

5.2 Answering the research questions

This section strives to answer both research questions based on the findings drawn from the conducted interviews and other material.

RQ 1: *Which factors hinder and complicate knowledge sharing and knowledge management within and between globally distributed cross-functional teams?*

The role of this question was to identify those factors that individuals felt hindering organizational knowledge management in and between cross-functional teams. It was evident from previous observations that knowledge was not efficiently shared or managed in the case organization and the purpose of this research question was to find out why. Is it because individuals want to keep hold of their knowledge? Maybe the organization's environment doesn't promote a culture of sharing. Does the organization itself discourage knowledge sharing between colleagues? The study indicates that there are multiple factors that have a hindering effect on knowledge management. These factors have been introduced earlier in Table 1 and this section discusses those findings more in detail. These factors can be categorized and grouped into five separate themes. These themes are interrelated and connected and sometimes difficult to separate from one another because multiple factors from different themes presented can have an influence on a situation or individual, thus causing discouragement or issues in knowledge management and sharing.

Personal social topics include factors where individuals' actions, perceptions, decisions, intentions, and motivations are mostly concerned when it comes to knowledge management. Participants identified that personal reasons like lack of time, perceived importance of sharing knowledge, motivation to manage knowledge, or lack of confidence are all factors that can hinder knowledge management and sharing in the organization. These factors can obviously be affected by other themes, but these factors are mainly in the hands of each individual. Participants indicated that personal values and one's understanding of knowledge management influence their ability and willingness to participate actively in and promote more effective knowledge management. Some of the participants had suffered more from the lack of shared knowledge than others and those participants were more eager to support knowledge management initiatives and more willing to take the time necessary to properly both share and manage the knowledge they possess.

Organizational social topics include factors where the organization's current culture, habits, systems, rules, and guidelines are in the middle of attention. Organizations develop these things over time; they are shaped by employees and embraced by newcomers. These factors cannot be changed by an individual's decision like personal social topics could, but these can be influenced by teams and groups of people if needed. Participants identified that many of the set habits, norms, and guidelines have been built for years and now they feel too outdated. The most difficult thing with these factors is the change resistance waiting to be erupted. Several participants expressed their dissatisfaction with current ways of handling knowledge but didn't see an easy way to solve those problems because it would mean major changes to habits, norms, and the organization's culture. This was seen as highly difficult because the successful change would require positive reactions from practitioners who have worked for years or decades building the current ways of working. In a large organization, there are also

multiple sites and countries involved which causes different teams and social circles to have their own habits, norms, values, and guidelines that don't necessarily match with other sites or teams. Issues such as the lack of governance, unclear ownership of knowledge, developed habits, and confusing organizational vocabulary are factors that concern all employees at once and changes to these have to be driven by the management to enforce the whole picture. These hindering factors have taken years to build and changing them on purpose will most likely take a similar amount of time.

Technical topics are mostly related to issues with technical solutions that support knowledge management. Factors included in this theme are issues with tools and access rights for example. Since a lot of the communication and sharing of knowledge cannot be done in personal face-to-face interactions because of the globally distributed nature of the organization, several technical tools have been implemented to support knowledge management. The study indicates that recent changes in markets, developments in technology, and competition for competent workforce have caused employees to think that having the best possible tools to compete and benefit from knowledge is essential. Some participants worried that old-fashioned tools could prevent employees from fully benefitting from the knowledge that the organization possesses. Others expressed issues with accessing the right tools or information produced by others which in turn hinders effective knowledge sharing. Not having the right tools or the right access, forces employees to contact other people and take time from their schedules, when trying to access some information that could be found just with a click of a button, rather than after four calls and six emails. These kinds of issues can also have an effect on the organization's image and how potential newcomers and job applicants view the organization. These factors are almost completely related to technology and technical capabilities, although some of the perceived issues mentioned here could be a result of incompetent use of tools or their functionalities. However, these factors are not likely to be solved by having employees act differently, but rather by having technical solutions that match the current needs of the market, customers, and employees.

Environmental topics concern the surroundings and setting around the organization. Factors included in this theme are very long-lasting and stable. Sometimes organizations cannot do anything to these factors to change them, and thus needs to adapt to them. Legal and regulatory demands are one example of factors that can hinder knowledge sharing, but there's nothing the organization can do about it to change that. Instead, they will have to adapt to that. The complexity of the organization, globally distributed team, and the sensitivity of documents are all factors that exemplify issues that come with the current case organization's environment. Unlike legal regulations, these factors have been decided by the organization years ago but are almost as hard to change as the legal demands, because of their stability and influence on the business. Participants stated that having this kind of complex and global organizational structure discourages knowledge sharing because it is hard to know who needs what kind of knowledge and what kind of knowledge can be shared to whom and to which

country. The sensitivity of the documents also causes confusion because some employees label their documents and others don't which leaves the sensitivity of the document up to the reader. With these types of factors, participants agreed that the best way usually is to have workarounds to bypass the issues.

Interrelated social and technical topics contain factors that were so difficult to separate into either social topics or technical topics, that they were grouped to a separate theme. These factors are equally influenced by available technology and employees' perceptions, motivations, decisions, and actions. Bad usability of a tool can have an influence on individual's motivation to share knowledge via that tool and thus decides to not share at all. Acquiring or sharing information in a complicated internal wiki page can feel very time-consuming and employee decides to use the time to do something more productive. Lot of the mentioned factors in this group concern information itself; the status, location, or availability. Employees don't want to use their days looking for information from different locations and then trying to assess whether or not the information is still valid to use for decision-making. Typical for these factors is that the technical solution is either too difficult, complex, or bad that it demotivates the employee to share, acquire, look for, or manage any knowledge. On the other hand, cases were mentioned where social aspects affect the technology choice, which in turn leads to issues. Some employees for example, prefer to use chat or email to document decisions that were made in a meeting or on a phone call. Months later, when that decision needs to be reviewed, it has either been lost in the emails or has been automatically deleted from the chat. Very similarly how these different factors influence each other, these themes discussed here and presented in Table 1 influence each other and need to be considered together rather than separately.

RQ 2: What kind of measures can be taken to solve hindering factors in knowledge sharing and knowledge management within and between globally distributed cross-functional teams?

This question strives to seek out solutions to counter hindering factors in knowledge sharing introduced previously. This section introduces some measures to tackle hindering and discouraging factors in an organization. The case organization had ongoing initiatives for knowledge management at the time of the interviews in which some of the found measures to tackle hindering factors are being solved. Although these measures are aimed at the interviewed organization, other international organizations in software development may benefit from considering these recommendations because several organizations are having difficulties in having a consistent and structured approach to support knowledge management (Aurum et al., 2008). However, every organization has unique situation and challenges when it comes to knowledge management, which should be considered before acting on these recommendations. After introducing these general recommendations, that the case organization is currently addressing, specific recommendations for the case organization will be presented. All of these recommendations are based on the interpreted findings of this study and thesis.

The general recommendations, that are currently already being addressed in the organization, but nevertheless worth mentioning in this thesis, are all related to clarity with knowledge management. The first general recommendation is to have clear responsibilities around knowledge. Who owns the data? Who maintains repositories? Who updates the documents? Who possesses the expertise in which domain? Setting clear responsibilities within the organization and communicating those to all employees reduces confusion and misunderstandings. Secondly, distributed teams rely on documents and remote interactions, which can best be supported by effective governance and structuring of knowledge. When knowledge is structured better, it is easier to find and share. This in turn reduces the time and effort one needs to put into sharing or acquiring knowledge. Thirdly, globally distributed teams need a common way of working between different sites, regions, and countries. Having a common way of sharing, documenting, storing, acquiring, and maintaining knowledge, helps with onboarding newcomers, saves time, and motivates employees to collaborate with remote colleagues.

Next, five recommendations are provided that are directed to the case organization. These recommendations support the ongoing initiatives improving knowledge management in the organization by covering the main hindering factors not yet covered. These recommendations are based on the findings of this study and the objectives of the ongoing initiatives mentioned before. Specific recommendations for the case organization to improve knowledge management are:

1. Productize an organization-wide induction plan that considers knowledge management.
2. Provide training for knowledge management-related topics.
3. Enhance and focus on cultural change to promote intelligence culture.
4. Provide guidelines for documentation.
5. Insist document labeling.

These recommendations support each other and are best implemented together. These recommendations aim at transforming employees' interest and perceived feelings of importance towards knowledge into concrete actions. The recommendations are shortly discussed below.

Productize an organization-wide induction plan that considers knowledge management.

Participants agreed that there's very little material on knowledge management available within the organization and finding a way to access and acquire necessary knowledge can be overwhelming, especially for newcomers. Different functions are having different induction plans, but they are not informing the new employee on knowledge-related topics. One participant had started in the organization a couple of months ago and was still wondering where to find certain key information and how to use some of the tools that possess documentation. Instead of having induction on the topic, this new employee had to ask around, email unknown colleagues, and spend hours with different tools containing some

knowledge. An organization-wide induction plan would not only give the opportunity to inform newcomers about knowledge management practices and culture, but it would also unify the way the employees work with knowledge and the tools dedicated to supporting knowledge management.

Provide training for knowledge management-related topics.

Newcomers are not the only employees that struggle with sharing and acquiring knowledge on a daily basis. More experienced employees have old habits that might complicate knowledge management and wider networks within the organization which could mean that they manage and share knowledge only within their social circle or personal network. Participants felt like the reason for this kind of behavior most likely is the fact that no training has been provided on knowledge management topics. When there are no guidelines, resourceful people come up with their own way of doing things. When multiple employees around the globe come up with their own way of documenting, sharing, and acquiring knowledge the outcome is quite messy and complex. Providing training on how knowledge should be documented, shared, acquired, and maintained would help in simplifying knowledge management within the organization. Training should consider not only the donor and owner of knowledge but the receiver and searcher of knowledge as well. The training could instruct how to use available tools for knowledge management, how knowledge should be documented, how different sources of information could be bookmarked or flagged, and how information should be searched. This kind of training would have similar benefits to the induction plan but would be directed to all employees.

Enhance and focus on cultural change to promote intelligence culture.

An organization's culture strongly defines the way work is being done and what is considered important. Participants expressed that the current culture doesn't support knowledge sharing as well as it could. It was indicated that intelligence culture, in which knowledge and benefitting from knowledge are in the middle of, was still lacking. Some participants suspected that intelligence culture is not seen as very important yet because it has not been actively promoted, it has not been included in job descriptions, and employees are not used to doing that kind of work. It was claimed that most of the employees don't fully understand the importance of knowledge and intelligence and that is reflected in the current situation and culture. Basing the culture around knowledge would automatize some knowledge-sharing, acquiring, and management practices. The successful cultural change would affect employees' motivation and capabilities to draw more value from available knowledge.

Provide guidelines for documentation.

This study showed that there were several issues with knowledge sharing when it comes to documenting knowledge. Participants acknowledged how difficult it was to know which document contains valid information, where certain documents can be found, and if certain documents can be compared because they are presented in various ways. Multiple locations of information, spread out knowledge, document life-cycle management, and access issues were all mentioned by participants when asked about issues with knowledge sharing. The overarching issue seemed to be the lack of common guidelines that would guide the donor of knowledge as well as the receiver of knowledge. Guidelines for documentation could consider how often certain documents need to be checked and updated, what is the appropriate location to store certain documents, who is entitled to have access to certain documents, and how knowledge should be presented and structured. These guidelines could be included in training materials and induction plans as they would form the base for the other recommendations discussed.

Insist document labeling.

Trying to find a certain document out of the tens of thousands stored in the database might seem like an impossible task sometimes. Participants recalled how they were searching for a certain document with the correct keyword and the search engine offered over 16 000 search results and the correct document wasn't even found eventually. The case organization has a lot of stored information which complicates the day-to-day searches. This complexity takes unnecessary time and effort from employees, which causes many employees to abandon any technical tools and prefer contacting their colleagues directly, taking their time on the matter. A participant recalled how a colleague couldn't find information from the internal wiki page and contacted this participant. Then this participant had to use their time to go to that very same internal wiki page to find that information so that they could provide the link to the information. Finding that information took two employees and double the time it should have. One solution to ease this is to use labeling in the documents. Attaching an agreed label to each document helps in categorizing documents and filtering down search results. If labeling would be supported and insisted on documents could be searched with the keyword and label, thus potentially narrowing the search results from tens of thousands to a handful.

5.3 Implications for practice

This thesis helps practitioners understand what kind of factors can prevent or hinder knowledge sharing within and between distributed teams involved in software development. This thesis might also raise practitioners' awareness of knowledge sharing and knowledge-management issues within their organization or team. Long-term obstacles and hindering factors that have remained

undiscovered for years might be found when light is being shed on practical issues experienced by an actual organization. Issues can only be addressed if they are first correctly identified. Not only is this thesis offering help for identifying these issues but also recommendations on how to address and solve hindering factors in knowledge management. These recommendations can improve the quantity and quality of knowledge sharing and knowledge management.

Although this thesis offers some recommendations and clarifies potential hindering factors, this study is exploratory and was not aimed at generalizing any findings. Even though the study covers multiple individuals around the world and the sample size was relatively extensive in both quantity and quality, the focus of the study was on one organization. Although some other European organizations implied having similar issues and thoughts on the matter, a systematic study to generalize findings was not conducted. Readers are advised to keep in mind that each organization, situation, and environment is different and thus likely to have hindering factors not mentioned in this study. The applicability of the presented findings in this thesis and recommendations on effectively addressing them should always be carefully evaluated by the reader. It is believed that these findings can be a good starting point for other organizations and teams to take a look at when considering improvements in knowledge management efforts. The main takeaway from this thesis for the practitioners is that knowledge management won't be improved by just implementing practices that presumably work, but by considering and addressing factors that are hindering knowledge sharing and management efforts.

5.4 Implications for theory

This study was initiated from an observation that knowledge management is not working efficiently in an international IT organization. After little research on the topic, this observation turned into a perceived general issue among organizations. Several sources indicated that for some reason - that was not well identified or described - effective knowledge management in practice was very challenging despite comprehensive research results on knowledge management practices. Some prior research efforts focused on motivations to share knowledge and best practices to support knowledge management, but previous research had not considered the reasons and factors why the already existing practices are not working as they should be. Rather than exploring again what works and why this study explored why it isn't working. The findings of this study and the collected data on the topic confirm that approaching knowledge management from this angle is needed and can benefit both practitioners and researchers alike.

The findings indicate that the implementation of new knowledge management practices without considering the hindering factors in the organization is likely to end up in failure. Results show that practitioners are very aware of the importance of knowledge management and are motivated to act on it, which would indicate that the general assumption of practitioners not understanding

the importance of knowledge management causing issues could not be true in every environment. Results also indicate that decision-makers in top management usually make decisions regarding knowledge management practices and initiatives don't perceive the importance of knowledge management as highly as practitioners dealing with knowledge management more often. Researchers should consider preventing and hindering factors when recommending new practices or procedures for knowledge management so that decisions on implementing any practices would be done based on the actual factors that are preventing or discouraging effective knowledge management. Reporting challenges and new practices over and over provides lower value than reporting challenges and practices that are tied to factors that might hinder the proposed solutions to provide a more comprehensive understanding.

6 CONCLUSIONS

The initial idea for this thesis was born out of an observation of discrepancy between the perceived feeling of the importance of knowledge management in an international IT organization and the lack of action concerning it. The objective of this thesis was to identify and understand the reason why this gap is existing between the common perception and actual reality and how this gap could be narrowed or even disposed of. This thesis especially focused on identifying hindering factors that could complicate or prevent effective knowledge sharing and management within and between teams in a large international IT organization. More specifically, the focus in the IT organization was on teams and functions around software development, from sales to engineering and from testing to legal functions.

Prior research was carefully studied to provide a solid base for this research effort. The theoretical background was based on prior research and primarily focused on the definition and types of knowledge, the importance of managing knowledge, and the currently known challenges and practices in knowledge management in software development. Also, due to recent tendencies to distribute teams and colleagues around the world in global software development, attention was paid to globally distributed software development, which causes unique challenges in knowledge sharing due to different distances between colleagues and teams.

After setting the theoretical background, the objective of the empirical research was to study the phenomenon more in-depth because prior research had not sufficiently covered or explained it. The empirical research was conducted as a case study and was not seeking to generalize the results, which is why an interpretive case study method was selected and semi-structured group interviews were used to collect data. Participants were gathered from 22 different teams, each representing a separate function. Participants represented a wide variety of experience in the field, time in the organization, and positions in their respective teams, giving unique richness to the empirical data acquired.

The results of this research indicate that there truly is a gap between the reported perception of importance and how this perceived importance is not

realized in practice. Several factors that hinder knowledge sharing and management were identified and grouped into five groups based on their estimated root cause. Found factors were grouped under personal social topics, organizational social topics, technical topics, environmental topics, and interrelated social and technical topics where all of the factors represent something that prevents or discourages an individual to share, acquire, or manage knowledge. Although divided into groups, respective hindering factors can be connected and dependent on each other in different situations where one factor can cause another and so on.

The biggest number of factors were grouped under social topics rather than technical or environmental factors, which indicates that human motivations, values, habits, perceptions, and personalities have a much stronger influence on effective knowledge management than the technical tools and means or the surrounding environment. However, there were no indications that individuals would be unwilling to share their knowledge, meaning that lack of motivation and willingness to share might not always be the reason for poor knowledge sharing and management as some previous studies have implied.

Based on empirical data, the most significant individual factors hindering knowledge sharing and knowledge management are the lack of joint recommendations or guidelines regarding knowledge, and the time and effort used on activities related to knowledge. Not having joint guidelines results in scattered knowledge in several locations that are not properly maintained and eventually becomes obsolete. Obsolete knowledge scattered everywhere cannot be trusted which destroys employees' interest in trying to find relevant information or share their knowledge if it will just be buried somewhere and over time become obsolete. Trying to acquire knowledge takes time and effort as does documenting and storing knowledge for others. If these activities are not made simple and effective, employees will stop sharing and caring, because they value their time so much. Time put into searching for a specific document is always time away from other tasks for the day. Essentially, employees focus on activities that are worth their time and efforts, and knowledge management and sharing have to match that expectation or less attention will be paid to those activities.

The primary contribution of this thesis is in the identification and descriptions of hindering factors that discourage and prevent effective knowledge sharing and management within and between globally distributed teams around software development. Recognizing, identifying, and understanding these factors is a prerequisite for addressing them properly and maximizing the potential to increase the quality and quantity of sharing and managing knowledge. Based on the findings, some recommendations to ease and address these found factors were proposed as well. Practitioners can benefit from understanding potential reasons for poor knowledge management and researchers can benefit from understanding practitioners' issues caused by these identified factors to focus the direction of future research.

6.1 Limitations

Every academic study has some limitations, and this thesis is no exception to that. The limitations that might have affected the results and are recognized by the researcher are presented in this section to enable critical evaluation of this study.

The selected research method causes some limitations to this study. The purpose of an interpretive study is not to generalize the findings but rather to explain individual phenomena. In this case, this phenomenon was studied in a single case organization, thus possibly limiting some of the results to plausible only in certain settings or organization. Even though interviewees were from several different continents and countries, they are all more or less accustomed to the culture and habits prevailing in the case organization.

Data was mainly collected through semi-structured interviews where participants are free to express their opinions and thoughts. Given the sensitive nature of the topic being discussed, it is possible that some issues could have remained hidden because of interviewees' choice to withhold information. Absolute honesty was emphasized at the beginning of each interview to ensure the best possible results. It seems that this was well understood because interviewees were very open about potential issues in the organization and talked about negative habits, tendencies, and actions. Despite the researcher's perception of honesty in the interview, some information could still be withheld for various reasons.

The data collection method could also act as a limitation because the one interpreting the interviews is also prone to misunderstand or misinterpret. Interviews were conducted by the same person who performed the transcriptions and interpreted the results alone. Interviews were transcribed manually per the case organization's request which leaves room for human error. The coding process was also done by the same individual manually. Manual work predisposes to more errors and a single researcher could have researcher bias, having done the whole empirical process alone. Although necessary measures were taken to ensure that researcher bias wouldn't affect the codification of data or interpretation of data, there's always a possibility for that.

The majority of invited employees agreed to participate in the interviews. Some however refused and this could be considered a possible limitation. Those who agreed to be interviewed were voluntarily doing so and this could be seen as elite bias where only those employees who are active in knowledge management activities would participate. However, based on the interviews this was not the case since some participants were encouraged by their managers to participate in the interviews and several participants had little to no idea about knowledge sharing and management practices. The actual sample size was relatively comprehensive, and the variety of individuals was wide as well in terms of experience and position. Unfortunately, none of the executives from the top management participated in the interviews which could be seen as a limitation

as executives are usually the ones who decide on organizational knowledge management practices and activities.

Some limitations are also originated from the lack of resources. Keeping in mind that a master's thesis has its limitations on time and means to conduct comprehensive research, the scope is usually limited, as is the case here as well. This master's thesis can also be considered as the first proper study conducted by the researcher making it possible that despite best efforts some mistakes might have originated from the lack of experience.

6.2 Future research

Interesting research topics in the future could be drawn from the limitations of this study. Some other possible future research aspects came to mind during the completion of this thesis and these possibilities are introduced here.

Prior research has addressed known knowledge management challenges and practices quite extensively, yet those practices are not often resulting in desired outcomes in practice. It seems that implementing and adopting new practices has a relatively low success rate. If the new practices are difficult to integrate into the current way of working, the possible benefit is lost. Future research should focus on understanding the exact needs organizations have relating to knowledge management and how new practices can be simply implemented. A study where the adoption of new knowledge management practices is monitored could be interesting and result in valuable understanding towards better integration of knowledge management practices.

This study focused only on one organization, thus limiting some of the results. Comparing multiple organizations from different cultures and of different sizes would be needed to understand this phenomenon better. Comparing possible hindering factors between different organizations would help in understanding why knowledge is not effectively shared and managed despite all the known practices and possibilities. Similarly, future research could focus on knowledge management between an organization and its external stakeholders like suppliers and customers and what kind of influence their actions have in knowledge sharing and management.

Finally, it was briefly mentioned that Agile methodologies encourage less documentation than the previous waterfall model where almost everything should be extensively documented. Agile methodologies have been more common in recent years and are gaining a stronger foothold in software development. Future research could compare how an organization's choice of software development methodology affects the effectiveness of knowledge management and sharing and how the mindset of employees differs when different software development methodologies are in use.

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APPENDIX 1 INTERVIEW STRUCTURE

Introduction

- Researcher's introduction
- Reminder of study's purpose, goals, and scope
- Facts about the interview – recording, privacy, data processing
- Importance of honesty, policy to not judge
- Any questions before the recording starts

Theme 1: Information/knowledge owned by you and your team

- Types of documents, assets, tools, and resources
- Teams and individuals benefitting
- Importance of the information for others

Theme 2: Information/knowledge needed by you and your team

- Types of documents, assets, tools, and resources
- Teams and individuals owning that information
- Location and availability
- Importance of the information for you

Theme 3: Knowledge sharing and knowledge management

- Importance, benefits, personal motivation
- Activities and initiatives in the area
- Current state vs. desired state
- Challenges

Theme 4: Recommendations to improve

- Encouragement and motivation
- Ability and capability
- Responsibility
- Concrete ideas for more effective knowledge-sharing and management