

MASTER'S THESIS

Knowledge Management in Virtual Teams

- A multiple-case study of
Deloitte and Touche, KPMG and Öhrlings PWC

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This eMBA thesis is the result of twenty weeks work and research. The thesis covers an area that has had very little attention from researchers. We have put efforts in blending two key areas from modern workplace to one extensive topic. To accomplish this mixture we have had important help from our surroundings. Therefore, we would like to show our sincere gratitude and appreciation to the people that have helped us during the process of writing and making this thesis possible.

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Abstract

The purpose of this thesis is to gain a better understanding of how organizations with entirely knowledge-based services are using Knowledge Management (KM) in virtual teams. Our research explores, describes and begins to explain how knowledge is managed, how KM strategies are used and what the critical success factors in virtual teams are. In our quest for answers, we have conducted a multiple-case study with three companies. Our findings show that managing KM in virtual teams depends on both internal and external knowledge sharing and interaction. The findings concerning the KM strategy indicated that organizations should appoint a specified position for handling the knowledge flow. Finally, the critical success factors in virtual teams showed strong influence from stress related levels together with the ability to allow internal and external knowledge sharing.

"We can know more than we tell"

- Polanyi, 1966, p.136 



This is based on the assumption that it can be difficult to express all knowledge contained within us.

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1 INTRODUCTION

The first chapter in this thesis will introduce the concept of knowledge and how knowledge management has become an increasingly important factor for organizations. We start with a brief background to why knowledge has gained more interest today. After this, we move into to the problem discussion, in which we focus on the appliances of knowledge, knowledge management strategies and critical success factors used in virtual teams. Finally, we present the purpose, the research questions, delimitations and a disposition of the thesis.

1.1 Background

In the present postindustrial society, knowledge has become a key resource of the economy (Bell, 1973). Today when most of the jobs are becoming ever more information intensive, a majority of employees are moving to knowledge intensive industries (Bhatt, 2002). In e-business, knowledge has become a strategically important resource. The way organizations interpret new skills, the learning capability, is becoming a key role in organizations (Sanchez, 2001). The pressure of success is forcing organizations to become more dynamic in their operations and adopt innovative approaches to be competitive (Arnison and Miller, 2002). There is an increasing amount of information and knowledge value needed by every firm (Burn, Marshall and Barnett, 2002). This is why it is becoming a paramount necessity for survival to cope with the task of transforming information into a body of knowledge, to be used whenever needed (ibid). This knowledge is made up of an individual's understanding of factors, facts, things, events and its environment (Sanchez, 2001).

Many argue that knowledge has become the main competitive tool for many businesses. Drucker (1993) has described knowledge, rather than capital or labor as the only meaningful economic resource in the knowledge society, and Senge (1990) has warned that many organizations are unable to function as knowledge based organizations, because they suffer from learning disabilities. Although there is recognition that the knowledge society and the knowledge economy have arrived, and that knowledge is a key business asset, organizations are still in the early stages of understanding the implications of knowledge management (Rowley, 1999). Bhatt (2000); Abell and Oxbrow (2001) bring up that competitiveness of organizations is determined by organizational capabilities and core-competencies. Prahalad and Hamel (1990) continue by stating that the increased realization of knowledge as the core competence is becoming a crucial survival factor.

The recent advances in the merging field of computing and high-speed communications have increased the organizations interest in the topic of KM. This has also enabled organizations to be much more efficient in the transfer of data, sound and video (Abell and Oxbrow, 2001). This growing field is covered under the name Information and Communication Technologies (ICTs). Advances in this area have increased organizational interest in the topic of knowledge management (ibid). The importance of information in strategic management has long been recognized (Porter and Millar, 1985). Information technology plays a key role in changing the “rules” of

firm, industry and global competition (Scott-Morton, 1991). This has led to the notion of “information-based competition” as a special concern within the competence-based perspective. More recently, the literature on competence-based competition (Hamel and Heene, 1994; Merali and McGee, 1998a; Nonaka and Takeuchi, 1995; Sanchez and Heene, 1997) has highlighted the importance of organizational knowledge management for competing in dynamic contexts. The information an organization generates and uses is a fundamental part of the cognitive infrastructure that underpins organizational learning and the leveraging of capabilities (Merali and McGee, 1998a). With increasing capabilities of ICTs, an understanding of different knowledge strategies has become much more important (Burrows, 1994). Strategies to investigate Knowledge Management (KM) would be to increase the level of social interaction that occurs in the organization, only some of which may be technologically assisted, Earl and Scott (1999); Bontis (2001). Often an organization's informal networks provide the necessary knowledge rather than a database or some other form of knowledge repository. With an increased number of individuals participating in the networks, both the needs and wants of knowledge sharing will intensify (Matthews and Gladstone, 2000).

With the entrance and continuant, improvements made in the field of ICTs, companies are changing their way of doing business. Raghuram, Garud, Wiesenfeld and Gupta (2001) mentions that ICTs has provide information and knowledge sharing with a new dimension. The changes have also affected the way groups interact and gather information (ibid). Johnson, Heimann and O’Neill (2001) say that the rapid development in information and communication technology has provided the foundation for a new kind of group interaction mode. This mode is called *the virtual teams*.

1.2 Problem discussion

The process of knowledge learning in a virtual team is based on the collaboration of tools and structures in order to function (Carneiro, 2001). In knowledge based organizations, also referred to as learning organizations, the ability to learn and interpret new knowledge is of an adaptive nature (Abell and Oxbrow, 2001). This means that organizations view its future and subsequent competitive advantage based on continuous learning and adaptive behavior (ibid). Garvin (1993) motivates that a true definition of a knowledge-based organization can only exist if meaning to its learning process, apply able management and measurements for evaluating achieved learning level are involved. According to Abell and Oxbrow (2001), this implies that a culture and processes needs to be developed in order to improve knowledge sharing on individual, team and organizational level.

Both Braf (2000) and Senge (1990) bring up the importance of awareness and learning abilities as indicators whether to classify an organization as a knowledge based organizations or not. Carneiro (2001) continues to say that it is this individual learning, which is the ground from where the concept of KM can appear and be understood. The management in the organization must support this learning; otherwise, it will fail (Barney, 1986). According to Sanchez (2001), with the support of Stenmark (2000), points out those individuals in groups, must have some knowledge in common in order to perform tasks in a coordinated fashion.

Collaborative knowledge sharing activities are also a learning process (Carneiro, 2001). This means that team members can work in a knowledge-improvement system by continually interact and learning from each other (Sanchez, 2001). Bhatt (1998) points out that the extent to which each individual interacts with the other depends on the organizational culture (ibid). The interaction is also based on the idea of sharing knowledge between team members (Boisot, 1987). Lipnack and Stamp (2000) points out the importance of interaction between the team members to enrich the knowledge base within every member of the virtual team. The authors also specify a formal breakdown of work-structure towards more interaction between members. This focuses on interactions, such as who to interact with, how to seek knowledge and what knowledge to seek. This interaction has primarily been face-to-face (ibid).

With today's technology, knowledge can be delivered and accessed through enterprise networks and tools thanks to the ICTs and KM tools (Carneiro, 2001). The ICTs and KM tools work as nodes in the distribution process of knowledge and information when using e-mails, databases or intelligent agents (ibid). These tools play an important part in the knowledge sharing and interaction of the virtual teams (Boisot, 1987). Intelligent agents are software that enhance and help to distribute information and knowledge among the team members (Carneiro, 2001).

According to Choo, Detlor and Turnbull (2000) the organization's Intranet plays a large part in distributing the knowledge. The authors' mention three different domains attached to the Intranet; the information space, communication space and awareness space. The information space is about the access to the stored information and the communication space is about interpreting this information. The last space mentioned by Choo, Detlor and Turnbull (2000) regards the awareness in interacting with other members with the adequate knowledge base. Stenmark (2001) adds a fourth space; the collaboration space, which deals with the collaborative routines for the team members. These domains act like a distributor of information and knowledge in the internal KM processes (Choo, Detlor and Turnbull, 2000).

It is not merely the tools being used that need to be highlighted; the role division of virtual teams is also an important area (Sholtes, 1995). Sholtes (1995) mapped that there are different roles in a team. The author claims that clear role division in the team eases the performance and enhances it. There are different roles in a team like the guidance, team leader, quality advisor and team member (ibid).

According to Abell and Oxbrow (2001), no one can manage knowledge. What can be done, and what companies are doing is to manage the environment that optimizes knowledge. Carneiro (2001) refers to that many organizations do not know how to manage and effectively take use of the most important competitive edge possessed by the teams. Baily and Clarke (2000) bring up the concepts of relevance, currency and action that introduces the enhancements management can do to contribute to the virtual team. Out of these influencing factors, a set of useable ideas can be distinguished for how to effectively manage virtual teams (ibid). The concept of relevance has to do with the motivation of the team member, while the concept of currency and action deals with distribution of knowledge and monitoring of knowledge processes (ibid).

The effective KM adaptation is partly accomplished by enhancement from management (Wiig, 1996). The author continues by mentioning the way management could enhance the way teams work. This could be done through creating incentives and communication routines. Abell and Oxbrow (2001) argue for a KM strategy in virtual teams. Desire to express competitive advantage; increased effectiveness and competitiveness are the most common goals. The authors continue to talk about the importance of experiences in the organization and that these experiences are shared with the others. (ibid)

Liebowitz (2000) confirms that knowledge sharing is involved in the virtual teams. Management should create an environment that encourages its employees to collaborate and share knowledge (ibid). This results in enhancing employees' knowledge and creating knowledge through individual interactions in contexts such as the virtual teams (Bhatt, 2002). One way, according to the author is to enhance individual knowledge is by creating an environment of collaboration and informal coordination. The interaction processes of individuals have great affects on the need, usage, creation and transfer of knowledge (Syed, 1998). This strategy is divided into the planning and the operation of activities. However, Baily and Clarke (2000) use a KM activity matrix to explain the KM strategies. With the use of the matrix, a number of critical questions allow to be generated about the nature of existing KM activities. In order to identify a theme, an emerged picture of the audit, Baily and Clarke (2000) mention the importance of raising questions. The audit can focus on the organizational, group or individual level depending on where it will be most useful for the user (ibid). In terms of what technology to use, this selection is highly connected to the chosen strategy (Burn, Marshall and Barnett, 2002).

Johnson, Heimann and O'Neill (2001) proclaim that virtual teams are gaining ground in organizations due to reasons like flexibility in working hours, timesaving and cost-efficiency. The authors are also bringing up the problems associated with virtual teams. According to Jarvenpaa and Lediner (1998), there are three major obstacles in adapting KM in virtual teams. These are trust, communication and culture. Arnison and Miller (2002) write that the degree of trust between team members could affect the performance in the virtual team. Short and Christie (1976) suggested that computer-based communication media might eliminate the type of communication cues that individuals use to convey trust, warmth, and attractiveness within the virtual team. In addition, Arnison and Miller (2002) mention several factors, such as shared norms, repeated interactions, and shared experiences that could enhance the level of trust.

Walther (1997) argues that communication does not differ from face-to-face communication in the content of capability of information exchange, but rather in a slower rate of transfer. It is actually possible to obtain better management from the increasing horizontal flow of information within the network of communication. According to Carneiro (2001), ICTs enable knowledge acquisition and transfer to be more effective which makes it possible to concentrate on the diffusion of knowledge. Wiseman, Hammer and Nishida (1989) found that people with high knowledge of people skills are more willing to explore diverse topics. This might suggest that people whom are more socially experienced may seek and interpret information more than those who are not. The level of social skills might in turn help and develop the

attractiveness on the team, at least in the eyes of the socially advanced individuals (Wiseman, Hammer and Nishida, 1989).

Potter, Balthazard and Cook (2000) continue that it is likely that the eclectic members of the team could experience communication problems due to the different view on things like individualism and devotion to work. This will require team development in the area of cultural diversity (ibid.). Potter, Balthazard and Cook (2000) continue this reasoning by bringing up team members responsibility to deal, not only with national culture, but also with organizational culture in the context of KM. Johnson, Heimann and O'Neill (2001) claim that there are three other factors affecting the success of KM in virtual teams. The first one deals with team members' willingness to use the KM tools, and the second with the allowed virtual privacy level. Thirdly, the authors mention that the stress level is increased due to the multiple usages and higher interaction level of KM-tools.

Johnson, Heimann and O'Neill (2001) together with Arnison and Miller (2002) both point out the fact that, organizations have been forced to adopt innovative approaches in order to be competitive. This is a cause of the increased spread of KM in workplaces and the continuous pressure of success (ibid.). Against this background, Johnson, Heimann and O'Neill (2001) argue that it is in the best interest of the KM organizations who to investigate the factors influencing the success of KM in virtual teams. Abell and Oxbrow (2001) together with Lipnack and Stamps (2000) discuss the possibilities and the difficulties of handling knowledge management in virtual teams. Still there is a large number of organizations who do not know how to take advantage of their competitive edge's in which effective knowledge management is the key aspect (Carneiro, 2001). This is why the concept of knowledge and how to manage this asset in virtual teams are two challenging areas (Lipnack and Stamps, 2000). For both researchers and organizations, it is therefore worth better attention. This challenging area gives reason and encouragement to design virtual teams and use KM with objectives to solve future challenges (ibid.).

1.3 Purpose

The problem discussion strives to show the importance of how knowledge can be managed with the use of KM strategies in virtual teams. The purpose of this thesis is to gain a better understanding of how organizations with entirely knowledge-based services are using KM in virtual teams. The purpose will be investigated through the three following research questions:

- 1. How is knowledge managed in virtual teams?*
- 2. How can the KM strategy in virtual teams be described?*
- 3. How can the Critical Success Factors of KM in virtual teams be described?*

1.3 Delimitations

We have in this thesis chosen to limit the research area to include the KM in the virtual teams among Swedish companies. When we describe the area of KM we will focus on processes describing knowledge flows and how this can be monitored by

organizations and their virtual teams. We will take on both an information and strategic perspective when describing these processes in order to obtain a more complete picture. As we continue to describe the tools used in KM we do not intend to value or measure any use of them. The way the overall organizational usage is made would also be interesting to look into but the extensive field to cover would make it too difficult and time consuming to handle within our given period. When we later on bring up the issues of ICTs and intelligent agents we do not intend to describe the vast and complex field of computerized agents used in knowledge architecture. This would only lead us away from our main purpose, which is to describe how knowledge management is used in virtual teams. A detailed description of each architectural tool has therefore been left out to prevent the reader from getting off-track when reading.

1.4 Disposition of the thesis

This thesis consists of seven chapters, as shown in figure 1.1. In this chapter, an introduction to the research area is given, and the research purpose together with the research questions are stated. The next chapter presents the literature review followed by the conceptualization and our emerged frame of reference in the third chapter. In the fourth chapter, the methodology used for this thesis will be discussed. The fifth chapter will handle the empirical findings, which consists of a company background followed by the gathered data from the interviews and questionnaires. In chapter six, the empirical findings will be analyzed against frame of reference. Finally, in chapter seven the presentation of this study's contribution is brought up under conclusions. This chapter also discusses implications for management, theory and further research.

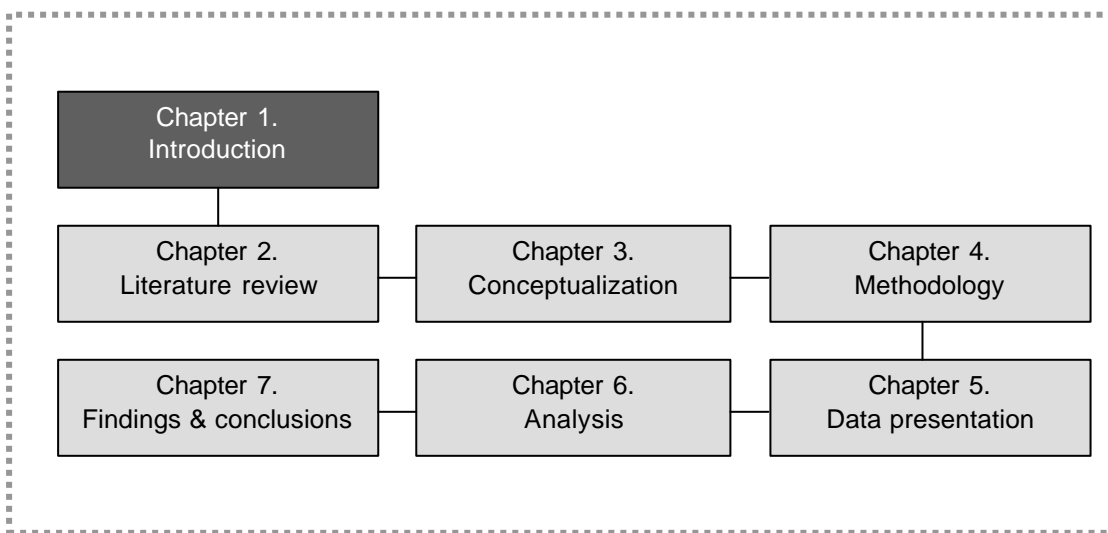


Figure 1.1: Disposition of the thesis.

2 LITERATURE REVIEW

This chapter will bring up relevant theories needed to find answers and connect to our research questions. First, a presentation of key concepts is made so that it becomes easier to understand the research area. Then we will look deeper into KM tools and the usage of them, continued by how KM is used in virtual teams. Finally, we will describe the different Critical Success Factors surrounding KM in virtual teams.

2.1 Key concepts

In order to find suitable literature connecting to our research questions an explanation of key concepts is necessary. This is why a description is made of knowledge, knowledge management and virtual teams in the beginning of this chapter. Figure 2.1 illustrates the path of which the literature and key concepts will be presented through the entire chapter.

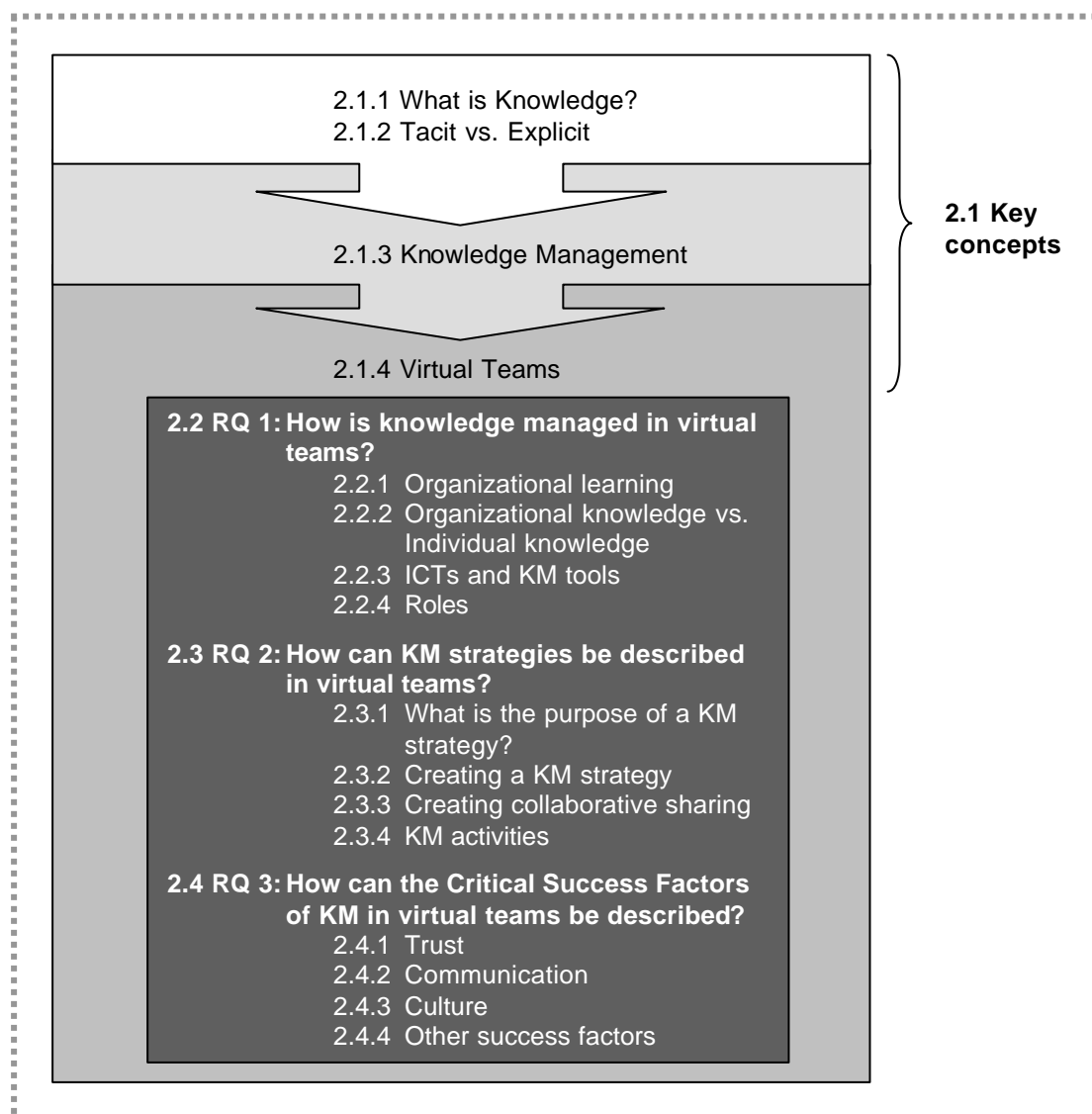


Figure 2.1: The structure of chapter 2.

2.1.1 What is knowledge?

“Knowledge is dynamic, since what is new and innovative today may well be the core for tomorrow”.

- Burn, Marshall and Burnett (2002)

If the term knowledge is to be understood, a description of how it is generated, for example its cornerstones is needed. By using the following definitions and relationships between data, information and knowledge an understanding can be established of how data can flow and be stored within an organization (Boisot, 1995). In figure 2.2 below, the transformation from data to knowledge is described. This is followed by an explanation of what each concept mean and how they relate to each other.

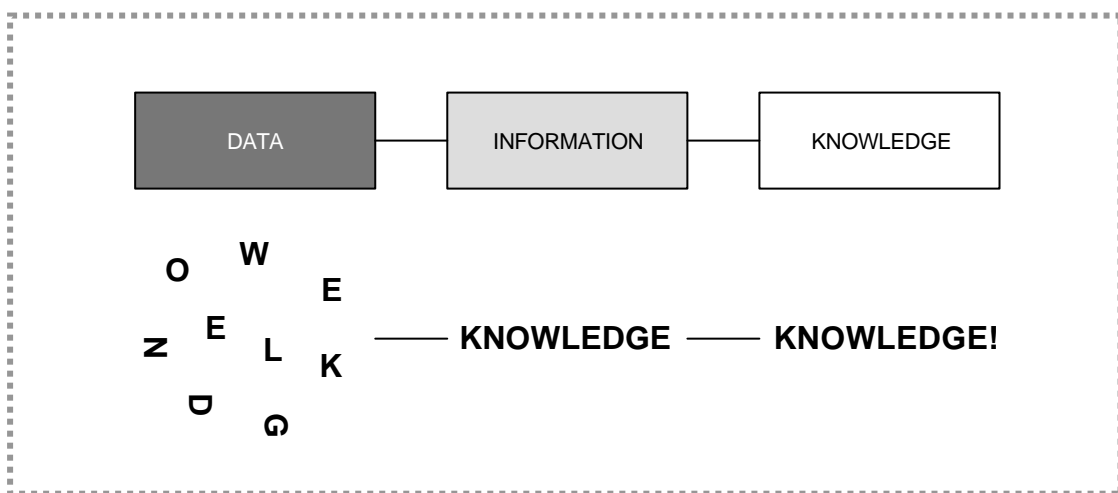


Figure 2.2: The flow and transformation of data to knowledge.

Beginning with *data*, this can consist of a single or gatherings of symbols or signals, functions as carrier of information. It simply exists and has no significance beyond its existence. Furthermore, data can be a word, number, a meaning that is possible to write on a paper or communicates through telephone, face-to-face communication. (Burn, Marshall and Burnett, 2002)

Information is extract from incoming data that relate in a meaningful way to an observer's prior expectations. This means that it is data given a meaning by evaluating data in an interpretive framework (Sanchez, 2001; Boisot, 1995). It can also be viewed as chunks of data being received by an individual which put together gives new form to that individual's perception (Merali and Frearson, 1995). Information can therefore be viewed as data, which gives meaning by a relational connection. In that, sense the information embodies the understanding of a relationship of some things and events. In short, information could be facts that are received from one sender through a type of media. (Merali and Frearson, 1995)

Knowledge could be viewed as an individual's understanding of factors, facts, things, events and its environment (Sanchez, 2001). Knowledge can also be a thought of an observer's belief that disposes him or her to act on the receipt of new information

(Popper, 1983). Knowledge flows comprise the set of processes, events and activities through which data, information and knowledge are transformed from one state to another (Newman and Conrad, 1999). In a broader sense knowledge is a set of beliefs about causal relationships in the world and an organization. In essence, individuals adapt a pragmatic concept of knowledge as some variant of belief that “A causes B”. In sum, data is something “out there” that an observer notices (Boisot, 1995). Thereafter, information is extracted from data and finally, the observer constructs what his or her beliefs resides “within” and constitute his or her knowledge (ibid).

In figure 2.3 an organization of knowledge flows is made into four primary activity areas: knowledge creation, retention, transfer and utilization. (Newman and Conrad, 1999)

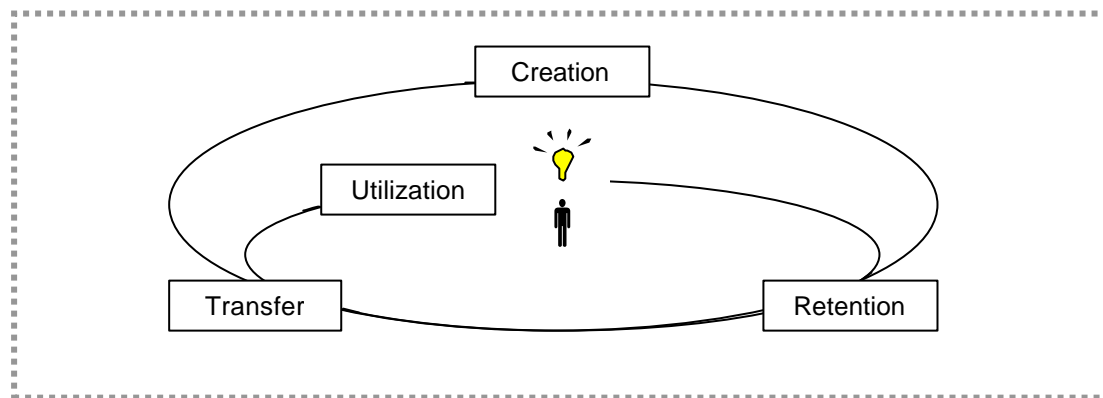


Figure 2.3: The General Knowledge Model.
Source: Newman and Conrad, 1999

Knowledge Creation - This comprises activities associated with the entry of new knowledge into the system, and includes knowledge development, discovery and capture (ibid).

Knowledge Retention - This includes all activities that preserve knowledge and allow it to remain in the system once introduced. It also includes those activities that maintain the viability of knowledge within the system (ibid).

Knowledge Transfer - This refers to activities associated with the flow of knowledge from one party to another. This includes communication, translation, conversion, filtering and rendering (ibid).

Knowledge Utilization - This includes the activities and events connected with the application of knowledge to business processes (ibid).

It is important to note that within each activity phase, a smaller set of knowledge flows and cycles exists. These sub-cycles span over a broad range of organizational processes ranging from broad to discrete actions and decisions. By using this model, it becomes possible to trace individual knowledge flows. This can be done by examine and understand how knowledge flows enables specific actions and decisions (ibid). According to Newman and Conrad (1999), a suitable way to approach knowledge would therefore be to visualize it as a key intellectual asset of an organization. Boisot (1998) says that this intellectual asset could be seen from an information perspective,

where knowledge is seen as a capacity built on information extracted from data. There are however organizational activities and environmental challenges that affect the generation and storage of these assets (ibid). These activities and challenges are appropriate and essential according to Merali and Frearson (1995) in the essence of studying KM. Before looking into KM, there should however be an explanation of the two existing forms of knowledge. Each form distinct and unique compared to the other, yet inseparable.

2.1.2 Tacit knowledge versus explicit knowledge

Polanyi (1966) explained that there are two distinct forms of knowledge, tacit and explicit. Cook and Brown (1999), Tsoukas (1995) and Molander (1996) all agree that there are two distinct ways that knowledge should be viewed. Tsoukas (1995) continues saying that both tacit and explicit knowledge are mutually constituted and should not be viewed as separate types. Molander (1996) argues that it can be useful to treat them separate only as long as the two are seen as two separate *aspects* of knowledge and not as different *sorts* of knowledge. Since it always exist a tacit dimension of knowledge it is impossible to put words to all our experience (Polanyi, 1958; 1966). Tacit knowledge often takes the form of a mental model and can be a mix of facts and perceptions typically answering reasoning's such as why certain activities are carried out (Burn, Marshall and Barnett, 2002).

According to Liebowitz (2000), a key to creating knowledge is to tap the pool of tacit knowledge and convert it into explicit knowledge. However, it is often very hard to formalize and communicate this aspect of knowledge (Burn, Marshall and Barnett, 2002). Tacit knowledge refers to the knowledge imbedded within us, the “automatic” knowledge, the knowledge one uses perhaps without even realizing it (Liebowitz, 2000 and Stenmark, 2000). When knowledge is articulated parts of our tacit knowledge becomes information (Alavi and Leidner, 2001). To fully understand and interpret this information people depend on their tacit knowledge (ibid).

“Knowledge that can be expressed in words and numbers only represents the tip of the iceberg of the entire body of possible knowledge”

- Nonaka, 1994, p.26

Figure 2.4 explains the interaction between articulated and tacit knowledge. It shows how our tacit knowledge becomes information if it is articulated. The figure also shows the important role of how individuals' own beliefs, experiences and traditions are embedded within us and therefore, are difficult to articulate. The resemblance to an iceberg is based on the assumption that only a small part of the knowledge is surfaced, in other words, possible to be articulated.



Indicates tacit knowledge, and how it is processed by one owns personal beliefs and thoughts. To show this a "bubble of thought" is used.



When the knowledge shift in form to become articulated and explicit "bubbles of speech" are used.



The internationally recognized symbol of information is used to indicate when tacit knowledge becomes explicit or articulated.

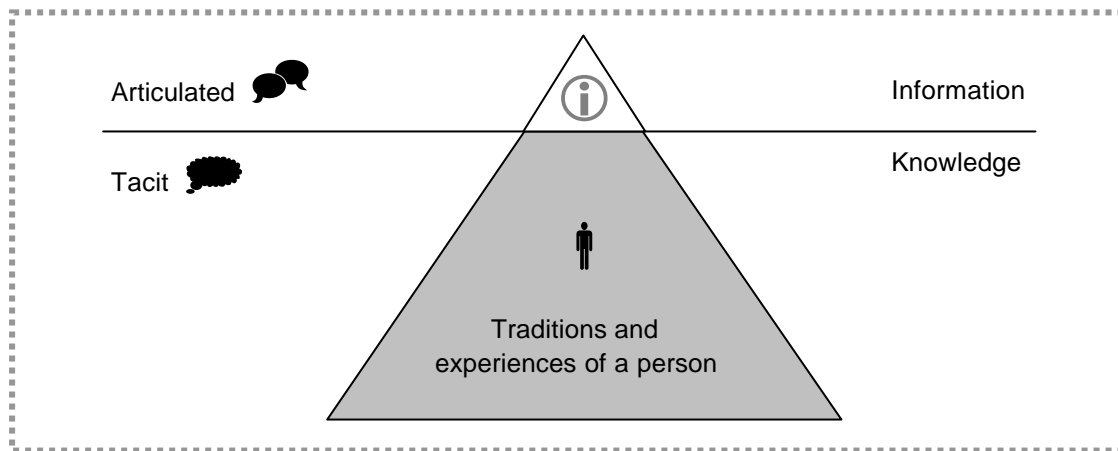


Figure 2.4: The “Iceberg-relationship” between knowledge and information.

Source: Modified after Stenmark, 2001

The transfer of tacit and explicit knowledge is different within an organization (Baumard, 1999). For example, when a new member joins a project team a lot of explicit knowledge is easily gained from documents and face-to-face discussions with other team members. On the other hand, tacit knowledge within the project team, such as being able to identify potential problems early and minimize their impact, is quite difficult to transfer (ibid). It is not a simple matter of reading the minutes of meetings or a procedures manual. Tacit knowledge is an important source of sustainable competitive advantage, whereas advantages based on explicit knowledge are regarded as more unstable, because they can be more easily understood and reproduced (Dierickx and Cool, 1989). In order to gain such competitive advantage by transforming tacit knowledge to as much explicit knowledge as possible the concept of how knowledge is managed explained.

2.1.3 Knowledge Management

Knowledge Management (KM) looks at how an organization adapts to changing conditions in order to survive in the same way that animal and plant species change over time to adapt to changing conditions, or like unsuccessful firms, they die off or are swallowed up by more successful competitors (Burn, Marshall and Barnett, 2002). KM is concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the organization’s objectives (Sanchez, 2000; Abell and Oxbrow, 2001). The knowledge to be managed includes both explicit, documented knowledge, and tacit, subjective knowledge. Management entails all of those processes associated with the identification, sharing and creation of knowledge (Rowley, 1999).

Organizations that succeed in KM are likely to view knowledge as an asset and to develop organizational norms and values, which support the creation, and sharing of knowledge (Abell and Oxbrow, 2001; Rowley, 1999). There are still many definitions of KM, because it is such a wide concept that could be interpreted in many ways (Barth, 2000; Wünsche, 1999). Defined broadly, “*KM is the process through which*

organizations extract value from their intellectual assets” (Kaplan, 2002). By adopting this belief of KM, the following definition of KM is suitable.

"Knowledge Management caters to the critical issues of organizational adaptation, survival and competence in face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek synergistic combination of data and information processing capacity of information technologies and the creative and innovative capacity of human beings".

- Malhotra, 1997

Note that this is a strategic view of KM that considers the synergy between technological and behavioral issues as necessary for survival in ever changing environments (ibid). A way of breaking down knowledge management into distinct tasks has been made of Galagan (1997), whom proposes the following as a sample list of knowledge management processes:

- Generating new knowledge.
- Accessing knowledge from external sources.
- Representing knowledge in documents, databases, software and so forth.
- Embedding knowledge in processes, products, or services.
- Transferring existing knowledge around an organization.
- Using accessible knowledge in decision-making.
- Facilitating knowledge growth through culture and incentives.
- Measuring the value of knowledge assets and the impact of knowledge management.

To make it clear, a classification of knowledge management is made in two dimensions: one dimension is to manage existing knowledge, which includes developing of knowledge repositories (memos, reports, presentations and articles), knowledge compilation, arrangement and categorization. Another is to manage knowledge-specific activities, that is, knowledge acquisition, creation, distribution, communication, sharing and application (Stenmark, 2001).

For sustaining these effective knowledge processes, both tools together and environment have to be created and nurtured. At organizational level, distinctive organizational visions and strategies are formulated to guide and regulate knowledge management; relevant evaluation and reward institutions are to be created to define responsibility and liability of individual and organization. (Stenmark, 2001) In the pace, that KM grows, with more and more individuals that both need and want to share knowledge, the incentives for using virtual teams for interacting with each other increases (Mattews and Gladstone, 2000).

2.1.4 Virtual teams

According to Johnson, Heimann and O'Neill (2001), virtual teams are groups of people who collaborate closely even though they may or may not be separated by space, time, and organizational barriers. This means that even a continent between each member does not need to separate or “disconnect” the virtual team. In fact, every

team that needs to work together and whose members are more than 50 feet apart is a virtual team (Pape, 1997). A group of technologies, including desktop video conferencing, collaborative software, and Internet/intranet systems, converge to forge the foundation of this new workplace (ibid).

According to Kristof (1995) virtual teams could be divided in two different type of groups; permanent and temporary groups. In this content, another aspect is added to the virtual team characterization as global, which implies culturally diverse and globally spanning members that can think and act in concert with the diversity of the surrounding environment (DeSanctis and Poole, 1997). Virtual teams have a heavy reliance on computer-mediated communication technology that allows members separated by time and space to engage in collaborative work (Pape, 1997). Johnson, Heimann and O'Neill (2001) further explain that the movement from the traditional face-to-face teams towards virtual teams attributes many factors. The following factors and benefits can be listed to why organizations should take advantage of virtual teams (ibid):


- Virtual teams allows flexible hours so that employees can spend more time with family
- Saves time and money in the daily transportation to and from work
- Increased work efficiency and knowledge sharing
- Requires less office and parking space
- Reduces costs of heat and electricity

2.2 How is knowledge managed in virtual teams?

Today there are new ways to deliver and access through the enterprise network thanks to the ICTs. This requires systems for the knowledge creation and maintenance of knowledge repositories. It also needs methods to cultivate and facilitate the sharing of knowledge and organizational learning (Rowley, 1999). This means that tools and structure of how functions and procedures are performed must be distinguished. In the effective organizations, the process of mapping virtual teams becomes both natural and essential in terms of "who knows what". To do this most appropriate and effective it is normal to divid the virtual teams members into roles divisions (Sholes, 1995).

2.2.1 Organizational learning

The term "learning organization" was introduced by Senge (1990) and has since then been frequently used. This type of knowledge based organizations is based on five core activities; systematic problemsolving, experimenting, learning from experience, learning among each other and sharing of knowledge (Garvin, 1993). Carneiro (2001) declares that organizations need to achieve a better understanding and concentrate its development efforts on the process through which knowledge and learning can contribute to the achievement of the objectives. According to Sanchez (2001), the competent organization has different learning cycles that are divided into three general levels into the organization, the organizational level, group level and individual level. The figure 2.8 shows how knowledge is shared within these three levels.

 This symbol is used to indicate the process of knowledge is shared and how a flow of knowledge is established.

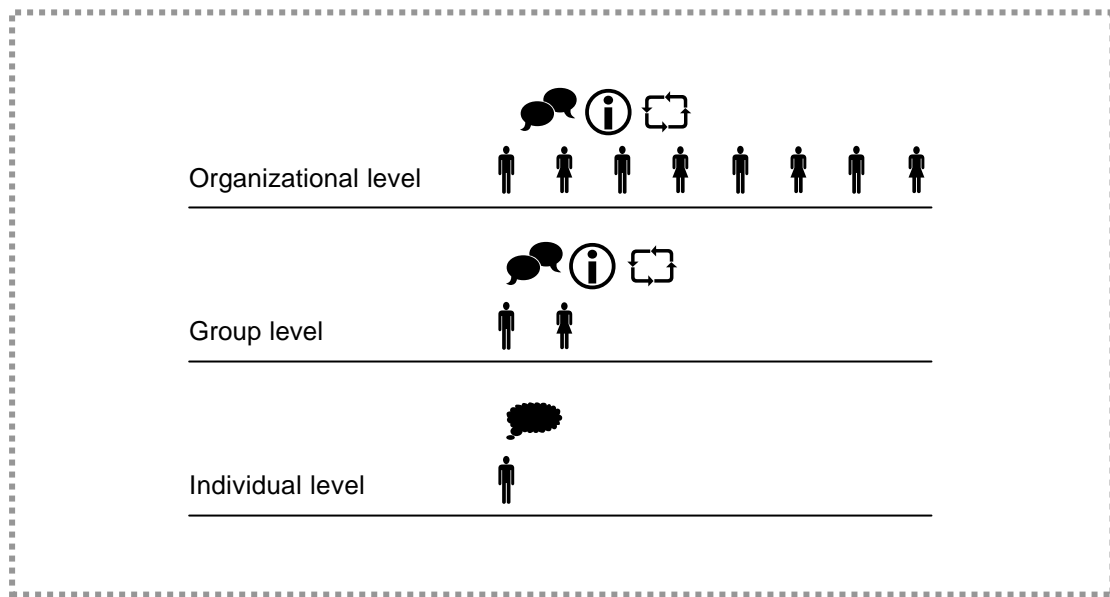


Figure 2.5: The three learning levels of the competent organization.

On the individual level, all the knowledge stays within each individual and all knowledge is connected to internal processes in one's mind. When information becomes explicit, others share it in both group and organizational level. It becomes information that flows in the group and organizational level, that one interprets again it becomes knowledge (Stenmark, 2001; Nonaka, 1994). On the organizational level, the foundation of the organization's knowledge is the knowledge that individuals develop through their own personal sense-making processes. In essence, individuals within an organization are the sources of beliefs that become incorporated in interpretive frameworks used by the organization. Some knowledge possessed by an individual may be applied directly to performing his or her assigned task, but much individual knowledge must be shared with other individuals in a group before that knowledge can become the basis for taking action. (Sanchez, 2001)

According to Carneiro (2001), individual learning is the ground from where the concept of KM can appear and be understood. It is widely accepted that individuals must participate actively in several learning processes in order to acquire the requisite knowledge to perform tasks. Sanchez (2001) continues by mentioning that individuals in groups must have some knowledge in common in order to perform tasks in a coordinated fashion. Collaborative knowledge-sharing activities are also a learning process (Carneiro, 2001). This means that team members can work in a knowledge-improvement system by continually learning from each other (ibid).

Organizations have distinctive ways of promoting knowledge and learning across the organization (Boisot, 1987). The model is concerned with transforming individual knowledge through group learning into organizational learning. As shown in figure 2.6 there are a number of internal processes for management focus on within this process (ibid).

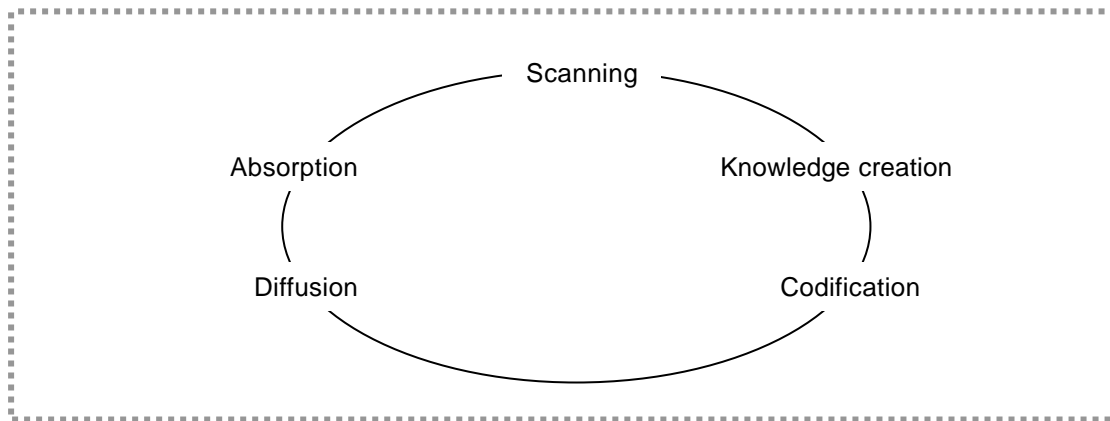


Figure 2.6: The model for organizational learning.
Source: Boisot, 1987

Scanning – is concerned with obtaining information to develop a map of the organizational and external environment. Scanning involves developing a map of “what is” within that environment but also identifying any problems or opportunities that are presented by the environment. (ibid)

Knowledge Creation – is concerned with “know how” and insights obtained from dealing with or solving a perceived opportunity or problem. The knowledge gained at this stage is new knowledge for the organization, will be confined to the knowledge base of the problem solver, and which is likely to be in the form of tacit knowledge. (ibid)

Codification – is concerned with codifying the new, tacit knowledge so that it communicates to those in the organization beyond the original problem solver. Codification may consist of verbal articulation of what is known by the problem solver, or it may be made manifested in procedures or action taken by the problem solver. (ibid) This is the stage where the tacit knowledge becomes explicit (Sanchez, 1997).

Diffusion – is concerned with communication and spreading codified new knowledge through the organization. Successful diffusion results in the incorporation of new knowledge into the regular patterns of task performance beyond the problem solver. (Boisot, 1987)

Absorption – occurs when the new knowledge has become so embedded in organizational routines that it is an implicit part of “how things are done around here”. (ibid)

This means that what started out as “new knowledge” transforms from tacit *individual* knowledge to an integral part of the tacit *organizational* knowledge base. It is important to remember that tacit knowledge is deeply rooted into action, commitment, and involvement in specific environments (Nonaka, 1994). This is what makes transfer of tacit knowledge usually slow and may often only reach a limited audience (Boisot, Griffiths and Moles, 1997). This model is useful for describing all levels of knowledge promotion and learning transfers both across and within an organization.

At macro level, it is relevant for understanding how an organization perceives itself within its environment. At micro level, it helps to make sense of social learning processes between individuals. (Merali, 1997)

Knowledge ultimately resides in the minds of individuals, yet it is also possible to refer to organizational knowledge (Sanchez, 2001). Organizational knowledge exists when individuals in an organization share sets of beliefs about causal relationships that enable them to work together in doing something (ibid). Bhatt (1998) argue that individual knowledge and organizational knowledge are distinct yet interdependent. The extent to which each individual interacts with others depends on the organizational culture (ibid). In addition, this cultural environment requires individuals to make many rapid decisions to resolve customers' problems. Instead of using rules and regulations as directed from the hierarchy, employees are forced to make many judgments to solve business problems efficiently (Stalk, 1988). Education and training programs are powerful tools for transferring knowledge. However, external benchmarking can also provide the organization with powerful insights that may come from competitors, clients and providers (Carneiro, 2001).

2.2.2 Knowledge sharing

A number of researchers such as Weick (1978) and Simon (1976) believed that organizations did not have learning capabilities. It is rather so that the learning capabilities reside within the individuals stationed in organizations. However, a number of researchers like Starbuck (1983) and Nelson and Winter (1982) propose that organizations evolve through their learning capabilities. Organizations learn and acquire knowledge through their routines and repertoires (ibid). To do this organizations take use of its embedded knowledge that is being stored throughout history (Nelson and Winter, 1982). The way in which knowledge of diverse repertoires or routines is integrated and new knowledge is created and shaped by organizational history and culture (Barney, 1986). In this perspective, an organization is referred as a problem-facing and problem-solving entity. The learning that takes place in an organization is significantly affected by the complexity of tasks and the organizational environment (Sanchez, 2001).

In performing group tasks, people learn by interaction (ibid). This creates practical, hands-on, “know-how” knowledge of how to perform a given task consistently. This interaction has primarily been face-to-face, often with the same manager (Lipnack and Stamps, 2000). However interactions in between people can sometimes be limited due to the fact that a subject cannot be sufficiently described for someone else. In such sense that to fully understand it or be able to do it, since understanding requires familiarity with both the concepts themselves and the context to which they normally belong (Stenmark, 2000). Unlike formal breakdown of work-structures as dictated by management, knowledge sharing is an informal and social process (Bhatt, 2002). In other words, how professionals’ process and share knowledge becomes an expression of their personal expertise, experience, and creativity (ibid). Based on the knowledge professionals’ expertise and experience they are selective with whom to interact. How this interaction takes place, and what type of knowledge to seek relates to the way these people process and share knowledge. Cappelli (2000, p. 104) explains this with the following words:

"The open competition for other companies' people, once a rarity in business, is now an accepted fact. Executives know that fast-moving markets require fast-moving organizations that are continually refreshed with new talent"

According to Idegard and Lageson (2000), the more time spent in front of the computer screens, the more the need for face-to-face interaction will increase. However, the majority of the studies done in recent years has conveyed a positive picture of how the Internet will provide new business opportunities: *"There are good reasons to question the universal claim that face-to-face contacts are necessary in case of non-routine activities"*, according to van der Smagt (2000, p. 148). Hence, business activities can be exclusively in the virtual world, without any actual face-to-face encounters (Deeter-Schmelz and Ramsey, 1995). In the ever-changing business environment, the individuals behind the screen are making the business possible (ibid).

2.2.3 ICTs and KM-tools

An organization should have the capacity to exploit its knowledge and learning capabilities better than its competitors should if it decides to assume a given competitive strategy (Grant and Gnyawali, 1996; Roth, 1996). This capacity depends on its KM tools, the usage of ICTs and the organizational structure. It is therefore important to investigate how organizations and their employees take advantage of the technological tools that can make communication more convenient and less expensive. Before describing the tools in detail it is important to remember that the knowledge repositories consists of all the documents with knowledge embedded in them, such as memos, reports, presentations and articles (Kaplan, 2002). These repositories are used when knowledge goes through the following phases: acquisition, creation, distribution, communication, sharing and application (Stenmark, 2001). Today organizations often have electronic directories and databases to nurture these knowledge phases.

The ICTs work as nodes in the distribution process of knowledge and information. Zeff and Aronson (1999) mention the use of e-mail as a very popular tool used in communication processes. Arnison and Miller (2002) write about the usage of video- and teleconferencing among virtual team members. Interaction through video conferencing allows face-to-face through Internet or satellite connections. E-mail, video- and teleconferencing are user-friendly tools and have the characteristics of shortening the distance between the team members (ibid).

If so called intelligent agents would have access to various databases this could function as a valuable resource in the decision-making process (Carneiro, 2001). Intelligent agents are software programs that perform a given set of tasks on behalf of a user or other agents without the direct human intervention, and in so doing; employ some knowledge of users's goals (Liebowitz, 2000). The intelligent agents have taken an important role in today's organizational structure (Carneiro, 2001). The concept of the intelligent agent is based on individual competence, that is, personal capacity to act in various situations according to rules, beliefs and professional procedures (ibid). In a management environment, intelligent agents can be conceptually defined as entities that are able to understand the sense of a given situation and to act according

to some orientations (Russell and Norvig, 1995). In fact, with the intelligent agents, it is possible to explicitly link strategy, knowledge and performance in order to increase the probability of adding value (Carneiro, 2001).

These interacting agents are owners of a great amount of knowledge, professional experiences and beliefs that they can share and constitute a ground, which may account for the achievement of useful co-ordination levels during interactions. The study of intelligent agents has become one of the most important fields in understanding organizations performance (Carneiro, 2001). Intelligent agents are playing a vital role in bringing about the rise of new advantages and participating actively in consistent innovation, because this is the key to an organization's development (Pearson, 1991).

The document management systems can be described as complex systems based on details from the strategic knowledge activities. These systems try to document as much routines and procedures as possible that can be connected to organizational activities. The findings are stored in databases, which can be accessed through platform independent applications that have been created by the company. (Sayed, 1998)

Intranet is according to Choo, Detlor and Turnbull (2000) described as an information environment used internally within organizations. A key part in many Intranets is that so-called GroupWare's, such as Lotus Notes, facilitates them. GroupWare are networked system applications that facilitate information/knowledge sharing and exchange (Abell and Oxbrow, 2001). When knowledge-based organizations perform tasks and solve problems there are a strong requirement for the use of a combination of both applications and tools (Sayed, 1998). This usage automatically includes different interaction activities (ibid). In TABLE 2.1, a categorization is made of the applications and tools with concern for facilitation requirements regarding knowledge sharing.

TABLE 2.1. Four types of interactions with modern technology.

Application or tool \ Activity	Gathering	Organizing	Sense making	Communication
Videoconference*			√√√	√√√√
Teleconference*			√√	√√√√
E-mail*				√√√
Intranet/GroupWare**		√	√ - √√√	√√√
Document Management Systems**	√√	√√√	√ - √√√	√√
Intelligent agents**	√√√	√√√	√√√	√√√
NOTE! * = ICT ** = KM-tool				
Blank = nil; √ = Poor; √√ = Below average; √√√ = Average; √√√√ = Above average; √√√√√ = Excellent.				
A hyphenated entry denotes a range implying that the contribution depends on the tacit knowledge of users.				

Source: Modified after Sayed, 1998

According to Syed (1998), these computer-based applications and tools support the activities of gathering, organizing, sense making and communication differently. By grading with markers it is shown how well or poorly a certain tool matches a interaction criteria. Tacit knowledge of the user plays a role in each of these activities,

but most importantly so in sense making, and communicating. According to Syed (1998), these activities have to do with:

- Reframing tasks and problems to make them fit within the limitations of available tools and techniques
- Converting tacit, ambiguous and incomplete knowledge about tasks and problems into explicit inputs for available tools and techniques
- Combining the outputs of tools and techniques with the tacit understanding of tasks and problems to complete tasks and provide solutions in a way that makes sense within their context.

Still many of the ICTs function as cornerstones in the dynamic internal window of communication, which is the Intranet (Arnison and Miller, 2002). Choo, Detlor, and Turnbull (2000) describe the use how Intranet can be a tool for management and organization. Intranet is an information environment encompassing three different domains (ibid). These domains are; the information space, the communication space, and the collaboration space. Stenmark (2001) brings up a fourth awareness space, which together forms the model shown in figure 2.7.

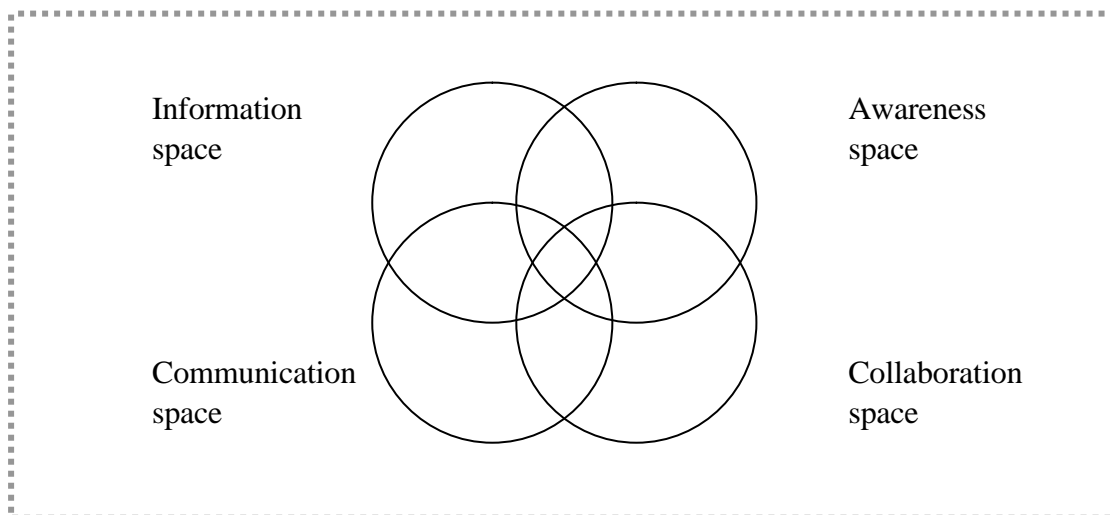


Figure 2.7: The four dimensions of the Intranet information environment.

Source: Stenmark, 2001

- *The Information space* – gives access to information stored in corporate databases and documents. This access to rich and diverse sets of information is important for organizational knowledge creation since it provides rich stimuli and requisite variety (Nonaka and Takeuchi, 1995).
- *The Communication space* – enables the organizational members to collectively interpret the available information by supporting various channels for conversations and negotiations (Stenmark, 2001).
- *The Awareness space* – exploits not only explicit links but also tacitly expressed connections to hook up organizational members with information and people they might otherwise have missed. This certainly increases the chances for community buildings, communication and collaboration (ibid).

- *The Collaboration space* – provides means for organizational members to actually participate in collaborative work by offering workflow, shared project areas, and coordinating routines (ibid).

Stenmark (2001) propose that a holistic view of these spaces must be applied where they are not separated from each other instead; they actively work together based on the information available to them.

2.2.7 Roles

There are numerous of different roles within each virtual team, although not all of them are so evident. In fact, teams can bring together the right mix of intelligent agents who have the appropriate set of knowledge, skills, information and abilities to suggest solutions in what concerns difficult and unpredictable problems (Carneiro, 2001). Belbin (1996 pp. 24) state that team role could be defined as “a tendency to behave, contribute and interrelate with each others at work in certain distinctive ways”. Schmelz and Ramsey (1995) agree and add that all roles are part of the accomplishment of team functions and can influence team outcomes. The team functions are trust, interdependence, conflict, communication, shared values and leadership (ibid).

Trust and Interdependence - plays an important role in external team relationships. Since team members bring complementary skills to the team, they are interdependent and must trust one another to contribute to the whole. Both trust and interdependence are important between selling and buying teams. (ibid)

Conflict and Communication - Conflicts are common and necessary in teams but to attain high team performance it is important to keep conflicts constructive by communicating. An open communication is positively related to team satisfaction and performance. (ibid)

Shared Values - High level of long-term commitment presumes a shared value system between exchange partners. Shared value system may also improve relationships, increased trust and interdependence, and improved negotiation outcome within and between teams. (ibid)

Leadership - Team leaders rely heavily on other members and they do not believe that they have all the answers. The leaders do not manage team activities, but they create an environment that enhance performance and ensures that team efforts are coordinated with the departments and organisations efforts. (ibid)

The participants in virtual teams are according to Scholtes (1995) divided into the following roles: guidance team, team leader, quality advisor, and project team members. Noticeably it is generally the most active participants who have the most important team roles (ibid).

- The Guidance Team supports the project team’s activities, secures resources, and clears a path in the organisation.
- The Team Leader runs the team; arrange logistics details, facilitating meeting and so on.

- The Quality Advisor is trained in the scientific approach and helps keep the team on track and provides training when needed.
- The Project Team members are the people who form the bulk of the team and who carry out assignments and make improvements. (ibid)

Belbin (1996) has a different way of expressing a team's role descriptions. He describes nine different roles in a team:

- Shaper: The shaper drives the teamwork towards the goal and tries to solve different problems on the way.
- Implementer: Implementers are people that realize ideas and concepts into reality. Resists changes and new standards of work.
- Completer: The completer is a person that corrects errors and is careful. Tries to keep the time schedule and deliver on time.
- Coordinator: Often the leader of the team, and have experience from previous teams. Recognize the weaknesses and strengths of the team, but could take credit for others efforts.
- Team worker: Are team members that are diplomatic and cooperative. They tend to support other team members and try to avoid stressful situations.
- Resource investigator: Are always trying to search for new ideas and connecting new contacts with people outside the team.
- Creative person: Are creative and tries new ideas. These people are excellent solution vendors but neglect routine duties.
- Monitor: is strict, analyzing and logical. View skeptic new proposals.
- Specialist: they contribute with their special knowledge in a narrow area that they tend to work alone. (ibid)

Belbin (1996) writes that all the roles are present even in the smallest team, since a person could attain several roles at the same time. Johnson, Heimann and O'Neill (2001) points out the importance of having clear orders and specific roles in a team to accomplish the work required. Clarity in what to do is one of the critical factors that can bring the teamwork to success (ibid). It is important to remember that there is no blueprint for the ideal knowledge mobilization team, KM unit or knowledge transformation department (Abell and Oxbrow, 2001). Each organization has its own unique approach, which is not a transferable "one size fits all" solution. Obviously, the roles play an important part for these KM units. These units can also be viewed or function as virtual teams.

Abell and Oxbrow (2001) describe and state the importance of role division in KM to succeed. Meyerson, Weick and Kramer (1996) assume clear role divisions among team members who have well defined specialties. Inconsistent role behavior and "blurring" of roles erode the attractiveness (ibid). Abell and Oxbrow (2001) ask what the roles need look like if they are to support knowledge management, and what the associated competencies are that both individuals and organization need to acquire? Organizations have recognized that successful knowledge management initiatives depend on the commitment of top management, and the contribution of senior consultants or experts (Rowley, 1999). By contrast, in virtual teams, members remain in different locations and often are accountable to different individuals Kristof (1995).

Such teams are assembled less based on their specific roles and more based on their knowledge differences, partially related to the geographic location of the individual, which provides them with greater knowledge of that environment (ibid). These differences may have significant implications for the team. In the temporary teams described by Kristof (1995), what is at stake are the professional reputations of members, the reputations of the persons to whom the team members report, impending threats from closely knit social and professional groups to which members and the supervisor belong, and perceived interdependence among the team members (Meyerson, Weick and Kramer, 1996). In virtual teams, the reputation and professional network effects may be weak because of less clearly defined and bounded professional networks and less emphasis on roles (ibid).

2.3 How can KM strategies be described in virtual teams?

According to Abell and Oxbrow (2001), no one can manage knowledge. What can be done, and what companies are doing is to manage the environment that optimizes knowledge. Carneiro (2001) refers to that many organizations do not know how to manage and effectively take use of the most important competitive edge they possess. Dale Neef (1999, p. 72) describes a typical response from a manager with whom he shared a taxi ride after a KM conference:

"Am I just stupid (wondered the manager) or is there something behind all of this that I'm not appreciating."

Could anyone explain to him, he asked what exactly KM was, in practical terms and why it was important to his company? Despite the ever-burgeoning literature and growth of conceptual models and tools, hard-pressed managers seem to find it difficult to appreciate the special significance that KM has for redefining their managerial work. (Baily and Clarke, 2000)

2.3.1 What is the purpose of a KM strategy?

To start with, companies have their competitive possessions made up of knowledge that is manifested in intelligent technological resources and intellectual assets (Carneiro, 2001). It is also important for managers to understand and accept the growing field of KM, with particular emphasis on knowledge-based systems and their competitive use (Abell and Oxbrow, 2001). The challenge that modern organizations face is to turn the scattered knowledge of their intellectual assets into a well-structured knowledge repository (Van der Spek and Spijkervet, 1997).

Baily and Clarke (2000) bring up the concept of relevance, currency and action that in some way clarifies what enhancement management can do to contribute at personal, group and organizational level. These are influencing factors for how virtual teams can operate and carry out routines within an organization. Figure 2.8 tries to explain how the challenge lies in making KM ideas current, relevant and actionable. (ibid)

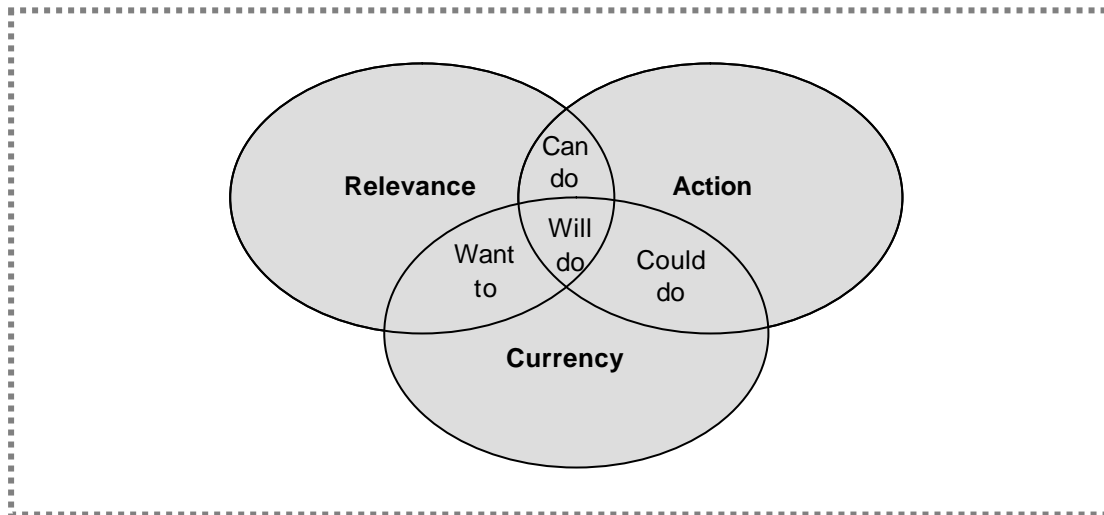


Figure 2.8: Developing usable ideas.

Source: Baily and Clarke, 2000

Relevance - This means being able to use the idea of KM to demonstrate how individuals can somehow personally benefit in a way not immediately apparent by adopting other perspectives on managerial work (McAdam and McCreedy, 1999). The personal motivation function as a key element in helping managers appreciate the value of adopting any new or different perspective (Baily and Clarke, 2000).

Currency - Operational processes concern how the organization achieves its strategic objectives; it involves managing knowledge about how organizational strategy is delivered through the performance of key processes such as distribution processes and employee development (ibid).

Action - There are many existing categorizations of KM activities including searching, transforming, consolidating, monitoring, exploiting and creating information (ibid).

Baily and Clarke (2000) mention that if KM is to become useful from a management perspective, it must start with the everyday realities of managers. Defining knowledge as "usable ideas" helps to accomplish this. It also encourages considerations of what characteristics the ideas include with in order to be "usable". Defining these characteristics as being currency, relevance and action does this. When all three coincide, managers are able to see the organizational importance of KM, its personal relevance and the opportunity to do something about it. (ibid)

According to Marshall et al. (1996), effective KM is accomplished by organizational change. Wiig (1996) mentions cultural driving forces such as "It's not my job" and values such as "Not invented here" mentality must be replaced with more positive factors; "anybody can talk to anybody else" and "high trust culture for shared learning". Examples of incentives include awards (non-monetary) and recognition's, bonuses and other monetary rewards, personnel evaluations and promotions, special focus meetings, and general communication approaches (Wiig, 1996).

2.3.2 Creating a KM strategy

“If KM is just handed over to IT, it ensures failure.”

- Born Wright, referred by Kaplan, 2002

The objectives for initiating a KM strategy can be many, some overall aims are however common to all organizations (Kaplan, 2002; Abell and Oxbrow, 2001). Abell and Oxbrow (2001) express competitive advantage; increased effectiveness and competitiveness; increased innovation and creativity and finally the reduced risk and cost control as being examples of the common objectives. Skyrme and Amidon (1997) specifically identify three new aspects for the knowledge agenda:

1. Make knowledge and knowledge processes more explicit.
2. Develop a strategic framework to guide the exploitation of knowledge in products, services and processes.
3. Introduce a more systematic method to the management of knowledge.

Initiatives for avoidance of duplication of effort and waste, repeating mistakes, time wasting and missed opportunities are crucial for working effectively in virtual teams and organizations at whole (Abell and Oxbrow, 2001). People working on a problem or task can benefit from the experience of anyone who has encountered the same problem or who has relevant expertise (Abell and Oxbrow, 2001). This is why a team of experienced people working together is even more effective.

By combining the knowledge exploitation with exploration orientation of the organization together with internal and external orientation, a framework (see figure 2.9) for knowledge strategies around virtual teams takes form (Zack, 1999).

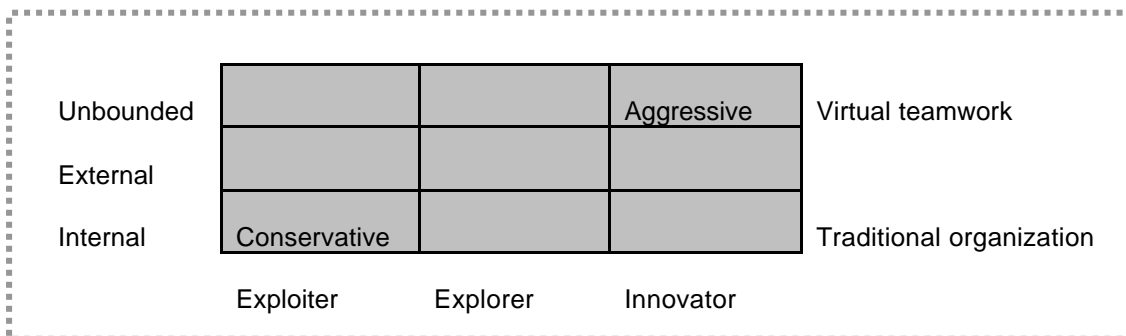


Figure 2.9: Framework for a knowledge strategy

Source: Zack, 1999

The choice of exploitation, exploration or innovation reflects the overall competitive business strategy of the organization. Strategic positioning within this framework reflects the KM strategy in alignment with the business strategy (Zack, 1999; Burn, Marshall and Barnett, 2002).

When developing a knowledge strategy, organizations and virtual teams normally achieve the following benefits:

- A better understanding of the potential impact of knowledge on business performance
- Identification of new business opportunities available through better KM
- Minimizing of duplication of effort and the loss of knowledge following organization restructuring
- Understanding how existing organizational knowledge can be better exploited
- A vision and framework for action
- A prioritized set of knowledge-based initiatives
- Clarity of capabilities needed and required organization and management changes
- Improved alignment between business strategy and technology infrastructure for knowledge sharing and development

2.3.3 Creating collaborative sharing

Organizational knowledge is the most valuable strategic resource, and the ability to create and apply it the most important capability for generating competitive advantage (Zack, 1999). Organizational knowledge and business strategies are very much tied together. Liebowitz (2000) confirms this by saying that management objectives in the context of the organization's business strategy are a combination of customer knowledge and internal "know-how". This internal "know-how" is therefore automatically also stored in the individuals who are involved in the virtual teams (Burn, Marshall and Barnett, 2002). According to Wiig (1996), organizational knowledge should be accessible to those who may need it:

- New knowledge should be rapidly generated and made accessible
- Controls are developed to embed the most reliable and robust knowledge
- Organizational knowledge is tested and validated periodically
- KM must be facilitated through its culture and incentives

Organizational knowledge is reflected in products and services that an organization creates and sells to its customers. Individual expertise in an organization is an asset, however, if management does not nurture individual expertise carefully, individual self-expressions become organizational liabilities. Therefore, management should create an environment that encourages its employees to collaborate to share knowledge. This results in enhancing employees' knowledge and creating organizational knowledge through individual interactions in contexts such as the virtual teams. (Bhatt, 2002)

One way through which management can manage individual knowledge is by creating an environment of collaboration and informal coordination. In so doing, an organization not only deepens its employees' knowledge but also creates new organizational knowledge. Through participation and cooperation, an organization establishes a shared-schema to replace old knowledge with the new one that becomes necessary for continuous improvement and breakthrough innovation. (Weick, 1995)

One of the techniques used to leveraging the organizational knowledge as part of the KM strategy is a method called "knowledge mapping" (Liebowitz, 2000). The knowledge map involves two aspects: knowing how individuals learn and create

knowledge, and knowing how teams create insight. Junnarkar (1997) describes four elements regarding the individual knowledge creation.

1. *Tacit-to-Tacit Knowledge Creation:* Face-to-face meetings, teleconferences and videoconferences are some of the common methods of exchanging tacit knowledge.
2. *Tacit-to-Explicit Knowledge Creation:* The most common form of capturing tacit knowledge and making it explicit is e-mail.
3. *Explicit-to-Explicit Knowledge Transfer:* E-mail, Internet, Intranet, GroupWare, distribution of printed documents and CD ROMs are examples of how ICTs has greatly enabled this type of knowledge transfer.
4. *Explicit-to-Tacit Knowledge Creation:* Successful sensemaking depends on attributes of each individual such as expertise, experiences and mindset.

To understand how individuals collectively create insight in focus turns to different processes. These processes are described as; the dialogue among team members (socialization), the way team goals are articulated (externalization), the collective knowledge base of the team (combination of intellect) and in what way activities are performed (internalization). Knowledge maps can be a useful method to support the KM strategy since it takes both individual and team level interactions and processes into consideration. (ibid)

The creation and transfer processes of knowledge described by Junnarkar (1997) are depending on both face-to-face interactions as well as ICTs. Syed (1998) mentions how performing tasks, making decisions, and solving problems take place with both internal members and external people. Figure 2.10 show how the use of ICTs such as videoconferencing and teleconferencing is used for facillitating the direct activities (Syed, 1998; Arnison and Miller, 2002). However, the IT-enabled connections are getting a stronger foothold since computer networks and KM-tools increase in use. The figure also indicates the knowledge flow within each virtual team, which is a result of the creation, transfer and sense making processes.

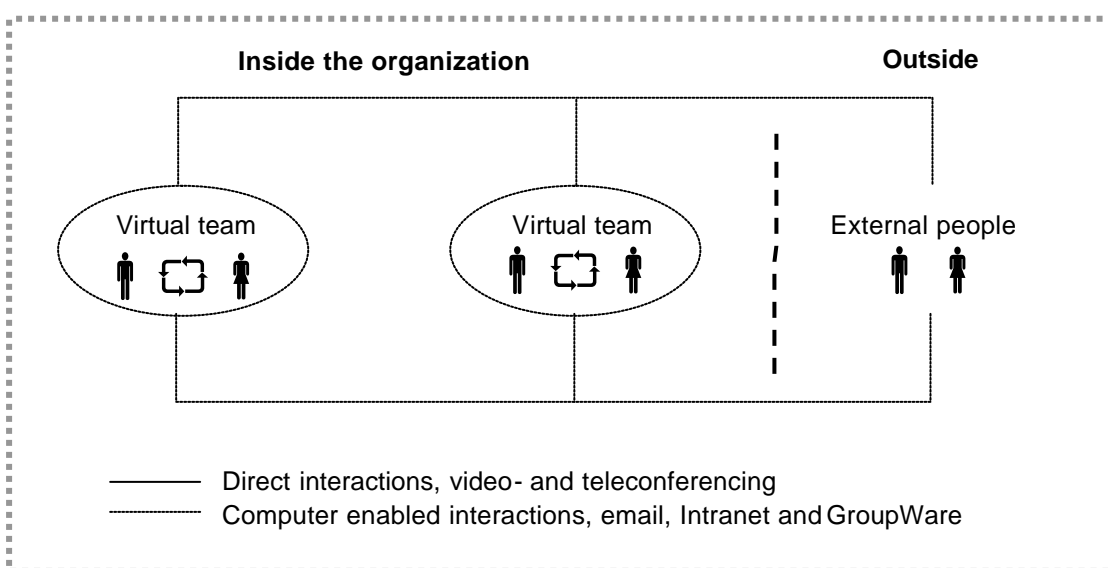


Figure 2.10: The context and dynamics of virtual teams.

Source: Modified after Syed, 1998

In the face of the complex foresight horizon, a balance must emerge from the cognitive and structural practices of the company and its intellectual assets. Doing so requires an infrastructure that facilitates these practices. Agent-based systems provide a natural means of creating an infrastructure that can provide control for selectively shifting the interactions from “direct” to “IT-enabled.” The systems can be built to facilitate interactions in a community of human and software agents. (Syed, 1998)

The degree to which virtuality can be implemented effectively relates to the strength of existing organizational links (virtual and real) and advantages they bring to the virtual structure. The virtual culture of the organization is the result of interplay between the virtual strategy, virtual structure and the use of ICTs. However, in order to align these processes and manage change virtual teams will also encompass knowledge of the overall business arena, with its *outside*. The most successful organization or team is the one that regards the storage and communication of knowledge as a core asset. (Burn, Marshall and Barnett, 2002)

The interaction processes of individuals have great affects on the need, usage, creation and transfer of knowledge (Syed, 1998). The following tasks can help designing content maps for Intranets and KM strategies, which enables organizations, teams and individuals to work more efficient (Liebowitz, 2000).

- Identify the information needs of the organization, teams and individuals
- Identify the information created and assess its value
- Identify the expertise and knowledge assets
- Identify the information gaps
- Review the current use of external and internal information
- Map information flows and bottlenecks within those flows
- Develop a knowledge map of the organization

2.3.4 KM activities

The content maps together with the previously mentioned KM strategy aspects and desired benefits help breaking down process into “actionable” activities (Baily and Clarke, 2000). Managers should be focused on ensuring processes, practices and individuals with the appropriate intellectual capabilities (ibid). According to Syed (1998), activities in a knowledge-based organization are classified into two types: planning and operations (see TABLE 2.2).

TABLE 2.2. Characteristics of interactions and activities.

Type of interaction	Gathering	Organizing	Sense-making	Communicating
Planning	Ease of access and filtering	Flexibility and evolvability	Coordination and collaboration	Clarity and directness
Operations	Speed and automation	Structured and fast access	Analysis and optimization	Speed and real time view of operations

Source: Syed, 1998

Activities used in the KM strategy can also be explained using a KM activity matrix (see TABLE 2.3). This matrix describes the nature of the important KM activities in each of the knowledge domains (Baily and Clarke, 2000). In the managerial

knowledge portfolio, each of the knowledge domains can ensure that KM activities deal with important managerial concerns and organizational issues (ibid).

TABLE 2.3. Organizational KM activity matrix

B - Strategic Fit	C - Strategic Potential
<p>What practices´, processes, techniques or people are in place to:</p> <ul style="list-style-type: none"> ▪ Generate information about the strategic environment and capability? ▪ Communicate information about strategic achievements and gaps? ▪ Exploit information about strategic fit in order to: <ul style="list-style-type: none"> - Inform strategic potential? - Inform operational and performance requirements? - Inform improvement and development requirements? 	<p>What practices´, processes, techniques or people are in place to:</p> <ul style="list-style-type: none"> ▪ Generate information about the future environment and capability? ▪ Communicate information about strategic possibilities and their value? ▪ Exploit information about strategic potential to: <ul style="list-style-type: none"> - Inform current strategic direction? - Inform current operational priorities? - Inform future development investment?
A - Performance Management	D - Performance Development and Potential
<p>What practices´, processes, techniques or people are in place to:</p> <ul style="list-style-type: none"> ▪ Generate information about performance and capability? ▪ Communicate information performance objectives, levels and capability? ▪ Exploit information about performance in order to: <ul style="list-style-type: none"> - Inform strategic achievement and fit? Or, - Inform performance development and potential? 	<p>What practices´, processes, techniques or people are in place to:</p> <ul style="list-style-type: none"> ▪ Generate information about process, product, service developments or improvement? ▪ Communicate information about improvements and potential new developments? ▪ Exploit information about potential developments and improvements to: <ul style="list-style-type: none"> - Inform strategic potential? - Inform operational performance? - Inform strategic fit?

Source: Baily and Clarke, 2000

This matrix can work as an aid to select proper KM tools that can help an organization in many different ways (Baily and Clarke, 2000). It could work as a basis for KM auditing or as guidelines for enhancing groups and virtual teams' effectiveness. It has also been used as a template for analyzing personal activity and contribution. By using this KM activity matrix for organizational work, managers are able to see where the value and limitations of certain KM ideas and tools can be found (ibid). The organizations usage of ICTs and KM tools are in focus when viewing the communication of ideas in and between each quadrant.

- In quadrant A and C; data mining of tacit knowledge is an information generating activity.
- In quadrant B; strategic analysis and review are activities to do with generating information in.
- In quadrant C; break-through thinking and scenario planning are information generating activities.
- In quadrant D; innovation management techniques are substantially focused on KM this also refers to organizational learning and activities to do with exploiting ideas.

The matrix allows a number of critical questions to be generated about the nature of existing KM activities in an organization (ibid). Baily and Clarke (2000) also mentions the importance of raising questions in order to identify a theme, an emerged picture of the audit. The audit can be focused at the organizational, group or

individual level depending on where it will be most useful for the user. When applying this audit at group level for teams that work in a virtual context the following questions are examples of questions needed to be asked in quadrant A:

- Is it known what competencies are needed to maintain our existing service levels? (generating).
- How effectively does the virtual team communicate key information about our core processes? (communicating).
- To what extent is tacit knowledge about product and service delivery being leveraged through day-to-day processes to enhance product or service delivery? (exploiting).

Changing strategy or operational processes refers to how the organization or virtual team intends to align culture, structure and processes to this strategic direction; it involves managing knowledge about present states and future possibilities. (Baily and Clarke, 2000) Whether a strategic step in terms of alignments and changes will be needed to make it's found out as the critical success factors are discussed next.

2.4 How can the Critical Success Factors of KM in virtual teams be described?

When the success factors are, studied focus falls on the human aspects. A strong academic majority raises a big concern around this area. Kaplan (2002) and Burn, Marshall and Barnett (2002) to mention a few, all agree that the intellectual assets of the employees are the foremost critical success factor.

“Usually people begin a KM project by focusing on the technology needs. But the key is people and process.”

- Shir Nir, referred by Kaplan 2002

Johnson, Heimann and O'Neill (2001) explained that the successful adaptation of KM in virtual teams attributes to many factors. They argued for some factors and reasons to why organizations would use virtual teams and benefit from them. They mentioned factors like increased efficiency and lower costs, but also time saving and flexible hours as other benefits from virtual team composition. It is obvious as Johnson, Heimann and O'Neill (2001) proclaims that virtual teams are gaining ground of the mentioned reasons, but the authors are also bringing up the problems associated with virtual teams. According to Jarvenpaa and Lediner (1998) there are three major obstacles in adapting KM in virtual teams; these are trust, communication and culture. Figure 2.11 shows how the three obstacles interrelate in the virtual team

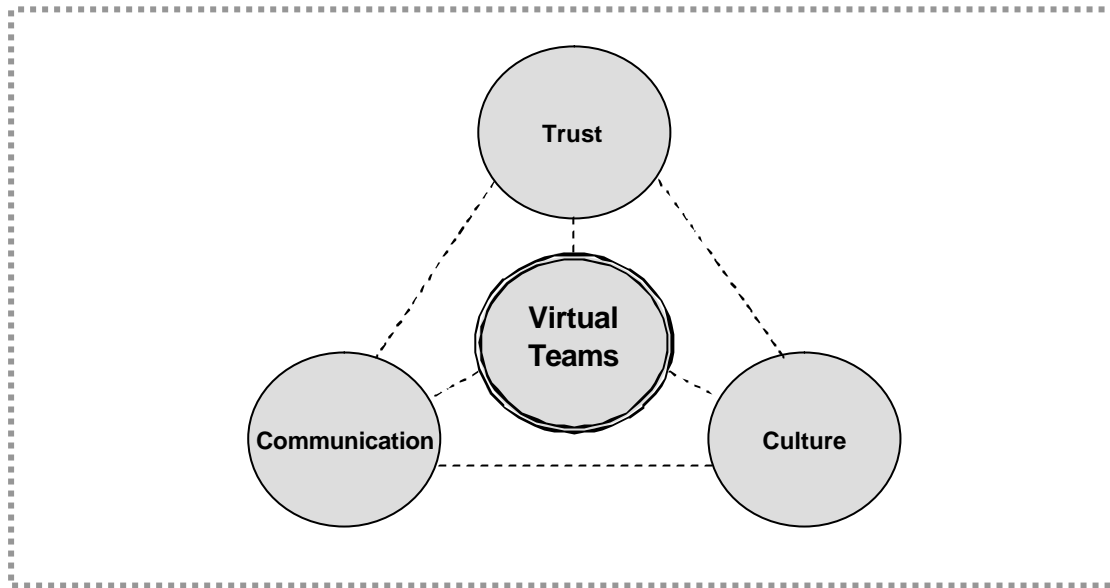


Figure 2.11: The three major obstacles in adapting KM in virtual teams.

In the next section, the first factor, trust will be explained, followed by communication and the impact of culture.

2.4.1 Trust

Arnison and Miller (2002) state that trust is often built through face-to-face interaction between the team members and that the level of trust could affect the degree of performance. Cummings and Bromiley (1996) studied the maintenance of trust within a group and stated that trust is built when a person believes that the group “makes a good-faith effort to behave in accordance with any commitments both explicit or implicit, (b) is honest and (c) does not take excessive advantage of others even when the opportunity is available”. Several factors, such as shared norms, repeated interactions, and shared experiences, have been suggested to facilitate the development of trust (Bradach and Eccles, 1988; Lewis and Weigert, 1985; Mayer, Davis and Schoorman, 1995).

Another factor asserted to promote trust and cooperation is the anticipation of future association between the group members (Powell, 1990). Such anticipation of future association is higher among group members who are co-located than among physically dispersed members (Latane, Liu, Nowak, Bonevento and Zheng, 1995). Co-location or physical proximity more generally, is said to reinforce social similarity, shared values, and expectations, and to increase the immediacy of threats from failing to meet commitments (Latane et al, 1995). Furthermore, face-to-face encounters are considered irreplaceable for both building trust and repairing shattered trust (Nohria and Eccles, 1992; O’Hara-Devereaux and Johansen, 1994). Already in 1976, Short and Christie showed that social presence and trust development are bounded to each other in virtual teams. The authors suggested that computer-based communication media might eliminate the type of communication cues that individuals use to convey trust, warmth, attractiveness and affections within the virtual team.

2.4.2 Communication

Walther (1997) showed that computer-mediated communication does not differ from face-to-face communication in terms of the capability of information exchange, but rather in terms of a slower rate of transfer. Walther (1997) also found that discussions, depth, and intimacy were greater in computer-mediated communication groups than in face-to-face groups, even for groups with geographically dispersed and diverse partners who had never met face-to-face. Another difficulty brought up by Johnson, Heimann and O'Neill (2001) is the tendency of being less effective in communicating and whereby being a problem. This falls into the following three categories (ibid):

- *Lack of project visibility* – members are unclear on what tasks they are required to do, and they are vague on how their tasks fit into the project as a whole.
- *Getting in touch with people* – team members never get back out questions and would never get back a response.
- *Constraints in technology* – members had difficulty in determining the meaning of text-based messages such as e-mails, especially if the person was attempting to be sarcastic.

To overcome the difficulties with communication, Lea and Spears (1992) suggested that in the absence of individuating cues about others, as is the case in computer-mediated communication, individuals build stereotypical impressions of others based on limited information. These stereotypical constructs are dependent on the variable of diversity. According to Walther (1997), who acknowledges this tendency to resort to categorical information processing, over-attributions on minimal social cues of the communication partners in computer-mediated communication groups, predicts that the effects from de-individualization should decrease in the face of information on individual differences, particularly if the team had diverse membership. Yet, the greater the team member diversity, the more time will be required for team members to form strong bonds (DeSanctis and Poole, 1997). Moreover, some teams may develop strong bonds and attractiveness despite heterogeneity and short time spans whereas others may not (ibid).

Wiseman, Hammer and Nishida (1989) explain that people with high confidence in the knowledge of people skills tend to be more willing to explore diverse topics. This might suggest that people who are more socially experienced might seek and disclose individuating information more than those who are not. The social dialog in turn might help develop attractiveness on the team, at least in the eyes of the socially experienced person. Wiseman, Hammer and Nishida (1989) conclude that both trust and communication ability is bounded to the present geographical culture among the team members.

2.4.3 The impact of Culture

Czinkota and Ronkainen (1998) define culture as “*collective programming of the mind*” and “*the accepted pattern of behavior among a group of people*”. In many organizations, virtual team membership will cross national boundaries, and a variety of cultural backgrounds will be represented on the team. The team could then experience communication problems due to the different view on things like goals,

individualism and devotion to work. Work interactions will then require team development in the area of cultural diversity. This is proclaimed in the fact that the greater team diversity, the more time will be required for team members to create and form strong bonds and thereby develop attractiveness. (Arnison and Miller, 2002)

Potter, Balthazard and Cook (2000) mention that team members have to deal, not only with national culture, but also with organizational culture. Each organization has its own settings, rules and key of interaction. This could affect the way assembled teams with different background in different organizational cultures could perform and interact towards the goal (ibid). Arnison and Miller (2002) continue to mention other factors that could affect the performance of the team. The amount of stress that is created on the team members during the work process that could affect the efficiency of the interaction, while trying to figure out the cultural background in each team member (ibid). Davenport, De long and Beers (1997) bring up the issues surrounding culture in the content of KM in teamwork. They discuss the importance of familiarity in other cultures and especially other team members' culture. The familiarity, according to Davenport, De long and Beers (1997) creates a larger understanding, and eases up the interaction between the team members.

2.4.4 Other factors influencing successful KM in virtual teams

Davenport, De long and Beers (1997) write about succeeds with KM in teams and point out several factors that affects that level of success. The authors are getting support from Johnson, Heimann and O'Neill (2001) as they mention a set of factors that could lead to successful virtual teams. The following factors are important for both the virtual team members and for managers who are implying KM within their organization (ibid):

- *Policies regarding communication* – an adaptive technologically advanced nonhierarchical organization are more likely to succeed with virtual teams than a highly structured, control-oriented organization (Apgar, 1998). Davenport, De long and Beers (1997) reflect on the suggesting to attempt to build awareness throughout the organization toward knowledge management.
- *Management support* – in order for virtual teams to succeed, a company's leaders need to have a culture established within the organization, which values communication, learning, teamwork, and the need for diversity (Apgar, 1998). One of the most important factors according to Davenport, De long and Beers (1997) is management support. The authors claim that changes cannot occur without initiative from upper levels in the organization.
- *People* – the ability of people to possess the proper knowledge and experiences. In addition, social skills are important to success in the group (Johnson, Heimann and O'Neill, 2001).
- *Tools* – do not assume that software is compatible. Do a dry run in the beginning of the project of every kind of transfer you may need to encounter, so that there is time enough to recover from problems that will turn up (Melymuka, 1997).

- *Knowledge sharing* – the importance of sharing acquired knowledge with others in the virtual team. Thereby, the new knowledge will be facilitated through the entire organization. (Carneiro, 2001; Sanchez, 2001; Boisot; 1995)

The above listed factors have also been confirmed as important factors in other studies (Markus, 1994; Ngwenyama and Lee, 1997). These studies concurred that the results of the interaction in virtual teams are more a function of the context, setting, and timing than the characteristics of the used tools. On the other hand, Arnison and Miller (2002) mention that critical parameters for computer-based work are pending on individuals' skills using the interaction tools and mastering these. Potter, Balhazard and Cooke (2000) point out such challenges related to tool interaction. First, they claim that many people, although they are comfortable with computers, may be a significant of the employees still uncomfortable with computers and other telecommunications technologies. One challenge is to bring these people into the virtual team environment. (ibid)

Second, organizations must establish a policy regarding communications privacy, then must strictly adhere to that policy, and thirdly is the level of stress (ibid). According to Townsend and DeMarie (1998) is the connection to several medias and communication terminals creating a higher level of stress. This stress is built up gradually due to the higher degree of overextend interaction and the ability of always be available to the other virtual team members (ibid).

The next chapter will present the conceptual framework of the thesis.

3 CONCEPTUALIZATION

In order to answer the research questions stated in chapter one we have to conceptualize them by building a frame of reference. We do this by building a frame of reference based on the literature review presented in previous chapter. Our frame of reference will constitute a base when analyzing the collected data connected to the relevant variable of each research question. Since we have studied several theories within the same theoretical area, we have selected the ones that match our research questions and our purpose in the most appropriate way.

According to Miles and Huberman (1994), a conceptual framework explains, either graphically or in a narrative form, the main things to be studied (p. 18). In order to create a conceptual framework Miles and Huberman (1994) state that this process is most easily done after a number of research questions been made. To create this conceptualization the following presentation according to each research question is made. This conceptualization will guide this research's data collection. We have based our questions in such way that we will capture the three areas of investigation in equal divided sections.

3.1 How is knowledge managed in virtual teams?

In order to answer this question we will use theories that explain how organizations work with knowledge. We will also use theories connecting to learning processes, interaction tools and finally theory relating to the roles involved in the virtual teams. In terms of knowledge based organizations we will use Carneiro (2001) and Sanchez (2001) that describe the essence of organizational learning and how this is created both on individual and organizational level. To investigate the knowledge transfer we will bring in the thoughts of Boisot (1987). His thoughts will also be used when looking at how different individuals and team members share and promote knowledge. In order to understand wheter the organizations are using any explicit forms of repertoires or routines we will use Barney (1986). This is also used in order to find out if connections work as an integrated form where new knowledge is created and shaped by organizational history and culture.

When we look at how knowledge sharing takes place, we will use Bhatt's (2002) thoughts to see if this is performed in informal and social processes. This will blend into Stenmark's (2000) reasoning where he points out the vitality of common knowledge as a key to solve the objectives. In order to find out how knowledge is shared and interpreted by the organization we will use authors such as Bhatt (1998) and with Barney (1986). This is done because they bring up the importance of having a decentralized organization view and the support from management.

When describing the usage of ICTs and KM tools, we will use authors like Liebowitz (2000), Zeff and Aronson (1999) and Kaplan (2002) since all brings up a certain tool or application being used. This could be more specifically defined as:

- Videoconferencing (ICT)

- Teleconferencings (ICT)
- E-mail (ICT)
- Intranet/GroupWare (KM-tool)
- Intelligent agents (KM-tool)
- Management Document Systems (KM-tool)

The introduction of more systematic methods for management to communicate and store knowledge through these ICTs and KM tools will be interesting to investigate. This can tell us whether applications and usage of new technology has any major affect on how business performance. The way in which Choo, Detlor and Turnbull (2000) describes Intranet's four spaces (awareness, information, communication and collaboration) will be used to see whether this can enhance knowledge usage in virtual teams. When referring to what responsibilities that exists in the teams we will concentrate on the four roles that Scholtes (1995) presents. These four roles can be described as guidance team, team leader, quality advisor and project team members (ibid). We will use the descriptions of these roles or Belbin's (1996) nine roles depending on the number of individuals participating in the teams.

Schmelz and Ramsey (1995) deepen the discussion about roles as they state that accomplishment of team roles includes to distinguis different functions. These team functions are considered to be trust, interdependence, conflict, communication, shared values and leadership and which all can have great impact of the team outcome (ibid). Since we would like to know how these functions are handled from a organizational and management perspective we will use this as part of our frame of reference.

3.2 How can the KM strategy in virtual teams be described?

To answer this question we will use different ingredients, such as “usable ideas”, “knowledge mapping” and an activity matrix. We will start this section by looking at how important managers believe it is to understand, accept and managing the knowledge flowing in the organization. By doing this we use theories described by Abell and Oxbrow (2001). They are also bringing up issues in regardance towards the knowledge-based systems and their competitive use. These will be taken in as bridge from the previously mentioned use of ICTs and KM tools and how an organizational perspective can be used to look at these competitive technology artifacts. When continuing with the purpose of a KM strategy Baily and Clarke (2000) bring up the concepts of relevance, currency and action. In order to clarify the concepts of how a KM strategy can be viewed, a set of usable ideas are developed for management. These “userfriendly” ideas can in turn contribute at personal, group and organizational level making it more tangible for managers that are alienated from the ideas of KM (ibid). With this background, we seek to answer to how organizations think in the aspects of using a KM strategy.

We use Abell and Oxbrow's (2001) explanation of how objectives for a KM strategy might be frased when comparing with how our investigated companies look upon the issue. These objectives are formulated as competitive advantage; increased effectiveness and competitiveness; increased innovation and creativity and finally the reduced risk and cost control (ibid). We will use Skyrme and Amidon (1997) and theirs description of the three aspects of a knowledge agenda. This will be done in

order to see whether there are any other aspects or incentives that our investigation can bring. The aspects brought up are as following:

- Making knowledge and knowledge processes more explicit
- The development of strategic frameworks to guide the exploitation of knowledge in products, services and processes
- The introduction of more systematic methods to the management of knowledge

Abell and Oxbrow (2001) continue the list of incentives where avoidance of duplication, repeating mistakes, time wasting and missed opportunities mentioned. These incentives should be easy to detect and at the same time give valuable indication of how well organizations' virtual teams are performing (ibid).

We would like to grasp what sort of benefits companies could gain using KM strategies and how this could add to their overall competitiveness. With these intentions, we use Burn, Marshall and Barnett's (2002) description of how usage of a KM strategy can give several of benefits. Further, Zack (1999) contributes how a KM strategy through these benefits can generate competitive advantages. Liebowitz (2000) brings up the internal "know-how", which can create interesting views in terms of how management encourages its employees to collaborate to share knowledge. Bhatt (2002) pose that individual knowledge sharing in virtual teams can create a greater knowledge base for the company at whole together with Wiig (1996) presents becomes natural to ask how accessible knowledge is to those needing it.

Liebowitz (2000), Junnarkar (1997) and somewhat Weick (1995) present the knowledge maps as valuable supporting instruments to the KM strategy. The area of knowledge mapping includes both individual and team level interactions and processes (Liebowitz, 2000; Junarkar, 1997). These authors reasoning can possibly contribute to better develop an understanding on how shared-schema can be established within organizations and virtual teams. Finally Baily and Clarke (2000) breaks the knowledge map and processes of the KM strategy down to actionable activities that in the creation of a matrix. We will test and see however this KM activity matrix can stay the test of our responding companies. By applying it we might be able to distinguish values or limitations of certain ICTs together with KM ideas and tools.

3.3 How can the Critical Success Factors of KM in virtual teams be described?

To investigate the critical success factors we will begin to use what Johnson, Heimann and O'Neill (2001) takes up as what makes KM successful in virtual teams. Why organizations would use virtual teams and benefit from them. The factors being mentioned are increased efficiency and lower costs, time saving and flexible hours. Potter, Balhazard and Cooke (2000) say that successful implementation of virtual teams would be highly dependent on the involvement from top management. Meyerson, Weick and Kramer (1996) continue to say that successful KM initiatives depend on commitment from management and the contribution of senior consultants. Therefore, we will look at what involvement and concerns management and how

senior employees put into this area. Further, we would like to see how ICTs are combined together with the organizations' intellectual assets since this is essential for success according to Burns, Marshall and Brunett (2002). We will after this close in on what Jarvenpaa and Leidner (1998) mentions as the three major obstacles in adapting KM in virtual teams:

- Trust
- Communication
- Culture

Systematic methods to the management of knowledge exist within the areas of trust, communication and culture. Aronson and Miller (2002) state that trust is often built through face-to-face interaction. When talking about communication, we will use authors like Walther (1997) who mentions that communication through ICTs in a sense that do not separate as much with traditional ways of communication as previously thought. This is an interesting notation that we feel necessary to investigate and see if this relates also in the line of highly knowledge-based organizations. Latane, Liu, Nowak, Bonevento and Zheng (1995) say that interaction enhances the performance of the team. Culture is an aspect that Potter, Balthazard and Cook (2000) discusses in the understanding of other people and thereby the increased the ability to communicate in order to succeed. Since success of virtual teams goes hand in hand, with what the organizational culture "allows" you to do we will try to find usable connections for this aspect.

What Bhatt (2002) initially described as importance of effective management is ones again brought up. However, why we will use this continuous discussion by Aronson and Miller (2002) is because they focus on performance and the fingertip-precision of the management in their execution. Townsend and DeMarie (1998) conclude the list of conceptual authors and theories by pointing out the importance of stress. They continue to discuss the burning question of today in which stress levels can be one of the crucial factors affecting the success of a virtual team. Since stress related issues are in the spotlight in these days we hope to have some useful answer within this area.

3.4 Emerged frame of reference

The conceptualization presented in the beginning of the chapter allows us to provide the study with a framework of theories to answer our stated research questions. This makes a conceptual model evolve of how the different research questions connect to each other. Each question relates to a certain research area that will work as subject to this study. How these subjects interrelate is illustrated in figure 3.1. It should also be told that the arrows shown in the figure act as indicators for how the research questions are interrelated. Since each research question use a specific set of theories, they also contribute to a better understanding of the concept of KM in virtual teams.

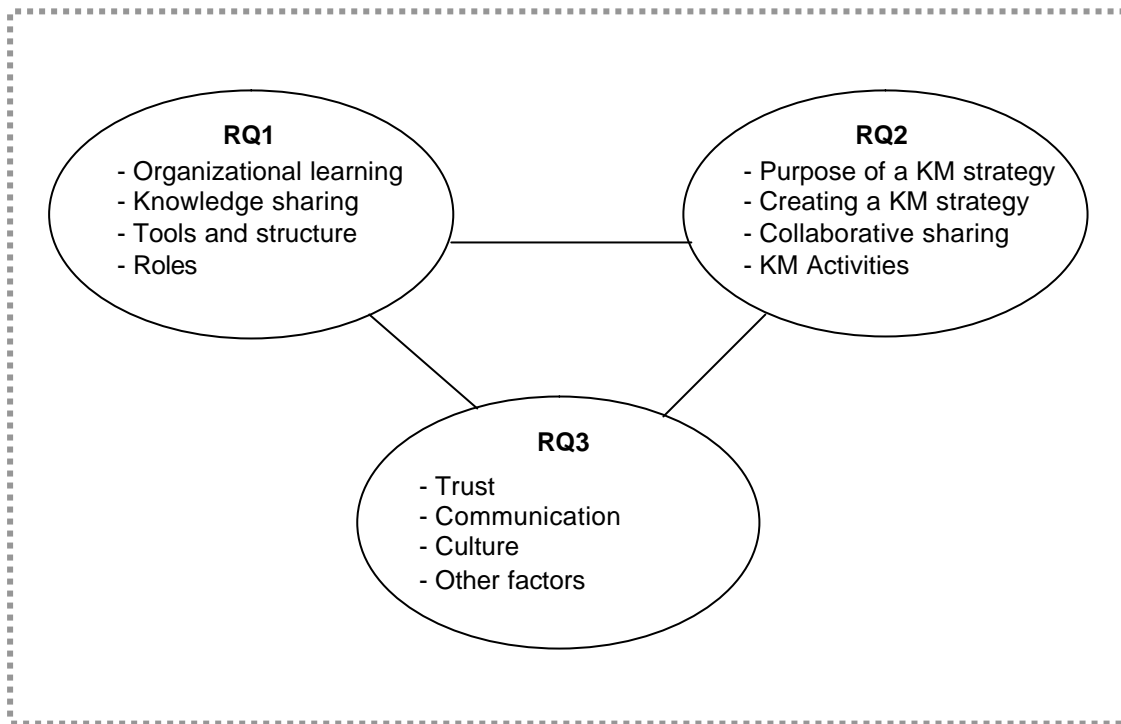


Figure 3.1: Conceptualization model

The theoretical journey starts with key concepts in the beginning of the literature review and ends in this conceptual model describing how the three research questions tie together. Since the aspects of all three research questions blend into each other it also becomes natural that they interrelate and affect each other. Our figure is trying to explain that phenomena by the use of arrows, pointing at one another of the research areas. Within each of our research areas, we have defined a specific research question that forms the base of the investigation within that specific area. The knowledge processes being described within the organizational context and how this affects the virtual teams tie the investigated fields together.

In brief, the model could be explained according to the following. The knowledge sharing that takes place through learning processes described in RQ1 are enabled with different tools. Using these devices make, the virtual teams become much more efficient in the sharing processes. The composition of virtual teams is also explained so that a better understanding can be made before entering the field KM strategies creation and adaptation in RQ2. By thoroughly explaining the meaning and purpose of the KM strategy, the importance of one makes the creation process come natural. Thereafter the KM strategy describes its essence in which collaborative sharing is the key. This is ultimately divided into activities that can be taken to enhance KM organizations at whole as well as for virtual teams. Finally, in RQ3 the critical success factors are turning the lights on trust, communication and culture, in which the core aspects of KM in virtual teams get attention.

We will now continue with describing the methodology used for creating this thesis.

4 METHODOLOGY

A method is a tool, that can help solve problems and reach new knowledge (Holme and Solvang, 1997). This chapter will present the procedure of the research. We will describe what methods we have used and how we created the thesis. In order to do this there are a series of steps to be followed and these steps are showed in figure 4.1. Finally, we discuss the methodology problems and what has been made to overcome these problems in order to strengthen validity and reliability to this study.

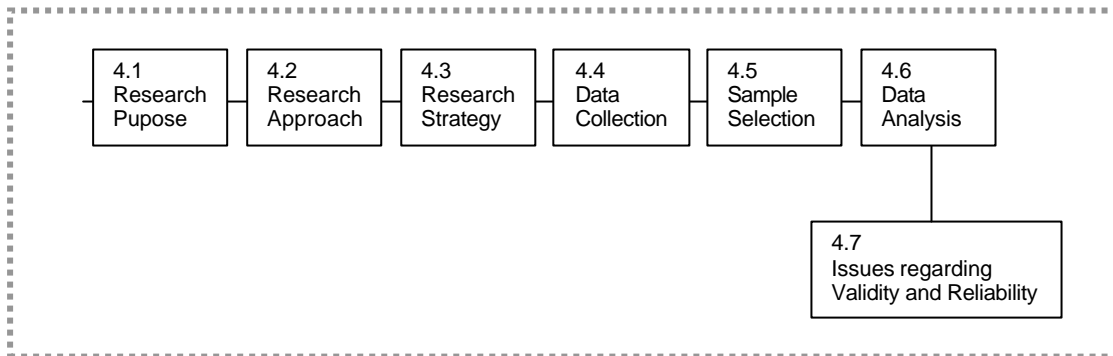


Figure 4.1: Schematic presentation of the methodology.

4.1 Research purpose

Yin (1994) mentions that scientific research has three purposes: explore, describe, or explain. Eriksson and Wiedersheim-Paul (1997) put this distinction between purposes into categories. They divide research into three different categories: exploratory, descriptive and explanatory.

Exploratory research is useful when the problem is difficult to limit, when the perception of which model to use is diffuse and it is unclear what characteristics and relations that are important (Eriksson and Wiedersheim-Paul, 1997). The purpose of an exploratory research is to gather as much information as possible about a specific subject. It is further common to use many different sources to gather this information (Patel and Davidson, 1994). An exploratory study should be designed by stating a purpose and stating the criteria to judge the exploration successful (Yin, 1994).

Descriptive research is appropriate when a problem is clearly structured and when intention is not to conduct research about factors related to causes and symptoms. (Eriksson and Wiedersheim-Paul, 1997) As presented by Miles and Huberman (1994) with reference to Bernard (1988) to describe is to make “*complicated things understandable by reducing them to their component parts*”. According to Eriksson and Wiedersheim-Paul (1997), the researcher conducting the study knows what he or she wants to investigate but not the answers.

Explanatory research is useful when studies involve relations between causes and symptoms (Eriksson and Wiedersheim-Paul, 1997). The researcher investigates however; a certain stimuli or factor affects one another. It is this identification of

factors, which together cause a certain phenomena (ibid). According to Yin (1994) an explanatory research approach could also be used when the study aim to explain certain phenomena from different perspectives or situations with given set of events.

We will in this study explore, describe and possibly start to explain how KM are used in virtual teams. Because the investigated area lack in previously studies our study is primarily exploratory. Since we strive to describe the discovered patterns of the exploratory stage, our research will also be descriptive. Finally, we aim to draw conclusions based on what we explore and describe. This automatically brings us the explanatory field.

4.2 Research approach

There are two main research approaches to choose from when conducting research in social science: *qualitative* or *quantitative* method (Yin, 1993; Holme & Solvang, 1991). There is one significant difference between these two approaches. In the quantitative approach, results are based on numbers and statistics that are presented in figures. Whereas in the qualitative approach where focus lies on describing an event with the use of words. Which approach to choose depends on the problem definition together with what kind of information that is needed. The two approaches can in cases where it is suitable also be combined. (Holme & Solvang, 1991)

The purpose for both the qualitative and quantitative approach is to create a better understanding of the society and to comprehend how individuals, groups and institutions act and have an influence on each other (Holme and Solvang, 1997). To reach each purpose different paths are however taken. The quantitative approach uses generalizations, based on the processed results of the investigation. For the qualitative approach the research problem is described out of the situation as a whole, without basing it on generalizations. According to Yin (1994) both methods have strengths and weaknesses. The approach best suited depends therefore on the specific study's research problem and accompanying research questions.

Quantitative research approach transform the information to numbers and amounts that later gets analyzed statistically. Quantitative studies tend to be more structured and formalized. (Holme and Solvang, 1997) The quantitative approach is also characterized by being study few variables on a large number of entities. To find answers to its research problem this is normally done in a broad sense by using surveys with already set answering alternatives. Furthermore, this approach is considered especially useful when conducting a wide investigation that contains many units. (Holme and Solvang, 1991)

Qualitative research approach aims at reaching a better understanding of the phenomenon being studied, they also tend to be relative flexible (ibid). Using this approach the researcher tries to separate the specific or odd and strives to create a complete understanding of the situation (ibid). Characteristics of qualitative studies are that they are based largely on the researcher's own description, emotions and reactions (Yin, 1994). The qualitative approach also includes a great closeness to the respondents or to the source that the data is being collected from (Holme & Solvang, 1991). The qualitative approach is characterized by gather abundant information and

to investigate several variables from a few numbers of entities. To take use of the possibility to gather high quality data the most common way to do this is with the use of case studies and interviews where no set answering alternatives are being offered. (Holme and Solvang, 1991)

Our study has a qualitative approach based on our research purpose and research questions, which required us to study the phenomenon in depth. This approach is suitable because we want to gain a better understanding of how KM works in virtual teams. This also meant that our research demanded detailed answers regarding the interviewed organizations'. With the use of our frame of reference, we aim to gain a better understanding of this phenomenon. We have chosen this approach instead of analyzing data statistically, as we otherwise would have done if conducting a quantitative study. Now when we have described that the research is focused on a qualitative research approach, the research strategy will be presented in the next section.

4.3 Research strategy

In the process of collecting empirical data there are a number of alternatives to choose when selecting the appropriate research strategy. As seen in table 4.1 each strategy is depending on the characteristics of the stated research questions. This is followed by the extent to which the researcher has control over behavioral events and whether the research is focusing on contemporary events or not. The researcher can then select among the following alternatives: an experiment, a survey, history, an analysis of archival records and a case study (Yin, 1994).

TABLE 4.1. Relevant situations for different research strategies

Strategy	Form of research question	Requires control over behavioral events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case study	How, why	No	Yes

Source: Yin, 1994, p.6

By applying Yin's (1994) reasoning and solely looking at the stated research questions, it appears that an experiment, history or a case study could fit as appropriate strategies. We have chosen to conduct our research with the help of the case study, which is generally superior when answering "how" and "why" questions about a specific topic (Yin, 1994). The choice of using a case study is motivated since we have little control over the behavioral events and the events under investigation are contemporary (ibid). Eriksson and Wiedersheim-Paul (1997) explains that the use of a case study also contributes to increase the understanding of a subject without generalizing. Reviewing our research questions all of them are stated as "how" questions which makes the selection of a case study an appropriate. By the characteristics of our research questions, they will provide us with relatively many variables, which is a further reason for selecting the case study. We therefore found

the case study to be the most appropriate strategy, since we wanted to gain in-depth information.

According to Yin (1994), a case study can involve a single and a multiple-case study. The single case study makes an in depth investigation regarding only one entity, such as an organization or a decision. However, when making a multiple-case study, two or more entities are studied which gives the opportunity of comparisons. Yet there is a risk with the multiple-case study, since each case might be less in-depth investigated (Wiedersheim-Paul and Eriksson, 1991). Still, according to Miles and Huberman (1994) the use of multiple-case studies will add to the confidence of the findings. By investigating similar and contrasting cases, the researchers have the opportunity to better understand the findings than if they came from a single case (ibid).

Miles and Huberman (1994) continue by explaining how the multiple-cases make it possible to specify how, where, and sometimes also, why a certain phenomena has a specific behavior. They conclude that multiple-case sampling also adds to the validity, precision and the stability of the findings. In this thesis, we have chosen to conduct a multiple-case study with three organizations being studied. This enables us to compare the results from each case in a cross-case analysis. Using a multiple-case study it can also make our findings more robust and possible make it easier to detect possible similarities and/or differences. How the case study is utilized is presented in the next section.

4.4 Data collection method

According to Yin (1994), there are six available forms for collecting qualitative empirical data, or as he refers to them as sources of evidence. These six sources of evidence are as documentation, archival records, interviews, direct observations, participant observation and physical artifacts. A major strength of case study data collection is the opportunity to use several different sources of evidence (ibid). By using multiple sources, “triangulation”, allows the researcher to obtain multiple measures of the same phenomenon, which can contribute to the validity factor of the thesis (ibid). Lundahl and Skärvad (1992) claim that the collected data can further be grouped into primary data or secondary data.

In TABLE 4.2 Yin (1994) describes how each data collection method has its own unique set of strengths and weaknesses.

TABLE 4.2. Six sources of evidence: Strengths and Weaknesses

Sources of evidence	Strengths	Weaknesses
Documentation	<ul style="list-style-type: none"> · Stable – can be reviewed repeatedly · Unobtrusive – not created as a result of the case study · Exact – contains exact names, references and details of an event · Broad coverage – long span of time, many events, and many settings 	<ul style="list-style-type: none"> · Retrievability – can be low · Biased selectivity, if collection is incomplete · Reporting bias – reflects (unknown) bias of author · Access – may be deliberately blocked
Archival records	<ul style="list-style-type: none"> · (Same as above for documentation) · Precise and quantitative 	<ul style="list-style-type: none"> · (Same as above for documentation) · Accessibility due to privacy reasons
Interviews	<ul style="list-style-type: none"> · Targeted – focuses directly on case study topic · Insightful – provides perceived causal inferences 	<ul style="list-style-type: none"> · Bias due to poorly constructed questions · Response bias · Inaccuracies due to poor recall · Reflexivity – interviewee gives what interviewer wants to hear
Direct observations	<ul style="list-style-type: none"> · Reality – covers events in real time · Contextual – covers context of events 	<ul style="list-style-type: none"> · Time consuming · Selectivity – unless broad coverage · Reflexivity – event may proceed differently because it is being observed · Cost - hours needed by human observers
Participant observation	<ul style="list-style-type: none"> · (Same as above for direct observation) · Insightful into interpersonal behavior and motives 	<ul style="list-style-type: none"> · (Same as above for direct observations) · Bias due to investigator's manipulation of events
Physical artifacts	<ul style="list-style-type: none"> · Insightful into cultural features · Insightful into technical operations 	<ul style="list-style-type: none"> · Selectivity · Availability

Source: Yin, 1994, p.80

When collecting primary data the researcher has a specific purpose to carry it out, whereas others that collect secondary data, does it for a different purpose. In this research, we have collected primary data through interviews and questionnaires. We have also collected secondary data in terms of documentation, by gathering information from each company's website. This complementary information was mainly intended for describing the companies' backgrounds.

Interviews as a collection method are one of the most significant sources for obtaining case study information (Yin, 1994). A further clarification is made where the positive aspects with the interview is stated to be its "targeting" possibilities. What the interview does is that it concentrates directly on the case study topic. It is also "insightful" because it gives perceived causal conclusions. These positive aspects discussed by the author are the reasons for why we have chosen the interview as a method of collecting data (ibid).

In order to collect primary data, Patel and Davidson (1994) together with Eriksson and Wiederheim-Paul (1997) mention two different types of interviews: personal interviews and telephone interviews. The advantages with personal interviews over

telephone interviews are that personal interviews give the interviewer the confidence of face-to-face interaction with the respondents (Eriksson and Wiederheim-Paul, 1997). This can have the affect that questions of more complicated nature can be asked (ibid). We have chosen to do personal interviews both since the geographical distance was limited. All of our qualified respondents were found at the local offices in Luleå.

Case study interviews can take according to Yin (1994), the form of being open-ended, focused, or structured. In an open-ended interview, the key respondents are asked for facts of a matter as well as for their opinions. In a focused interview, the respondent is interviewed for a short period. The focused interview may remain open-ended, but you are more likely to follow a certain set of questions derived from the case study protocol. Finally, the author maintains that the third type of interview, which is more structured, along the lines of a formal survey. The focused interview became our selection since we wanted to state a certain set of questions that needed to be answered in order to obtain data related to our research questions. The interviews also had to be open-ended to some extent because we wanted to preserve the flexibility of the interview with the opportunity of probing. To support the interviews we also used a limited number of questionnaires based on a structured set of questions.

We constructed an interview guide can be reviewed in APPENDIX A and B (English and Swedish version). In accordance to Holme and Solvang (1991) the interview guide was constructed in order to obtain answers on our set of questions. The same interview guide was used during all the interviews. We used three interviews, one with each office director. Before conducting the interviews, we first contacted the company to see who had the most knowledge of our topic. Then we contact the person and ask if we could book a time for an interview. We then sent email, a letter with a presentation of the subjects that we were going to discuss during the interview, so that the respondent would be able to prepare himself. The interview guide functioned as a support tool during our interviews that were all made in a conversational manner. During the interviews, we let the respondent talk freely with the interview guide as a base. The interview is also conducted in a relatively short time, approximately 45 minutes and all in Swedish.

We have used a tape recorder in order to register the empirical data more accurately. This is also strongly favored by Yin (1994) who continues to say that this gives the researcher the possibility to go back and double check the received data. The respondents were aware of the use of a tape recorder and had no objections. In addition to the tape recorder, both of us took notes during the interviews. We had different key roles conducting the interviews. One of us responsible for asking questions the other one making sure that no questions accordingly the interview guide were forgotten. This person was also focusing on taking notes in case the tape recorder would fail. We followed our interview guide, but at times when questions were opening a deeper level to the questions in our interview guide we persecuted those opportunities.

Together with the interviews, we also collected primary data by using five questionnaires at each company. The questionnaire can be constructed in a combination of grading scales, multiple choices and open-ended questions (Yin,

1994). We provided a brief explanation to the concept of Knowledge Management in the beginning of the questionnaire. This was made to prevent unnecessary confusion for the respondent concerning the topic. We constructed a questionnaire that had the similar set of questions asked in the interview guide. Still, we tried to make the questionnaire more structured, with just a few open-ended questions. The choice fell therefore on the use grading scales and multiple alternatives. This would make it somewhat possible to compare and verify data collected from each company. The constructed questionnaire was made in two versions, English and Swedish. They can both be found in APPENDIX C and D. As we now have described the data collection method used in this study, the following section will present the sample selection.

4.5 Sample selection

According to Miles and Huberman (1994), looking at contrasting cases can help understand a single-case finding, by specifying “how” and “where” carries on as it does. The authors continues by stating that if a finding holds in one setting and given its profile, also holds in a comparable setting the finding is more robust. Miles and Huberman (1994) further say that although contrasting cases are used, a sampling frame is needed, guided by the research questions and the conceptual framework. When selecting our sample, we therefore set the sampling frame to companies that use KM in virtual teams.

Regarding how many cases a multiple-case study should consist of, Miles and Huberman (1994) state that it depends on how rich and complex the within-case sampling is. Our research questions and conceptualization provided us with rather high complexity for each case. In order to focus effectively and to fulfil the exploratory, descriptive and, to some extent, explanatory purpose of the research, we decided to include three companies in our sample. In order to find appropriate companies we used the yellow pages, and limited our search to cover large companies in the region of Norrbotten due to the geographically closeness to the university.

Our search for participating companies was focused to organization that had to be dependent on their knowledge skills. Our choices fell therefore on three multi-international accountant and consultant companies with local offices based in Luleå. Hopefully this could develop new and interesting views upon how patterns of similarities and differences looked like in accordance to our stated research questions. The companies that we selected are PriceWaterhouseCoopers, KPMG and Deloitte and Touche. Our intentions were to also include a fourth company but due to their busy schedule and stressed up workload they had to pass this opportunity.

When conducting our questionnaire the choices depended on the fact that the companies had employees that was involved or had been active in virtual teams. The procedure of selecting people for taking part of our questionnaire was based on random sampling. This meant that we lost some control over how well informed our respondents were in the issues asked and at the time whether to which extent they had been involved in virtual teams. Of course, there was also a need to get these people willing to share their knowledge of this specific topic with us by answering our questions.

To make it easy for the respondent to provide us with answers through the questionnaire we used the Swedish version. The questionnaire was first pre-tested on a testgroup that gave us some valuable insights. We re-wrote a few questions and added the brief introduction before presenting it to our second testgroup. We hoped to get tips that are more objective by using a new testgroup. Since these people did not know anything what we had in mind before showing it to them. This, the second time we had no problems of understanding from none of our test-respondents. Since there was no need for additional questions from the testgroup, we went on using the verified version of the questionnaire to gather data. For the interviews, the choice of respondent was influenced by the fact that the companies had a well-informed person on a managerial position. This made our answers more solid since we got them from the top management of each company. Moreover, normally they are the ones that implement KM processes in the organizations. This could also contribute to a more enlighten set of answers in accordance to the more strategic questions.

According to Holme and Solvang (1991), selecting respondents with the right knowledge about the research area is crucial for qualitative research. In all our cases, we followed identical procedures of how respondents were chosen. As we now have clarified how the sample of this study was selected, we will in the next section discuss the data analysis.

4.6 Data analysis

Data analysis involves examining, categorizing, tabulating or otherwise recombining the collected data. Every investigation should have a general analytical strategy in order to determine what to analyze and why. Two general strategies are suggested. The researcher can either follow the theoretical propositions that led to the case study or develop a descriptive framework to organize the case study. (Yin, 1994) When analyzing the data collected from the interviews, the intentions were to find answers connecting to the earlier stated research questions. This research presents a multiple-case study, and therefore, the comparisons will be conducted within the different cases as well as between the cases, in a cross-case analysis.

Miles and Huberman (1994) state that a qualitative data analysis focuses on data in the form of words. The data analysis is believed to consist of “three concurrent flows of activity” (p. 10):

1. *Data reduction*: The process of selecting, focusing, simplifying, abstracting, and transforming the data. The purpose is to organise the data so that final conclusions can be drawn and verified.
2. *Data display*: Taking the reduced data and displaying it in an organised, compressed way so that conclusions can be more easily drawn.
3. *Conclusion drawing/verification*: Deciding what things mean – noting regularities, patterns, explanations, possible configurations, causal flows, and propositions.

As we analyzed the research data, we stuck to the points lifted out by Miles and Huberman (1994). For each research question, we also made a data comparison

through a within-case analysis, which made it possible to reduce the amount of data. To do our systematic analysis we have turned to Holme and Solvang (1991) and their recommendation in on how to do it. Beginning with the within-case analysis and followed by the cross-case analysis. The within-case analysis was conducted by comparing our empirical findings with theories used in our frame of reference. Thereafter we displayed the reduced data in a cross-case analysis, also according to each research question. What the cross-case does is that it allows data to be compared within the selection of the chosen companies. Organized and compressed ways of comparing our samples motivated the way discussions evolved regarding the existing differences and similarities. When we finally completed the within-case and cross-case analysis, our findings and conclusions of the research were drawn. To do this each research question was re-stated and answered based on the findings of our study. As we now have described how the data was analyzed, the following section will present how we have handled the reliability and validity issues in this thesis.

4.7 Issues regarding validity and reliability

In this section, we present methods for how we can measure our research. To establish what sort of reliance and quality the research study is entitled to Yin (1994) propose four commonly used testing methods. These testing methods could be described as construct validity, internal validity, external validity and reliability.

- *Internal validity* - establishes a causal relationship in which certain conditions are shown to lead to other conditions, as distinguished from fake relationships
- *External validity* - establishes the domain to which a study's findings can be generalized.
- *Construct validity* - establishes a correct operational measure for the concepts being studied.
- *Reliability* - demonstrating that the procedures of a study such as the data collection, can be repeated by others with the same results.

Internal validity only applies for explanatory or causal studies, and not for descriptive or exploratory studies. Since our study is exploratory and to some extent descriptive we will be reviewing all four testing methods.

4.7.1 Validity

According to Eriksson and Wiederheim-Paul (1997), validity is the most important requirement on a measurement instrument. Three sorts of validity need to be considered (Forsberg, 2002; Yin, 1994). We have to decide if our method of collecting data gave us the information that we were looking for. In this case we have to consider the construct validity through asking an outsider well known with the complex of problems about his/her opinions. We talked to our supervisor about the research area and how we tended to collect data. This leads us into the area of *internal validity*, which is used for establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from false relationships. Pattern matching is a way of affecting the internal validity. Comparing collected data with conceptualized literature to find patterns, does this. This is mostly applicable during conclusion drawing. (Yin, 1994)

Second, we have to secure the criterion validity, by comparing our data with other investigations made of others or simultaneous measurements with another methodology. We have a qualitative direction, which makes it difficult to measure the simultaneous validity. Yet, Eriksson and Wiederheim-Paul (1997) mention that with the help of *external validity*, dealing with the establishment of the domain on to which a study's findings can be generalized. Yin (1994) propose ways to increase the external validity, which emphasises the importance of using replication logic in multiple-case studies. Theories must be tested through replication of the findings in similar surroundings meaning that a specified theory has to come up with the same result (ibid). Once a replication is made, it provides the findings to be generalized to a greater number of surroundings (Yin, 1994; Eriksson and Wiederheim-Paul, 1997). To reach our findings we have tested the relevant theories in three different cases. The external validity problem has according to Yin (1994) been a major barrier in doing case studies.

Third, we have to look at our *construct validity* (Yin, 1994). Construct validity means that we have to see if our related idea corresponds with our measurements. However, it is hard to get construct validity because our research is a qualitative one. Construct validity includes the establishment of correct operational measures for the concepts being studied. Yin (1994) writes that there are three tactics available in order to increase construct validity.

- Use multiple sources (when collecting evidence during data collection)
- Establish a chain of evidence (during data collection)
- Construct a case study report (to be reviewed by the key-informants)

The choices of using interviews, documentation and questionnaires were made to increase the validity in this thesis. In relation to the construct validity of this study, we used "triangulation", which according to Yin (1994) justifies the use of multiple sources. We used both documentation techniques and interviews. To strengthen the validity even more we talked over the phone making sure that the respondents for the interviews were targeted right. This was also done to make it clear what this study was all about, minimizing misunderstandings. The validity was also increased due to that we will made contact with people that were involved in the KM processes of being in a managerial position. What further affected our validity was the respondents degree of openness and participation during the interviews and their willingness to share there knowledge.

The same interview guide was used in all our interviews. Furthermore, the collected data have been organized into separate sections were each of the companies are presented. We have tried to put the structure of the thesis in an easy way for other researchers or other readers can retrieve any desired material. It should also be told that all interviews were conducted in Swedish and thereafter translated to English. This automatically includes the risk of making translation errors. It was however the most natural way of conducted our interviews. As Yin (1994) brings up it is always risk that personal biases might interfere the interviews however cautious one tries to be. We must therefore bear in mind that, the influence of the respondents as well as our own attitudes and values can always be questioned.

4.7.2 Reliability

A measure is considered reliable if a person's score on the same test given twice is similar (Holme and Solvang, 1997). It is important to remember that reliability is not measured it is estimated (Yin, 1994). There are two ways that reliability is usually estimated, test/retest and internal consistency. Test/retest is the more conservative method to estimate reliability. Simply put, the idea behind test/retest is that you should get the same result on test 1 as you do on test 2. The three main components to this method are as follows (Yin, 1994):

- Implement your measurement instrument at two separate times for each subject
- Compute the correlation between the two separate measurements
- Assume there is no change in the underlying condition or trait you are trying to measure between test 1 and test 2

Internal consistency estimates reliability by grouping questions in a questionnaire that measure the same concept. For example, you could write two sets of three questions that measure the same concept and after collecting the responses, run a correlation between those two groups of three questions to determine if your instrument is reliably measuring that concept. The primary difference between test/retest and internal consistency estimates of reliability is that test/retest involves two administrations of the measurement instrument, whereas the internal consistency method involves only one administration of that instrument. (Yin, 1994)

Regarding the test/re-test issue, we measured our responding companies with the use of interviews and questionnaires, which were intended so seek out patterns of correlation. Yet only one interview per company was made. To improve our reliability, we made the interviews with the office director in all three cases. This way the reliability in testing against each other hoped to increase. Since we had a minimum of control over who took part in the questionnaires we could suffer in reliability. We used of random sampling within a certain population, in this case employees of a specific company. Furtheron they had all the common criteria that they had participated in virtual teams. This we did to secure a high reliability factor still without having controll over who provided us with the answers.

To increase the reliability in our study, we also took notes during the interviews. This notes were both answers and reflections that came from the respondents. To increase the reliability even more, we used a tape recorder and taped the interviews. By taking these measurements, we want to try to minimise the probability of misunderstanding and the risk of letting out something vital. Another thing that was done to increase the reliability was to avoid asking leading questions or commenting the answers from the participants. One thing that cannot be avoided and could affect the reliability was personal chemistry and personal interaction.

We now turn to the next chapter, which will present the empirical data that has been collected for this research.

5 DATA PRESENTATION

In this chapter, we will present the empirical data collected from the three companies involved in this study. Each company will be presented one by one. The presentation is divided into sections, where we begin each one with an introduction to the company. We move on by presenting the collected data. This will be done in the same order as our stated research questions are posed, conceptualized and the literature is reviewed. In the data presentation both our interviews and questionnaires are sewn together to form a complete image of what the specific company expressed about the subject.

5.1 Deloitte and Touche

Deloitte and Touch was founded in 1989 when 40 smaller accounting and consulting agencies merged into one company. Today, Deloitte and Touch has over 100 000 employees in 140 countries in the world. In Sweden, the company has 1200 employees and 15 of them work at the Luleå office. They are operating mainly as in accounting services for middle-sized and smaller companies in Norrbotten. Our respondent at Deloitte and Touche were Karl-Åke Larsson. He was until very recent the head of business operations at the lokal office in Luleå. Since he is considered the most experienced high ranked individual to deal with issues regarding organizational knowledge he became our respondent at Deloitte and Touche.

5.1.1 How is knowledge managed in virtual teams?

Accessible data that can be transferred to knowledge is the core business activity. This is what customers pay for and why Deloitte and Touche is an attractive consultant. Approximately 80-90 percent of the daily work for the accountants is made up by converting data into usable and easy to understand information. Larsson points out that being an accountant manager is automatically connected to a certain amount of knowledge. This knowledge often shifts in the way it is used and this relates to how different individuals use their intellectual capabilities. Still internal communication has shifted a bit to become more and electronic with the increased use of email.

According to Larsson, it is a lot of information in circulation. A way of keep up to date with what is work related news is by keeping weekly meetings where issues interesting for the whole company is brought up. Besides these meetings on regular basis, there is an contributing atmosphere among the employees that makes it easy to share information. This is done on more casual informal meetings or interactions during office hours, coffee brakes can sometimes give many new insightful tips. When ranking the alternatives in the questionnaire, informal meetings were considered the foremost important way of sharing knowledge with others. E-mail was also considered high in use in the sharing processes. The local office is shaped as an open landscape where it is very easy to communicate with each other.

Deloitte and Touche has formal internal education programs to ensure the individual development. During the first ten years of employment there are approximately 60-80 hours per year. There is a minimum of 40 hours per year and Larsson continues that if

an employee wishes to participate in a program they have not ever been denied yet. At the same time there are different programs for different employees depending on their work. Each customer are served by a small team of employees that work on several cases during the same time-period. Composition of the teams relies upon how the most experienced employees put together the needed intellectual assets. Any previous interaction with the specific customer is of course also favoring when putting the team together. At Deloitte and Touche, it is usual that the teams have involving roles such as commission manager, inspector and assistant. Normally no more than 2-3 employees take part of the teams.

Regarding the the KM tools, Deloitte and Touche has developed an application called "Deloitte Kontoret Online" and works as a virtual meeting place for customers to take part of the work as well as relevant information. This tool has been made internally by the office in Östersund and will be implemented globally under the name "CBC- Core Business Communicator". The Intranet is based on Lotus Notes, which is used also globally. Employees have a great source of information in the Intranet. Most of it is of a more general status concerning in their work and not specific information regarding different tasks and offices. Employees are however not expected to read and study everything, but rather use it as a resource and explore it when needed. The customers receive reports and this is a great way for knowledge storage. Databases functions as a great asset according to Larsson for retrieval and regeneration of knowledge. Within the company, there is a belief that better accessibility might improve the amount of work conducted virtually. The usability factor is also high.

The company describes themselves to be not entirely dependent on ICTs and KM tools for knowledge sharing taking place in teams working on virtual basis. In all the work that goes on the face-to-face communication is the key factor above all. This means a existing combination of ICTs and face-to-face communication is inevitably. Larsson brings up the usage of send-lists as a very common way for quick distribution of information in the organization. There are however a large quantity of the information that does not have any direct connection to employees at the office.

5.1.2 How can the KM strategy in virtual teams be described?

Deloitte and Touche are aware that being a knowledge intensive company means that the intellectual assets reflect the company image. They have put efforts in having continuous evaluation of working routines in order to provide top quality services. This is done however most of the time on informal basis. Helping one another is natural within the company. Larsson brings up the working climate and the corporate culture as important factors for this.

Strategies to keep knowledge at a competitive level are according to Larsson made through educational programs. There are both internal courses employees can take and from time to time external ones. During education, it is normal to have intensive courses for a day or two, sometimes a week, so that the workflow is not disturbed. The overall view regarding education is positive. Larsson explains that in time the company gets back what was initially paid. It is considered an investment for the future, not a cost. Deloitte and Touche believe themselves to become more attractive as a partner for potential customers by acting in this proactive way.

There are learning paths for each role within the company. This makes it easier when employees propose a program or course because he more or less knows in advance what type of education different employees might suggest. How to develop individual skills in a specific area by creating "knowledge peaks" is a key topic and discussed during personal meetings with employees. Another way to generate and transfer new knowledge is made by having the senior employees work as mentors for newcomers and less experienced employees.

To make sure that knowledge is not static within the teams there is a limit of a certain number of cases that are made by a specific team. Thereafter knowledge and individuals circulates so that fresh knowledge and new perspectives are put in the teams. Within Deloitte and Touche there is no explicit plan how to handle these activities. Instead, common practices that the best employees suited for a given task are the ones forming the teams. Since it, also a question of money for the customer it is important to make a proper evaluation of how much resources needed.

Sharing information is vital and has increased in importance since companies are faced with more information than ever. Larsson mentioned the "information overflow" as a risk for inefficiency in work processes. The meeting held on weekly basis is great opportunities to bring up new insights or facts. It is of strategic importance that information is shared, whereas formal meetings are just one way to do this. Intranet, reports, databases and mail are other ways for distributing information.

Throughout the company it is shared view that education program is strongly contributing to keep a high overall standard. This is also something that employees on regular basis demand to get. It is important that they as individuals find themselves develop through new learning, new tasks and job rotation. Work roles are shifting as time goes by and by having the opportunity to influence how to develop stimulates working processes. In the questionnaire it was brought up that GEM (Global Excellence Model) is used as navigating tool for employee feedback and development.

With today's technology, our work can be done much more efficient than in the past. There was a revolution ten years ago when computers made the work take radical changes. Not as many hours and human resources is spent on each case today. This made it cheaper for customers and suddenly after just a couple of years; the fees had decreased with approximately 50%, so the number of competitors. Many suddenly disappeared as Larsson remembers it. To be able to work on distance and send documents to each other Deloitte and Touche have implemented a system called "AS2". This system is used for reporting purposes and since all employees in the global organization is using the same system; virtual working is made much easier.

5.1.3 How can the Critical Success Factors of KM in virtual teams be described?

Both Larsson and the answers in the questionnaires favored communication, together with professional behavior, knowledge/experiences and previously teamwork as most important factors for virtual work According to the questionnaire regarding how employees distinguish benefits from working in virtual teams there was strong favors for increased efficiency together with lowered costs. There is a belief that working in virtual teams is limited due to the line of work. Technology is not limiting the work

for working in virtual teams. It is rather so that face-to-face communication is essential for as business is conducted today, at least towards customers. Tools such as "AS2" have the opportunity to increase interaction with external partners but in the end, the company is very dependent on its personal communication skills. A unanimous view at the local office that face-to-face interaction is irreplaceable gave answers that the amount of virtual work would not change particularly in the future.

So far, most of the time working in virtual teams has proceeded smoothly without any problems or failures. However, there were some indications from the questionnaires that communication problem had occurred. According to Larsson, trust is something that is fundamental for working together. It can therefore not be considered as a factor that is comparable with things as communication, experiences and professional behavior. It lies in the nature of work that you rely on your co-workers otherwise business will fail and the company goes bankruptcy. Having access to your work is made easier with today's technology and contributes to better communication within the teams. Broadband and fast connection is also making it easier for virtual interactions. Besides quick access when transferring documents, the usage of cellular phones has made availability a commodity. Larsson mentions that being able to reach other team members is gives confidence and security to the team.

If there is a security breakdown in the Intranet and mail servers, there might be risks for massive disturbance in the internal communication. This is why it is high priority that the technology is both up-to-date and well looked after. Security and trust aspects are mentioned as important for virtual teams to work. Trust must be established before employees leave each other at the office, but being employed also ensures a certain amount of knowledge. This means that if there is specialist within a certain area expertise at one office it automatically establishes trusts in the interaction. Larsson mentions that working with ICTs such as email the usage of language has suffer. Nowadays it is mostly made up chunks of words these are however easily understood internally when all employees has adopted this technique of writing emails. This could however also be viewed as a risk as Larsson put it. Deloitte and Touche has intentions to keep interactions with the outside world in professional manner so that no part get confused or irritated.

Larsson also brought up the importance of a dynamic organizational culture since it has very influencing effect on the degree employees performance tasks. If employees perform well as individuals, the company performs well and customers come back. The organizational culture makes daily procedures together with teamwork efforts be executed in a smooth way. Employees know the routines and can work efficiently on their own with essential interaction whenever necessary throughout different communication channels. The fact that Deloitte and Touche do not have an explicit strategy for knowledge distribution is not critical according to them as this is taken care of on natural basis through cultural aspects. The success of virtual teams is based on the employees' capability to cooperate. In addition, the way senior employees can bring together required knowledge is also highly relevant for its success.

5.2 KPMG

KPMG was formed in 1987 with the merger of Peat Marwick International (PMI) and Klynveld Main Goerdeler (KMG) and their individual member firms. Today KPMG has over 100 000 employees in 152 countries in the world. The company offer services in accounting, management, taxes, risk management and advisory services. In Sweden, the company emerged from the accounting company of Bohlins. Since 1990, the two companies have started an extensive cooperation, which led to the emergence under the name of KPMG. Today, the Swedish part of the company has 1800 employees in 80 offices around the country, and 15 of them work at the Luleå office. They are operating mainly as in accounting services for middle-sized and smaller companies in Norrbotten. For this study, we interviewed the office director Hans Öystilä. He has been in charge since 1999 but has worked for KPMG in Luleå since 1986. His responsibility stretches from marketing efforts and external contacts to budget responsibility and employee issues.

5.2.1 How is knowledge managed in virtual teams?

KPMG realize the value of knowledge and learning among the employees. As Öystilä explains that since the company is a knowledge intensive corporation, they are continuously developing their knowledge and skills. Öystilä claims that this development is necessary to be able to better serve the customers and stay in business. According to Öystilä, KPMG encourage employees to share their knowledge and experiences with other in the organization. This is done mainly through formal meetings once a month, and through informal meetings between the co-workers during the working hours. Öystilä explains that the KPMG has pre-requisites on the level of knowledge that the employees must have to be able to conduct a certain task.

KPMG also describes that the most important factors in participating in a virtual team is the level of knowledge in that specific area, former experiences and communication skills. The company also mentions that younger employees always learn from senior employees. On the other hand, there are no explicit plans for such activities, but is rather a common practice in the company. Öystilä describes that the level of knowledge sharing in virtual teams are not dependent entirely on ICTs, but rather on a combination of using the ICTs and face-to-face communication. Another important aspect in the knowledge sharing process is the knowledge background. This is shown in the questionnaire answers from the employees at KPMG. They preferred to work with someone that has a similar knowledge background as them.

Öystilä describes the combination of new knowledge from young employees and experienced senior employees as a good mix when working with a project. He also mentions the tools used by the virtual teams. KPMG uses reports and databases to store the results from different projects. They also use e-mails and telephones a lot in their interaction. Öystilä adds that the usage of e-mail and databases are increasing in the company. The results from the questionnaire also show that the employees like the ICTs, but miss the fact of not having a “face” when interacting in front of them. Öystilä mentions that they miss an important aspect in the usage of ICTs. He wishes that they could interact wirelessly from anywhere, without being dependent on having to look up for an Internet access. Another mentioned aspect was the importance of speed level of the Internet access.

KPMG mentioned databases as a mean to store reports, results and other outcomes from the different finished projects. They use a set of different softwares; one of them an in-house software developed together with SPCS is used to make important data more accessible. If an employee needs a certain type of knowledge, he/she could then download it. The software also creates opportunities to create new contacts and find specialists in areas of work and expertise.

Öystilä adds that when forming teams, the different roles in the team are set by the senior managers. He mentions that a team could have roles like a commission manager, an inspector and assistants. The team often consists of these roles and the roles are set on premises such as experience and former interaction. Öystilä says that all the participants in a team could do several tasks.

5.2.2 How can the KM strategy in virtual teams be described?

KPMG are aware that they are a knowledge intensive company and that they have to stay ahead to be able to compete with others and stay in business. Öystilä talks about the knowledge obtained in the company and the different strategies that they use to encourage and develop the employees' knowledge. He mentions the mentor program that they have. It is not a formal program but rather an informal that they have had. He says that it is more in the culture of the company that every new employee has a mentor. On the other hand, senior employees have their own set of planned courses and individual plans. The objective is to strengthen the competence in an interesting area or an area that is necessary for a specific and continuing role at KPMG.

KPMG tries to share as much information as possible within the organization. Öystilä explains that when someone have come up with something new, he/she shares it with the others on the monthly meetings that KPMG has. The knowledge is also shared partly through databases that everyone in the company has access to. The degree of sharing knowledge through databases is dependent on the amount of time reserved to upload such information to the database. If the company lack of competence at a local level, they acquire it through the national network of offices. Öystilä says that when they need a specialist they look first in their network of contacts, and then into the whole organization.

Öystilä can see some benefits from using a given strategy in KM in virtual teams. He claims that the employees and management sees a clear path or plan of how the individual employee could develop his/her knowledge and experiences. The answers from the questionnaire stated that employees know the benefits for themselves and thought that it was a good idea. Another issue that is brought up in the questionnaire by the employees is the demand from company management on continuous knowledge learning. KPMG has a clear goal that the employees have to develop their knowledge and stay up to date. The employees realize the benefits from such demands for their own development, and for the fulfillment of the tasks.

KPMG sees the learning process with a combination of both experiences and knowledge. For the Luleå office, Öystilä explains that they are aware of what kind of competencies that are needed. Sometime, he says, they need some specialists. These specialists are brought in from the rest of the national organization of KPMG. Öystilä mentions the period when KPMG shifted to use the ICTs as a part of the daily work.

Some of the older employees could not keep up with the new technology and just stepped down for younger employees to take place. This change towards ICTs was, according to Öystilä necessary. KPMG realized the benefits of ICTs for the organization. This was mainly in the possibility to share knowledge in the organization through databases and to be able to contact others in KPMG. It also created a possibility to offer a wide range of services due to the awareness of the potential of the company.

5.2.3 How can the Critical Success Factors of KM in virtual teams be described?

The results of the questionnaire from KPMG showed that the employees could distinguish several benefits from working in virtual teams. They mentioned increased efficiency and lower costs. Öystilä believed that working virtually would increase if they were not limited by the technology. They also mentioned some problems due to working virtually in a team. These problems were related to communication. Öystilä mentions that aspects like good personal relation, often built through face-to-face communication are vital for working in a team.

According to Öystilä, the employees have a high degree of trust in other employees in the organization. He claims that an earlier experience from working together affects the choice of team members working with others. The results from the questionnaire also showed that the employees has a high trust level, but misses things like the face-to-face interaction and social interaction. Öystilä brought up another issue that affected the ability to work effectively in a virtual team. He mentioned communication as a vital part of succeeding in a virtual team. Öystilä said that in order to have access to other employees being able for instant communication, the employees are often available through mobile phones. This has opened a new channel of communication according to Öystilä. Öystilä is sometimes disturbed about the slow transfer rates and complains about how this affects the communication extent through the ICTs. He would like to see a faster access to information, perhaps through other new ICTs like mobile platforms.

KPMG has experienced increased traffic of non-work related e-mails and messages during the last few years. The nature of these messages is more on promoting products or services. Öystilä says that he decides what messages of this nature allowed in to the office. He argues that these messages are taking the focus of work. Another phenomena occurring with ICTs are the tendency of simplifying the language and thereby creating a risk of misunderstanding or being blurry. These misunderstandings could, according to Öystilä be about the nature of a given task or what the other person means if the people involved has different degree of experience or knowledge base. The essence of communication was extracted from the questionnaire too. These answers showed the employees would like to work with people that have a high communication level and social skills. Another issue that the respondents of the questionnaire showed was the desire to work with someone of the same cultural background.

Öystilä talks about how company culture and the experience of working in an organization affect the degree of performance. He mentions how younger employees have some difficulties in understanding what senior employees want in the outcome of a given task. He says that company routines and ways of working at KPMG at

thought to the younger employees by the senior employees. This was also confirmed by the questionnaire answers. Öystilä finishes by talking about the success of a virtual team. He says that some guidelines are required and believes that issues like support from management, proper technology usage and experiences from senior employees lays the foundations for a successful virtual team.

5.3 Öhrlings PriceWaterhouseCoopers

PriceWaterhouseCoopers was founded in 1998 when Price Waterhouse and Coopers & Lybrand merged into PricewaterhouseCoopers. PriceWaterhouseCoopers has over 125 000 employees in 142 countries in the world. The company offer services in accounting, risk management, consulting advisory, taxes and human resource consulting. In Sweden, the company operates under the brand of Öhrlings PriceWaterhouseCoopers (ÖPwC) after an acquisition of Öhrlings AB. Today, ÖPwC has over 3000 employees in 130 locations in Sweden, and 27 of them work at the Luleå office. They are operating mainly in accounting services, tax issues and management consulting for middle-sized and smaller companies in Norrbotten. For this study, we interviewed the office director Tommy Enstedt. He has been in charge for the last two years for the Luleå office, but has worked 6 years before at KPMG in Luleå. His responsibility stretches from marketing efforts and external contacts to budget responsibility and employee issues.

5.3.1 How is knowledge managed in virtual teams?

Enstedt explains the importance of knowledge for ÖPwC. He says that every employee carries a lot of knowledge and experience that the company has to be aware of in order to take advantages. He mentions that ÖPwC acquire and take in new knowledge through their openness, which is based on their open organization. He continues to say that the company interacts and encourages interaction with people from outside the organization. In this way, the organization gets input and learns new things.

ÖPwC claims that they have group meetings once a month where employees share some particular knowledge or experiences with others in the organization. This knowledge is also shared through databases. ÖPwC has a large amount of databases and has an extensive amount of information in them. Part of the results from finished tasks could be stored in these databases. Enstedt also points out that the knowledge and experiences of each member of the team are vital. Therefore, ÖPwC only recruit people with desired knowledge and experience. Another important issue in recruiting is that the individual have a broad and wide range of other skills in various areas. The company points out the process of which younger employees learn from the more experienced ones, often the senior employees in the organization.

Enstedt explains that when working in a virtual team, there are a number of different pre-requisite are necessary to fulfill. Beside knowledge in that particular area, also issues like willingness to cooperate and social skills are important. When working in a virtual team, people tend often to learn from the older, more experienced members. At ÖPwC, the company believes it is in its own good, to share knowledge with others and discuss with other employees. This sharing of knowledge beyond borders has

made the employees much more open to other people from outside. This is shown in the questionnaire where ÖPwC respondents stated what was most important in working in a virtual team. They stated that level of knowledge and experiences as most vital.

ÖPwC uses some of the ICTs and KM tools in the daily work. The use of KM tools such as reports, databases and Intranet is rather active together with the usage of ICTs. These ICTs contains of e-mail, video conferencing, telephone. The company uses the databases in a large amount. Enstedt complains that the databases are creating problems due to the lack of a logical search function. Now, they are building up a new database to keep track on the other databases and to monitor the daily work and other events at the office. This new database is still under construction. Enstedt claims that the problems with not finding the wanted information are causing a higher level of stress among the employees. Another problem is that when employees are not happy with this way of working, soon they will abandon the databases and the rate of usage will drop.

The company monitors all the databases, results and e-mail traffic through a software called LotusNotes. Enstedt is very happy to use this software and thinks it is very good since it makes work easier and more accessible. One problem that he referred to with LotusNotes was the large amount of databases. Through Lotus Notes, they can contact someone else in the organization if they need anyone with some knowledge about a certain area or topic.

Enstedt ends up by taking about the roles in a virtual team. They often assign a head accountant, who chooses the team members (as they call them, assistants), depending on the size of the mission. The teams are built mainly on former missions together and if the customers have wishes, of whom they want to work with. These roles could shift in different teams depending on the degree of knowledge and experience. The members of a virtual team could consist of multiple function individuals.

5.3.2 How can the KM strategy in virtual teams be described?

For ÖPwC, strategies in attaining knowledge and keep it in-house are vital. According to Enstedt, the company has a pre-worked plan with the “Coach program”. This program is introduced to new and younger employees at ÖPwC. It contains of a “coach” often a senior employee, and the new employee. This system is working well. Once a year, they have an evaluation meeting where they summarize the last year. Often it is the development of the new employee that is brought up. He says that this system is similar to how they work when they evaluate the result from a virtual team effort. The results are analyzed by the mission accountant and thereafter presented to the rest. These results are often stored in databases and reports.

ÖPwC proclaims an open organization, which means that virtual team member are allowed o discuss issues and ideas with outsiders and people from other organizations. Enstedt thinks it is a strength to be able to bring in ideas to the team all the time. The company has a wide range of specialists that the whole organization tries to utilize. This is a practical solution when the virtual teams have a shortage of time.

The company does not have any given strategies in working in a virtual team, but they are using the experiences of senior employees in this field. ÖPwC are welcoming more working forms like virtual teams. This creates an instant flow of work to employees that just finished a task and are waiting for another one. The company talks about the way they acquire specialists through word-of-mouth. Often, they heard about someone that is good at something, and tries to consult him/her when needed. Otherwise, they compose the virtual team through asking other offices in the organization.

Enstedt talked about the shift to ICTs, and why this occurred. He claims that it was driven by the fact that they lacked of time to share and manage knowledge to others like in a virtual team. The fact that everyone used the same tools and could manage them, offered ÖPwC an opportunity to provide their customers instant access to special knowledge and consultants in the organization.

5.3.3 How can the Critical Success Factors of KM in virtual teams be described?

ÖPwC believes that there are some factors that affect the way and success of a virtual team. According to the questionnaire, the employees felt that working in a virtual team and using the ICTs generated benefits like faster communication, knowledge transfer and a larger network of contacts. They didn't want to increase their efforts in participating in more virtual teams. He believes that there are also some negative effects of virtual teamwork. He mentions aspects like the stress of being online all the time. The results from the questionnaire showed that the employees saw negative effects like absence of social interaction and the difficulties to motivate everyone to use the tools.

Enstedt says that problems related to virtual teams are mostly communication and knowledge issues. He regards face-to-face communication as vital in teamwork, independently if it is a traditional or a virtual team. He continues to talk about trust in a virtual team. Experiences and earlier projects are sometimes determining who will work with whom. The built trust in working together earlier is vital and often an important factor. He argued for the importance of communication in a virtual team. He says that it is even more important to have communication skills and the ability to handle social interaction through ICTs and virtual teams.

According to the questionnaire from ÖPwC, most of the virtual teams fail due to communication problems. The questionnaire answers also showed that a few face-to-face meetings are required often in such form of work. Today, the company uses cellular phones to keep track of the employees and to be able to communicate anytime and anywhere.

The company mentions some issues concerning the level of language usage in ICTs. He says that the tools are limiting the way that people want to be able to express themselves. Therefore, in the last years, he has seen that people tend to try to write a few lines and shorten the messages as much as possible. He believes it is due to time shortage and that it is faster to say it than to write it down. This could lead to some uncertainty about the meaning of the message and create a stress. Enstedt believes that impatient co-workers could be the answer to these phenomena. He also adds that

limitations in the technology could have some responsibility in creating these communication issues.

In a virtual team, with people from different backgrounds, this could create problems in understanding what the other means. He starts to talk about the essentially in understanding other people. The company encourages having an open organization and that ideas could be discussed in virtual teams. This atmosphere of openness has affected the employees at ÖpwC. According to the questionnaire, the employees at the company didn't see culture homogeneity as vital factor in working with someone else. They mentioned other factors like similar knowledge and communication skills as vital when choosing someone to work with. He ends up the interview by mentioning key factors in success of a virtual team like stress level and a development of better KM tools and ICTs.

In the next chapter, we will present the analysis based on our collected data from this chapter.

6 ANALYSIS

In this chapter, the presented data in the previous chapter will be analyzed. First, we will conduct within-case analyses for every case. Here, we will compare the collected data with previous research in the area, followed by a cross-case analysis for each of the research questions. The cross-case analyses will compare the data from the three cases with each other.

6.1 How is knowledge managed in virtual teams?

The analysis of the first research question will be presented under this section. First, we will show the results of the within-case analysis for each case will be presented. Thereafter, follows a cross-case analysis, where comparisons among the three cases are conducted.

6.1.1 Within-case analysis of Deloitte and Touche

The company says that their utilization of the gathered knowledge makes them attractive for customers and employees. This is confirmed by Carneiro (2001), who declares that organizations with better understanding of the process of using knowledge have better chances to achieve their objectives. According to Sanchez (2001), knowledge flows in the organization are depended on the flow of knowledge from individuals through groups and in the end through the organization. This is consistent with the collected data, where Deloitte and Touche explains that they share knowledge through weekly meetings and by creating a sharing atmosphere at work.

Carneiro (2001) and Boisot (1987) bring up another issue concerning knowledge sharing. He talks about how employees have to take part of the knowledge improvements. According to Carneiro (2001), team members learn from each other. The company agrees with the pre-mentioned authors by talking about the way the knowledge is enhanced and shared between the employees. The collected data showed that informal meetings or interactions that are not work-specific often work like knowledge enhancement moments.

The company talked about the essence of having a system that enhances the knowledge level in the team. This is coordinated so that the team members have some common shared knowledge. The investigated company explains this by mentioning the knowledge system of internal education programs with certain content. Carneiro (2001) and Boisot (1987), who say that a group must have some knowledge in common in order to function as a team and to achieve the goals, support this. Carneiro (2001), with support of Boisot (1987) also add that common educational plans are excellent ways to facilitate knowledge in a group or organization. Stenmark (2000) and Boisot (1987) point out that common knowledge on a basic level affects the outcome of the virtual team in a positive way, due to the faster understanding between the team members.

The collected data reviewed that the created environment around the employees enhanced the idea of knowledge sharing and made it easy to communicate. Bhatt

(1998) and (Barney, 1986) support that by saying that individuals must feel the support from the organization and a de-centralized environment to be able to make decisions.

Deloitte and Touche describes the KM tools used by their team members. Liebowitz, (2000) defines these as software programs. They mention the intelligent agents as the software programs that enhance knowledge processes. Deloitte and Touche did not use any intelligent agents and thereby do not support the theories. The company talked about other ICTs too, and mentioned KM tools as Intranet, document management systems, and databases such as Deloitte Kontoret Online. Zeff and Aronson (1999) who mentions e-mails as the most popular tool used in interaction confirm these tools. Kaplan (2002) supports individuals to interact and share knowledge with both team members and the rest of the organization by using databases. Sayed (1998) illustrates the knowledge and learning process through the ICTs and KM tools in the figure below. In this model, the company specific data are listed for each topic and the extent in which each of them are used.

TABLE 6.1: Knowledge facilitation with modern technology - Deloitte and Touche.

Applications or tool \ Activity	Gathering	Organizing	Sense-making	Communication
Videoconference*			√√√	√√√
Teleconference*			√√	√√√√
E-mail*				√√√
Intranet/GroupWare**		√	√√	√√√√
Document Management Systems**				√√
Intelligent agents**				

NOTE! * = ICT ** = KM-tool

Blank = nil; √ = Poor; √√ = Below average; √√√ = Average; √√√√ = Above average; √√√√√ = Excellent.

A hyphenated entry denotes a range implying that the contribution depends on the tacit knowledge of users.

Source: Modified from Sayed, 1998

TABLE 6.1 originally constructed by Sayed (1998), shows the way in which Deloitte and Touche uses the different ICTs and KM tools in their work and activities. According to Syed (1998), these computer-based applications and tools support the activities of gathering, organizing, sense making and communication differently. It seems like the devices are used for expressing and converting tacit knowledge, making it explicit. Focus falls on communicating information through different media. The sense making processes seem to be a bit vague, instead of making sure that the recipient really understands a message, the technology is often just used to inform others. There are unfortunately weaknesses in the way the knowledge is gathered and organized, which according to Syed (1998) has to do with the activities of making knowledge explicit.

The collected data talked about the usage of the Intranet and the large amount of information in it as an advantage for them. Choo, Detlor and Turnbull (2000) confirms, with the support of Nonaka and Takeuchi (1995) by talking about the information space and the need of storing the information. They also confirmed that these provide a diverse variety of knowledge for the users. The company also mentioned the importance of understanding the information available.

Choo, Detlor and Turnbull (2000) confirm this with their presentation of a communication space. The authors mention another factor called the awareness space, which is related to the building of communication and communities. This factor is supported by the company data, that the communication cues are dependent on a combination of both ICTs and face-to-face communication. Stenmark (2001) and Schmelz and Ramsey (1995) take on another factor by mentioning the collaboration space, which deals with the fact of having access to shared norms, project time and knowledge. These aspects are also supported by the collected data when the company is talking about the importance of creation of collaborated values and general status among the employees.

Deloitte and Touche says that role divisions are important in order to achieve the tasks. They say that experiences and earlier knowledge in a given task determines who will get certain roles. This ensures some trust in the different members of the team. The various team roles listed by Scholtes (1995) are to some extent confirmed by the collected data. Scholtes (1995) says that a virtual team could consist of a team leader, which are conformed by the investigated company as the commission manager. In addition, roles like the inspectors and assistants have support from Scholtes (1995). He says that quality advisors and project members are vital roles in the construction of a team. The role divisions that Belbin (1996) describes are not confirmed by the collected data. This is probably because the teams are small, and therefore makes the multiple roles of Belbin (1996) more favorable.

6.1.2 Within-case analysis of KPMG

Carneiro (2001) explains that an organization has to understand the learning and knowledge process in order to act as knowledge based company. KPMG understand the pre-mentioned statement by pointing out the essentiality of developing the knowledge of the employees. Sanchez (2001) and Boisot (1987), with a support from Carneiro (2001) says that the acquired knowledge in the organization or a team is depended on the interaction and sharing of knowledge from others in the organization. This is supported by the collected data that talks about the forms of knowledge sharing as formal meetings and other informal forms too talks about the learning process in a team. Carneiro (2001) and Boisot (1987) point out some issues concerning knowledge sharing. They mention knowledge development in the organization that the employees have to undertake. The authors continue by saying that the team members learn by interacting with each other's. KPMG says that they are doing so by letting senior employees learn and share their knowledge with the younger employees. This is done mainly through monthly meetings and through informal meetings between the employees.

Carneiro (2001), with the support of Boisot (1987) says that teams have to have a common knowledge base from the beginning to be able to function as a team. They also point out the essence of knowledge development plans in order to achieve the goals set by the team. These statment are confirmed by the presented data from the company, which talk about a specific knowledge plan. The theories are also supported by the collected data when mentioning the desire from the team members to work with someone that has a similar knowledge background as them.

KPMG talks about the importance of the ICTs used in the various teams. The company mentions tools like e-mails and in-house developed software to manage the work. Zeff and Aronson (1999) agree on the usage of e-mail as becoming widely used. In addition, Kaplan (2002) brings up other software programs that enhance the knowledge sharing. However, Liebowitz, (2000) talks about the importance of having KM tools like intelligent agents, which are software, programs that store and share knowledge from the team. This was however, not confirmed by the collected data.

Sayed (1998) shows the knowledge and learning process through the tools like the ICTs and KM tools in the table below. It shows the different ICTs, KM tools, and the extent to which each of them are used in the sample case.

TABLE 6.2. Knowledge facilitation with modern technology - KPMG.

Applications or tool \ Activity	Gathering	Organizing	Sense-making	Communication
Videoconference*				
Teleconference*			√√√	√√√√
E-mail*				√√√
Intranet/GroupWare**		√	√√	√√√√
Document Management Systems**				
Intelligent agents**				

NOTE! * = ICT ** = KM-tool

Blank = nil; √ = Poor; √√ = Below average; √√√ = Average; √√√√ = Above average; √√√√√ = Excellent.

A hyphenated entry denotes a range implying that the contribution depends on the tacit knowledge of users.

Source: Modified from Sayed, 1998

TABLE 6.2 shows the way in which KPMG uses the different ICTs and KM tools in their work and activities. Syed (1998) says that using these computer-based applications and tools facilitate a number of activities. The activities of gathering, organizing, sense making and communication is made differently based on the device being used. Making knowledge explicit through communication is the strongest activity. Sense making processes are a bit weaker due to the amount of information sent out from these devices. It seems like the technology is used to inform others, and probably mistakenly forgetting about recipient's ability to understand the message. KPMG have obvious difficulties to gather and organize the right knowledge with the help of the tools. Syed (1998) says that there is a problem of making knowledge explicit, which might give answers to the difficulties held in the gathering and organizing activities.

Choo, Detlor and Turnbull (2000), together with Nonaka and Takeuchi (1995), says that there are several information spaces. In the information space, the authors talks about the different amount and relevance of information stored in these spaces. This is confirmed by the collected data where the knowledge are stored through the ICTs and shared to the rest of the employees. The second space mentioned by the authors is the communication space, which is provided in the collected data by the wide usage of the e-mail and telephones. The main issue here, according to the investigated company, was the speed transfer, which they told could get better. Another issue they were dependent on was the availability to the information through communication channels.

The third space mentioned by Choo, Detlor and Turnbull (2000) and Nonaka and Takeuchi (1995) was the awareness space, where the building of an information base is depended on a combination of both a face-to-face communication as well as through ICTs. This is confirmed by the data that speaks of a proper mix of face-to-face interaction together with ICTs. Schmelz and Ramsey (1995), with the support of Stenmark (2001) bring up a fourth space by talking about the collaboration space. In this space, the creation of important shared values in the organization, which is not supported by the collected data. KPMG brings up the roles in the virtual teams. There are some roles like commission manager, inspector and assistants. Scholtes (1995) who mentions the roles of team leaders, quality advisors and team assistants, support these roles. Belbin (1996) is not used due to the various and many roles that one team member in this case would have to entitle in a team.

6.1.3 Within-case analysis of Öhrlings PriceWaterhouseCoopers

ÖPwC points out the importance of having an understanding for the knowledge and the process of learning in the company. Carneiro (2001) supports that by talking about the importance of knowledge in order to achieve the company goals and to have a strong competitive edge. Sanchez (2001) illuminates the issue of sharing knowledge in order to obtain an open view of it. This is found in the collected data where the company proclaims the essence of having knowledge shared among the employees. Carneiro (2001), who says that some specific forms of sharing and knowledge interaction are required, also mentions the knowledge sharing. The investigated company confirms that by mentioning monthly, formal meetings where employees and team members can share new and interesting knowledge with the others. Yet, informal meetings are a base for interaction and knowledge sharing at the company.

Carneiro (2001) and Boisot (1987) points out the importance of having some common shared knowledge in the team, to be able to work towards the objectives. The collected data confirms that by bringing up the pre-requisite demanded by the company when recruiting and composing a team. Carneiro (2001) also mentions educational plan, which ÖPwC has for each of the employees. The company says that they create an environment of interaction, both inside and outside the organization and team. They also say that they encourage employees to talk and discuss ideas with outsiders too. Bhatt (1998) and (Barney, 1986) support the idea of a de-centralized environment and the support from the organization to do so.

Liebowitz, (2000), brings up the role and use of intelligent agents. One of the KM tools are the intelligent agents, which are software programs that allows information to flow throughout the organization contribute to the sharing processes. From the the collected data no evidence is found that support any usage of software programs like the intelligent agents. The ICTs used by the investigated company are mainly e-mail, reports, video conferencing and telephone and to some extent databases. Zeff and Aronson (1999) that talks about e-mail as the most popular tool used in interaction support this. Kaplan (2002) who says that the use of e-mails, telephone and video conferencing are vital tools in the knowledge sharing process supports the mentioned ICTs. Sayed (1998) shows the extent of knowledge and learning process through the ICTs and KM tools in the figure below. The company data are compared to the rate of usage and utilization of each tool.

TABLE 6.3: Knowledge facilitation with modern technology - ÖPwC.

Applications or tool \ Activity	Gathering	Organizing	Sense-making	Communication
Videoconference*			√√√√	√√
Teleconference*			√√√	√√√
E-mail*				√√√
Intranet/GroupWare**		√	√√	√√√√
Document Management Systems**	√√√√***	√√√√***	√√√***	√√***
Intelligent agents**				

NOTE! * = ICT ** = KM-tool *** = (Under construction, expected usage)

Blank = nil; √ = Poor; √√ = Below average; √√√ = Average; √√√√ = Above average; √√√√√ = Excellent.

A hyphenated entry denotes a range implying that the contribution depends on the tacit knowledge of users.

Source: Modified after Sayed, 1998

TABLE 6.3 shows the way in which ÖPwC view its use of the different ICTs and KM tools in their daily work and activities. According to Syed (1998), the use of these computer-based applications and tools facilitate a number of activities. The activities are gathering, organizing, sense making and communication (ibid). ÖPwC have taken their first step in order to gather valuable information that otherwise only exist in tacit form within the employees. However, converting knowledge to explicit knowledge is still a strong activity together with the ability of making sense of the information. The problem with this is to make enough valuable knowledge explicit (Syed, 1998). The way individuals understands a message have great importance, although much of the technology is used merely to inform others.

Choo, Detlor and Turnbull (2000) talks, with the support of Nonaka and Takeuchi (1995) of the information space and the need of storing the information. They point out the importance of having a variety of information. The company confirms that by mentioning the extensive use of databases and stored information in the company. According to Choo, Detlor and Turnbull (2000) who mentions the communication space as related to the construction of the communities of communication. This is confirmed by the collected data that the company has plans for constructing a database for enhancing the collaboration and sharing knowledge with others. The company also mentions some difficulties related to searching for the right information. The ocompany says that the communication built in the company is a combination of face-to-face communication and through ICTs. This supports the awareness space that are mentioned by Choo, Detlor and Turnbull (2000) who says that it has to do with the type of communication and channels used it that purpose. Stenmark (2001) and Schmelz and Ramsey (1995) describes the last space, the collaboration space by saying that it handles shared norms and values in the organization. The company confirms this as they talk about how these are handled from the senior employees to the younger employees in the company.

ÖPwC brings up the aspect of roles in the virtual team. They say that it is important to have clear roles when working in a team. Scholtes (1995) who claims that different roles in a team are essential for the achivement of the objectives support this. He also says that the different roles are built on the earlier experiences and that these criterias help enhance the trust in the team. Scholtes (1995) continues with that teams should have roles like team leader and team members and quality advisors. These are found in the collected data as head accountant (which has the quality role too) and assistants.

Belbin (1996) takes on another approach of nine different roles in the team, but this is not supported by the investigated company due to the explanation that the teams often consists of two members (sometimes four members) but are rather too small. That is why the roles described by Belbin (1996) are not applicated. One team member, using his definition of roles, is entitled to more than a handful of roles.

6.1.4 Cross-case analysis

In this section, the cross-case analysis will compare knowledge managed in virtual teams between the three cases. TABLE 6.4 shows the presented companies and their listed parameters.

TABLE 6.4. How knowledge is managed in the three cases.

Knowledge managed by:	Deloitte & Touche	KPMG	ÖPwC
Essence of knowledge:			
- <i>importance</i>	♦	♦	♦
- <i>development</i>	♦	♦	♦
- <i>interaction</i>	♦	♦	♦
Sharing knowledge:			
- <i>outside the company</i>			♦
- <i>inside the company</i>	♦	♦	♦
- <i>formal meetings</i>	♦	♦	♦
- <i>informal meetings</i>	♦	♦	♦
Enhancement of knowledge:			
- <i>educational plans</i>	♦	♦	♦
- <i>de-centralization</i>			♦
ICTs and KM tools:			
- <i>intelligent agents</i>			
- <i>e-mail</i>	♦	♦	♦
- <i>databases</i>	♦	♦	♦
- <i>reports</i>	♦	♦	♦
- <i>telephones</i>	♦	♦	♦
- <i>video conferencing</i>			♦
Existence of spaces:			
- <i>information space</i>	♦	♦	♦
- <i>communication space</i>	♦	♦	♦
- <i>awareness space</i>	♦	♦	♦
- <i>collaboration space</i>	♦	♦	♦
Roles			
- <i>team leaders</i>	♦	♦	♦
- <i>members</i>	♦	♦	♦
- <i>quality advisors</i>	♦	♦	♦

All three sample companies had high awareness of knowledge and realized the value of developing the level of knowledge among the employees and members in the virtual teams. All the investigated companies thought it was a good idea to develop the knowledge level through interaction with other people. The companies also mentioned that it was important to have a functional interaction within the company. However, one of the companies, Öpwc, said that they emphasize the open organization, which in this case means that they allow outside interaction. This interaction with others outside the organization creates new ideas and let knowledge flow in to the company.

In the case of formal versus informal meetings when sharing knowledge and experiences, all the three companies says that they apply both. This is often done through scheduled formal meetings and informal meetings otherwise between the employees in a team. The enhancement of the knowledge level is connected to the ability to develop the knowledge through planned activities, such as educational plans. The three companies show a structured educational plan for each of their employees. They say that these plans are developed together with the employees. The other aspect of letting knowledge flow without restriction, the de-centralization of knowledge, is only developed at ÖPwC. This is probably the result of the open organization that they are applying. This also makes it easy for the team members to interact and to bring in new ideas without a restriction from the organization.

The ICTs and KM tools used in the different companies varied a bit. All the three companies, used e-mails and telephones but with different level of usage. KPMG was the company that used databases in a minimum rate, while ÖPwC used the databases in a larger extent. ICTs like e-mails, video conferencing and telephones are used by the ÖPwC, but just in the matter of communication with other members. KM tools like intelligent agents are not used by any of the companies in their work and interaction. Although we have limited our study by excluding measurements of the extent to which the tools are used, we would like to put them in a table. This makes it easier for a comparison how the different companies use their devices.

TABLE 6.5: The ICTs and KM tools being used.

Applications or tool	Deloitte & Touche	KPMG	ÖPwC
Videoconference*	√		√
Teleconference*	√	√	√
E-mail*	√	√	√
Intranet/GroupWare**	√	√	√
Document Management Systems**	√		√***
Intelligent agents**			
NOTE! * = ICT ** = KM-tool *** = (Under construction)			
Blank = No use, or missing information; √ = In use			

All three companies utilized the four spaces of information, communication, awareness and collaboration. However, it was obvious that the open organization of ÖPwC showed a larger interest in the issues of letting the employees discuss work without any restraints. Deloitte and Touche also talked about the environment of interaction and communication at work. The part surrounding the role division among the team members were consistent between the three companies, they all used similar divided roles and tasks in the virtual teams. At ÖPwC, the role of quality advisor and team leader was the same person, while at the other two companies, Deloitte and Touche, and KPMG, two separate persons was responsible for these tasks.

6.2 How can the KM strategy in virtual teams be described?

The analysis of the second research question will be presented under this section. First, the within-case analysis for each case will be presented Followed by a cross-case analysis, where a comparison among the three cases is conducted.

6.2.1 Within-case analysis of Deloitte and Touche

Wiig (1996) says that it is important for new knowledge to be accessible at all levels of the organization and available for concerned members. He also talks about the periodical validation and testing of the knowledge in the organization. This supports the collected data, when speaking of the importance of having continuous evaluation of working routines and quality controls. The investigated company also talked about the way that knowledge are shared and enhanced on an informal basis. This is confirmed by Bhatt (2002), who says that the encouragement of the employees and team members in a virtual team are created through individual interaction. This also supports what Weick (1995) mentions in replacing old knowledge and sharing the new one through informal coordination.

Liebowitz (2001) describes certain strategies involving KM strategies, which enables virtual teams to work in an efficient way. The author mentions identification of needs on various levels of knowledge in the company, the flow of information, internally and externally. The collected data confirms that by mentioning these aspects are often measured by providing educational programs. The company mentions both external and internal courses. Liebowitz, 2001 continues to discuss the KM strategies by talking about the essence of not disrupting the workflow by the knowledge development. Deloitte and Touche support this, by planning intensive courses during a day or two, so that the workflow is not disrupted.

The company mentioned that the objectives of KM strategies in a team are to give them a competitive advantage and make them more attractive for potential customers. The company adds another objective, namely the return of the costs paid initially. Abell and Oxbrow (2001) support the collected data by saying that virtual teams could enjoy competitive advantages and reduced costs by applying KM strategies. Abell and Oxbrow (2001) continue to talk about the importance of having experienced team members in a virtual team, if someone encountered the same problem before. This is supported in our data by the mix of senior employees and younger employees working together.

Baily and Clarke (2000) talks about concepts like relevance, currency and action. The authors explain that relevance has to do with the personal benefits from working in a virtual team. The second concept has to do with currency, which is the development of employees. The last concept has to do with action, which is the transformation of knowledge. The collected data showed a varied support for the theories of Baily and Clarke (2000). The collected data showed that relevance is not supported; but that currency is expressed in the way senior employees and younger ones are interacting. The concept of action are supported by the company then talking about desire to limit the number of cases the team member work with, and then circulate so the knowledge are transferred.

Syed (1998) emphasizes the importance of having a KM activity plan. The author divides the KM strategies into planning and operating the interactions. Planning is more a matter of coordination and flexibility, and operation is a matter of speed and structure. Deolitte and Touche handles the planning by having proper ICTs and roles in the virtual teams, which is consistent with the theories. In addition, the operations are supported by the collected data when the speed of the ICTs and the replacement of some work tasks by the computer are mentioned.

Baily and Clarke (2000) approaches another strategic tool in the virtual team. The authors mention the KM activity matrix. In this matrix, the team could see what of the KM tools and ideas that could enhance and help the team. There are four different topics discussed by Baily and Clarke (2000). The first topic is strategic fit and has to do with the strategic usage of tacit knowledge. This is supported by the collected data where Deloitte and Touche says that experiences are constantly transmitted to newer employees. The second aspect mentioned by Baily and Clarke (2000) are performance management, which deals with the gathering of information. The investigated company supports the theory by saying that they use approaches like group meetings and the use of a new tool “CBC – Core Business Communicator” which is part of the Intranet. The third aspect is the strategic potential, where Baily and Clarke (2000) says has with the knowledge generating activities. The collected data does not support this point at all; the company does not recognize this part. The last part of Baily and Clarke (2000) theory is about the exploration of ideas and using them in the rest of the organization. Deloitte and Touche support this by referring to the mandatory storage routines and the high usability of the databases affects the extent in which they are used in the rest of the organization.

6.2.2 Within-case analysis of KPMG

KPMG starts by saying that the knowledge levels the employees or team members have are constantly reviewed. The company says that this is done by annual development meeting with the team member. Wiig (1996) supports these statements by saying that a validation of the knowledge level is vital for reaching the objectives. Wiig (1996) adds that the knowledge in the teams should be accessible for other in the organization. The investigated company confirms that by talking about the different used ICTs and other information storage tools. In addition, Bhatt (2002) says that the knowledge should also be shared with other through interaction. The collected data is consistent with the pre-mentioned theory when KPMG talks about the possibility of letting the employees and team members interacting and even to share it in a more formal way, like seminars or meetings. By referring to Weick (1995) our empirical data is confirms that KPMG also believe that new knowledge should be shared with others.

Liebowitz (2001) mentions the essence of having KM strategies in order to enable efficiency in virtual teams. Liebowitz (2001) also mentions the need of knowledge in the company at different levels together with the flow of information both internally and externally. The company supports that by talking about the need of certain knowledge at any time. This could be complemented by calling an employee from the organization with that specific knowledge area to participate, and share the knowledge with the others in the team. Educational programs both external and internal ones often provide these aspects. Liebowitz (2001) adds that the KM strategies should not disrupt the workflow when developing the knowledge. KPMG confirms this by having a certain amount of reserved time for this purpose, without affecting the workflow.

KPMG highlight the aim of KM strategies in a team is to make their services more attractive for the customers. Abell and Oxbrow (2001) confirm the statement by saying that the virtual team could enjoy competitive advantages by applying KM strategies. The authors adds that it is of an essential factors to have experienced team

members in a virtual team, if they encounter the same problem as someone else has done before. The investigated company says that they apply both senior employees and younger employees in the virtual teams.

In order to get better insight how to take advantage of KM Baily and Clarke (2000) brings up the concepts of relevance, currency and action. The authors explain that relevance has to do with the personal benefits from working in a virtual team. The second concept has to do with currency, which is the development of employees. The last concept has to do with action, which is the transformation of knowledge. The collected data showed an eclectic conformation for the theory presented by Baily and Clarke (2000). KPMG talks about relevance and supports the idea of personal benefits; they explain that by having personal motivations increases the performance. They also support currency in the way that senior employees and younger employees are interacting and learning from each other's. The company does not confirm the concept of action.

Syed (1998) mentions the importance of having KM activity plans. The author adds that these KM strategies could be divided into planning and operating the interactions. Planning is a matter of coordination and flexibility, and operation is more a matter of speed and structure. KPMG handles the planning by having relevant working ICTs and roles in the virtual teams, which is consistent with the theories. In addition, the company confirms the operations when the speed of the ICTs is mentioned as a large factor for them to use some KM strategies. The company adds that a faster transfer speed is vital for stretching the concept of KM in their virtual teams.

Other writers like Baily and Clarke (2000) discusses the strategic tools in the virtual team. They mention the KM activity matrix, where a team could see what of the KM tools and aspects could enhance and help the team. There are four different topics discussed by Baily and Clarke (2000). The first topic is the Strategic fit and deals with the strategic usage of tacit knowledge. This is supported by the collected data where KPMG confirms that experiences are constantly transmitted to newer employees, and has been a part of the overall business strategy. The second aspect mentioned by Baily and Clarke (2000) are the performance management, which discusses the gathering of information. The investigated company supports the theory by saying that they use approaches like monthly meetings. The third aspect is the strategic potential, where Baily and Clarke (2000) say has with the knowledge generating activities. The collected data supports this by mentioning the "Mentor program" that is adapted to each new member. The fourth aspect mentioned by Baily and Clarke (2000) is about the exploration of ideas and utilizing them in the entire organization. KPMG points out that these aspects are covered by the developed Intranet routines.

6.2.3 Within-case analysis of Öhrlings PriceWaterhouseCoopers

ÖPwC mentions the importance of continuous developing knowledge, since they are a knowledge intensive company. The importance of checking the knowledge level in a longer perspective is another issue that the company brings up. Wiig (1996), who says that the testing and validation of knowledge should be an ongoing process all the time, supports these statements.

Bhatt (2002) talks about the encouragement of the employees and team members in a virtual team are formed through individual interaction. ÖPwC support the theory by mentioning both the formal and informal interaction in the organization and team. Another author, Weick (1995) also talk about replacing old knowledge and sharing the new one in the interaction mode. The investigated company talked about the need of interacting both internally and externally. ÖPwC allowed the employees to talk to outsiders about the work. Liebowitz (2001) describes these needs and the ability of satisfying them on various levels of knowledge in the company, the flow of information, internally and externally. Liebowitz, 2001 continues to talk about the KM strategies and the essence of not disrupting the workflow in the knowledge development process. This is confirmed by the company in mentioning the planning of regulated time specifically for the development of knowledge.

Abell and Oxbrow (2001) talk about the competitive advantages from applying KM strategies in the adaption in virtual teams. The collected data shows a consistency with the theory that they think that their products and services are becoming more attractive for the customers. ÖPwC speaks of blending senior and younger team members in aim of having experienced people in the teams. Abell and Oxbrow (2001) confirm that with the same motivation as the investigated company did.

Baily and Clarke (2000) mentions concepts like relevance, currency and action in the content of KM strategies. They explain that the aspect of relevance has to do with the personal benefits from working in a team. The second aspect has to do with currency, which is the development of employees. The last aspect has to do with action that is the transformation of knowledge. ÖPwC supported Baily and Clarke (2000) three aspects. First, relevance is supported by the cooperation between the management and the employee to find a motivation. Second, currency is shown when senior employees and younger team members are interacting together at work. Third, ÖPwC supports the concept of action, since they are concerned with the knowledge storage in their many databases. Syed (1998) splits the KM strategies into planning and operating the interactions. Planning is explained as coordination and flexibility, and operation is the speed and structure. ÖPwC deals with the planning by having using a wide range of ICTs, which is confirming the theories of Syed (1998). The operations are confirmed when the company mentions the essence of fast ICTs.

Baily and Clarke (2000) approach another strategic aspect in the virtual team. They mention the KM activity matrix. This matrix shows how the team could see what of the KM tools and ideas that could enhance and help them. The matrix consists of four topics according to Bailey and Clarke (2000). The first topic is the strategic fit and deals with the strategic usage of tacit knowledge. This is confirmed by ÖPwC when saying that the interaction is passing the knowledge to the rest of the employees, but also the routines of storing knowledge for the future. The second topic discussed by Baily and Clarke (2000) is the performance management, which deals with collecting information. ÖPwC supports the theory by saying that they facilitate forms of formal and informal meetings and the use of a new developed tool that will keep track of each member's performance and knowledge that will become a part of the Intranet. The third topic is strategic potential, where Baily and Clarke (2000) speaks of the knowledge generating activities, are not shown in the collected data. Baily and Clarke (2000) continue to mention the exploration of ideas and the importance of how to use

them. ÖPwC confirms this when they mention their “Coach program” and the high usability of the databases.

6.2.4 Cross-case analysis

In this section, the cross-case analysis will compare the KM strategies the in virtual teams between the three cases. TABLE 6.6 shows the presented companies and their listed parameters.

TABLE 6.6: The ingredients of a KM strategy in virtual teams.

KM strategies in virtual teams	Deloitte & Touche	KPMG	ÖPwC
Knowledge accessibility:			
- validation and testing	♦	♦	♦
- interction sharing	♦	♦	♦
- access to new knowledge	♦	♦	♦
Strategies for efficiency:			
- need identification	♦	♦	♦
- Internal/external	♦	♦	♦
- providing educational time	♦	♦	♦
- interruptance schedule	♦	♦	♦
Personal benefits:			
- relevance		♦	♦
- currency	♦	♦	♦
- action	♦	♦	♦
KM activity plan:			
- planning	♦	♦	♦
- operating	♦	♦	♦
KM activity Matrix			
- strategic fit	♦	♦	♦
- performance management	♦	♦	♦
- strategic potential	♦	♦	♦
- exploration	♦	♦	♦

All the companies agree the importance of developing the knowledge level, but they do so in some various ways. All the investigated companies are saying that sharing through interaction are implemented in a common way, by sharing knowledge between senior and younger team members. ÖPwC, and in some extent Deloitte and Touche, applies both external and internal knowledge sharing between the team members. The explanation could be that the ”open” organization that ÖPwC applies are affecting these aspects. Deloitte and Touche are trying to achieve the same effect by increasing the interaction through an open office landscape.

To some extent, most of the companies cover the investigated factors. These factors surrounding efficiency of strategies and how operations are made, are all conducted in a very similiar way. One of the companies, Deloitte and Touch could not verify the aspect of relevance, while the other two companies could talk for the three aspects and confirm them. Deloitte and Touche was also the only company that did not validate the strategic potential under the KM activity plan. However, all the other strategic factors could be confirmed and compared between the companies. The differences in the the strategies between Deloitte and Touche and the other two

(ÖPwC and KPMG) could be explained by the size of the organizations. While Deloitte and Touche are a rather small and young organization in Sweden, are the other companies well established in Sweden with a larger organization behind them.

6.3 How can the Critical Success Factors of KM in virtual teams be described?

The analysis of the third and final research question will be presented under this section. First, the within-case analysis for each case will be presented, followed by a cross-case analysis, where a comparison among the three cases is conducted.

6.3.1 Within-case analysis of Deloitte and Touche

The collected data mentions some factors that are justifying the usage of virtual teams. These are increased efficiency and lower costs, which are supported by Johnson, Heimann and O'Neill (2001) when they state that there are reasons to why organizations should use virtual teams, among them lower costs and increased efficiency. Jarvenpaa and Leidner (1998) talk about three large obstacles in adapting KM in virtual teams; trust, communication and culture. First, the company admits that trust is of an essence in forming virtual teams. Arnison and Miller (2002) address the trust issue by stating that trust is built through face-to-face interaction. Deloitte and Touche recognize this by mention how trust levels are enhanced by face-to-face interaction. The company also mentions that trust affects the level of performance, which confirms what Arnison and Miller (2002) say about the issue of trust in a virtual team.

In dealing with communication issues, Deloitte and Touche realize the value of good communication between team members in a virtual team. Walther (1997) supports the collected data by saying that computer-mediated communication does not differ from regular communication in developing trust. On the other hand, Johnson, Heimann and O'Neill (2001) do not support the collected data when saying that computer-based communication is less effective. The company thinks rather that the communication through ICTs gives the team members confidence and security in work.

According to Potter, Balthazard and Cook (2000), teams have to deal with both organizational and geographical culture. They also mention that the performance is affected by the culture. This is confirmed by the collected data from the company, where they speak about the influence of culture and that this could affect the level of performance in the teams. The company also mentioned that a homogenous culture at work makes it easy to interact and perform. Potter, Balthazard and Cook (2000), who say that people from the same cultural background have an easier way of working together, confirm this.

Johnson, Heimann and O'Neill (2001) bring up several other factors that could affect the success of KM in a virtual team. They talk about the importance of having a clear policy regarding human resources in the virtual teams. This is not supported by the collected data, due to the company's motivation that they do not need such a policy. According to the collected data, policy issues for human resources are taken care of through the management at the office. Davenport, De long and Beers (1997) as an

important factor on the other hand confirm this in attempting to build an awareness of KM in the virtual teams. Deloitte and Touche complained on the level of the communication skills concerning language usage, which is supported by Johnson, Heimann and O'Neill (2001), who say that the ability to possess good writing skills as important to succeed in a team.

6.3.2 Within-case analysis of KPMG

Johnson, Heimann and O'Neill (2001) explain that success in a virtual team is dependent on a set of various factors. KPMG could mention a few of those, such as increased efficiency and lower costs, which is equivalent to what the pre-mentioned authors say. KPMG also mentioned the problems that they endured during work in virtual teams related to communication and good personal relationships. Jarvenpaa and Leidner (1998) that mention three obstacles (trust, communication and culture) in adapting KM in virtual teams confirm these problems. KPMG thinks that the employees have a high degree of trust in others in the organization, and that this is built through earlier experiences of working together. Arnison and Miller (2002) who state that trust is often built through face-to-face interaction between the team members also support this. KPMG realizes that trust also affect the performance of the team, which Arnison and Miller (2002) also suggest it does. KPMG mentions that trust level is high in virtual teams, but things like social- and face-to-face interaction could enhance it. Latane, Liu, Nowak, Bonevento and Zheng (1995) and Powell (1990) among others, confirm what KPMG says about enhancement of trust through face-to-face interaction.

Communication was another issue that KPMG mentioned as an effect to the outcome of a virtual team, which thereby support what Arnison and Miller (2002) earlier stated. However, KPMG felt that the speed of the ICTs are vital and affecting their performance. This is in line with what Walther (1997) says about ICTs, that they do not differ from other tools, but that the slower degree of transfer was a concern. Johnson, Heimann and O'Neill (2001) also bring up the issue of speed as being less effective in communication. They continue by dividing this problem into three categories: lack of project visibility, getting in touch with people and constraints in technology. Two of the three categories are confirmed by the data from KPMG. In the first category, KPMG says that short messages, in example e-mails could create misunderstandings surrounding the task and thereby affecting the results of the project. In the second category, KPMG did not mention anything concerning this point. In the third category, KPMG talked about the simplified language in e-mails and other messages could create some confusion about the meaning of the message.

KPMG relate the communication problems to the different background of the employees. This difference is mainly in knowledge and experience base. Walther (1997) and DeSantis and Poole (1997) acknowledge what KPMG claims by saying that diversity in a team could affect the communication and level of understanding. KPMG also mentioned another point in the cooperation issue. The employees tended to like working with someone that have high social skills, which is confirmed by Wiseman, Hammer and Nishida (1989) who also say that socially skilled people tend to create attractiveness in the team and thereby affecting the outcome.

Culture was also another factor that KPMG thought was important, which has been confirmed by Arnison and Miller's (2002) earlier statement. The employees at KPMG wanted to work with someone from the same cultural background as himself or herself. They explained that sometimes, younger employees do not understand senior employees due to the understanding in how KPMG works and the routines in the company. Arnison and Miller (2002) agree with that and mention the cultural diversity, both geographical and company specific could affect the results from teamwork. This is due to efforts in understanding each other together with increased attractiveness of the virtual teams.

Johnson, Heimann and O'Neill (2001) mention other success factors like human resource policies, training, management support, people and tools. KPMG talks about some of these factors affecting the virtual teams and their work. Most importantly, they talked about support from management, which supports Johnson, Heimann and O'Neill's (2001) point in the importance of having a support from a higher level in the organization. KPMG also talks about how the team members use the technology, which confirms what Arnison and Miller (2002) mention as a critical factor for teamwork through ICTs. The authors mentioned another factor that is not found at KPMG, the essence of having an established policy regarding communication privacy. KPMG did not either talk about the level of stress among the team members as Arnison and Miller (2002) say affects the team's results.

6.3.3 Within-case analysis of Öhrlings PriceWaterhouseCoopers

Johnson, Heimann and O'Neill (2001) mention a number of various factors that affects the success of a virtual team that is similar to what ÖPwC said. ÖPwC mentioned factors such as faster communication and an increased network of contacts. On the other hand, ÖPwC said that negative effects like increased stress of being online, which is consistent with what Townsend and DeMarie (1998) talk about. Jarvenpaa and Leidner (1998) bring up the three major obstacles in adapting KM in virtual teams; trust, communication and culture. Regarding trust, ÖPwC felt that the level of trust among the team members is built up through earlier projects and experiences. Arnison and Miller (2002) agree by saying that trust is built through interaction between the team members, they also add that repeated interaction and shared experiences are vital for the success of a virtual team. ÖPwC believes that the composition of a team is determined by who has been working with who, and if they want to work together again. These statements are confirmed by Powell (1990) who says that people that have worked together before tend to work together again. The collected data also showed that team members miss the lack of social interaction, which Latane, Liu, Nowak, Bonevento and Zheng (1995) say could enhance the performance level of a team.

In the issue of communication that Jarvenpaa and Leidner (1998) brought up earlier, ÖPwC says that most of their virtual teams that fail do so due to communication problems. According to the collected data, ÖPwC explained that people were getting less effective in communicating through ICTs. It is referred mainly to the use of language, the technological limitations in expression and the lack of time. Johnson, Heimann and O'Neill (2001) confirm these factors by saying that the effectiveness in communication are falling into three categories: lack of visibility, getting in touch with people and constraints in technology. ÖPwC adds another factor to the problems

of communication, namely stress, which is consistent with what Townsend and DeMarie (1998) says about communication through ICTs. The authors say that there is a risk of increased stress in the increased usage of ICTs.

Potter, Balthazard and Cook (2000) state that team members has to deal with type different cultures, both organizational and geographical. The authors also say that this could affect the interaction and performance of a team or group. In the case of ÖPwC, the company proclaim to have an open organization, where people can talk to other people outside the team and to bring in new ideas into the organization. Davenport, De long and Beers (1997) discuss the issue of understanding others and to have a wide view, in order to ease the interaction between the team members. The results from the data collection also showed that the employees did not see culture as a vital factor for choosing someone to work with. These statements are contrary to what Arnison and Miller (2002) say about how people want to work with others from the same cultural background and that cultural diversity affects the performance of a virtual team.

The company mentioned other success factors in adapting KM in virtual teams like the stress level and better ICTs and KM tools. Johnson, Heimann and O’Neill (2001) confirm this by saying that the used tools in the interaction and work are vital for the success rate. In addition, Townsend and DeMarie (1998) mark the essential of monitoring stress in the virtual team and establish what ÖPwC said about the stress level.

6.3.4 Cross-case analysis

In this section, the cross-case analysis will compare the critical success factors in adapting KM in virtual teams between the three cases. TABLE 6.7 shows the presented companies and their listed success factors.

TABLE 6.7: The critical success factors in adapting KM in virtual teams.

Critical Success Factors	Deloitte & Touche	KPMG	ÖPwC
Benefits from virtual teams:			
- increased efficiency	♦	♦	♦
- reduces costs	♦	♦	
Trust:			
- affect performance	♦	♦	♦
- through face-to-face	♦	♦	♦
- through ICTs			
Communication:			
- affect performance	♦	♦	♦
- through ICTs	♦	♦	♦
-through face-to-face	♦	♦	♦
- lack of visibility	♦	♦	
- getting in touch with people			♦
- constraints in technology	♦	♦	♦
- social skills		♦	♦
Culture:			
- affect performance	♦	♦	♦
- homogenous	♦	♦	
- heterogeneous			♦

Other success factors			
- policies regarding communication	♦	♦	
- management support			♦
- tools	♦	♦	♦
- knowledge sharing	♦	♦	♦
- people	♦	♦	♦
- stress			♦

All of the companies realize that there are some benefits in adapting virtual teams in the content of KM. All of them mention increased efficiency as a parameter for the usage of virtual teams and KM. One of the companies, ÖPwC does not recognize the cost benefits from it. On the other hand, all three companies, mentioned trust as a vital factor in establishing KM in virtual teams. They all believed that trust affected the performance and that trust was important for the outcome of the work. To facilitate trust in the virtual teams, all the three companies did that through face-to-face interaction. On the other hand, the three investigated companies all thought that trust could not merely be built through ICTs. It is common to build parts of this trust at the informal morning meetings, just before the workday. At these occasions, they get the valuable time to interact and share knowledge before starting to work. An interesting point is that interacting over the ICTs is often “attached” with the feeling of having a “face” to relate to.

All of the companies admit that communication is important and is affecting the results. They also all agree on the fact that communication should be done through both face-to-face and ICTs. This is partly related to the facilitation of trust among the team members discussed in earlier. Only KPMG and Deloitte and Touche recognize the lack of project visibility as a concern in virtual teams. KPMG are concerned in the language used and the simplification of it in order to express more through the ICTs. Deloitte and Touche was on the other hand concerned with inappropriate information that did not belong to the work.

Only one of the companies, ÖPwC expressed a communication concern of getting in touch with people. This is related to the fact that ÖPwC encourages the employees to be more open and to take contact with others outside the organization, regarding the work tasks. It is also believed that this openness in the working environment drives management to ensure that the communication in the organization transfer new knowledge and ideas.

All three companies mentioned limitations and constraints in the technology as an important concern in communicating with others. The risk of misunderstandings is large when the technology limits the expression of the message. Therefore, the companies keep the team members with mobile phones to be able to reach them. One of the companies, KPMG mentioned the limitations of on-line connectivity. They wish to have access through other forms of communication with better file transfer capacity. They continued to explain this with how employees “out on the field” always have to use slow modems in order to get on-line to the local databases. In the communication discussion two of the companies, KPMG and ÖPwC thought that social skills were important for the success of KM in a virtual team. This is related to the fact that different people from different backgrounds are joint in a virtual team to

work together. When the team members have large social skills, they are able to handle different personalities and situations.

All three companies pointed out that culture was essential when working in a team. Deloitte and Touche thought, together with KPMG that for successful results, a homogenous culture was required. Only ÖPwC did not think that the cultural background of the team members affects the success. It seems as the openness of ÖPwC has made it easier for them handle different kind of people, and thereby working in a team.

All of the studied companies realize the choice of KM tools in a virtual team as important, this together with the right members in the teams. Another recognized success factor was knowledge sharing. The companies expressed their view on the sharing of information between the employees. Since the companies see that knowledge is shared between the senior employees and the younger employees, the knowledge stays in the organization. Two of the companies, Deloitte and Touche and KPMG talked about policies regarding communication. ÖPwC talked instead about the management support for emphasizing virtual teams and the involvement to increase them. It is obvious that the restraints of communication at both Deloitte and Touche and KPMG are not enhancing knowledge sharing. It is also related to the fact that these two companies are trying to keep the knowledge in-house. While on the other hand, ÖPwC proclaim the open organization with no restrictions on who will talk to whom with support from the management to do that. Only ÖPwC added the aspect of stress in the parameters of success when discussing these issues. Indications could also be found that communication and interaction is taking a large amount of time of the working day at ÖPwC.

This chapter has presented the analysis of the collected data, in terms of within-case and cross-case analysis. The following chapter will present our findings and conclusions of the research. We will also bring up implications for management and theory together with aspects for future research.

7 FINDINGS AND CONCLUSIONS

In this final chapter, we will conclude the findings from our research. In order to do so, we will re-state each of the research questions posed in chapter one and try to answer them, based on our conducted research. We will also give some overall conclusions before presenting implication for management and theory, followed by further research.

7.1 How is knowledge managed in virtual teams?

The study revealed variations between different organizations in how knowledge is being managed. There are distinctive variations in the use of ICTs and KM tools to support these activities. Some companies use a wide range of tools in a large extent while others were more restricted. We have noticed that the team that used the ICTs to its full capacity is more aware of what other parts of the teams are doing. In addition, the knowledge levels and sharing processes are more developed in those teams. This is a result of more efficient interaction procedures were the basic motives of openness and willingness to share information is the strongest. One issue that is affecting both the variety of ICTs and the usage level are the dominated culture in the organization. If the management support and facilitate the development for the ICTs, the rate of use will increase. Another issue that affects using the ICTs is the knowledge and skill stored within each employee. Here, the role of knowledge sharing and interaction becomes essential and important. These factors are strongly influenced in the building of a stronger knowledge base in the organization.

The research showed an interesting aspect regarding internal versus external interaction. The organizations that allowed external interaction showed a greater development in the context of managing knowledge. They also showed a tendency to regularly facilitate new ideas and input for the organization. By continually refreshing the knowledge base through daily interactions and learning processes, the organization becomes stronger. This is especially important for knowledge-based organizations that have to rely on their “brain capacity” in order to be competitive. Transforming tacit knowledge to explicit is done by the continuous information updates. This means that they update each other, and that the best suited knowledge for the purpose upgrade the old version.

Both the ICTs and the KM tools are affecting another area, namely the interaction. The team members are sometimes forced to interact. When for instance e-mails are received in the inbox, the employees feel the obligation to quickly respond, of course depending of the nature of the e-mail. However, this forced interaction becomes a routine after a while and a part of the accepted company culture. This means that greater use of ICTs does not necessarily need to make interaction more efficient for the company. Since core business processes might be negatively affected. If less time is spent for the intended work, companies can be put in a competitive weaker position. To cope with this risk companies cannot neglect this and must be willing to deal with this appropriately.

To summarize this section, we found that:

- The extensive use of ICTs in virtual teams increases knowledge sharing processes
- The importance of providing the necessary tools, allowing employees to become problemsolvers on their own finding information and knowledge by themselves
- The quality of the knowledge management requires a certain critical size of an organization in matters of intellectual resources and knowledge base
- The knowledge interaction and sharing capabilities in the company are depended on the support from management
- The organizations that allow both external and internal interaction and knowledge sharing are showing a larger development in managing knowledge
- The ICTs forces the employees or team members to interact

It is obvious that the ICTs and role division are part of the pattern, but the management of KM in a virtual team cannot work alone without a proper strategically view on the team members how to do that. These issues are presented in the next section.

7.2 How can the KM strategy in virtual teams be described?

The KM strategy is a dynamic document, which should always be kept up-to-date in order to facilitate its users. It consists of different actionable activities that surround the daily activities. It seems to be a difficult to find a well-defined strategy at the companies, although they are well aware of the importance of having updated information in circulation. KM strategies include more than just educational plans. Daily activities that are sometimes hard to express, yet on regular basis carried out should be interesting to make explicit. To do this it would be interesting to take use of a highly sophisticated database or perhaps with the development of a intelligent agent.

The research showed a clear understanding of the importance of strategies among the studied organizations. Larger organizations are aware of the importance of knowledge to them and that they should have a clear strategy. It is a large part of building and maintaining knowledge in the teams. Some variations were plotted among the companies throughout the entire spectra. It seems as smaller organizations might have a little easier to shift and adept new strategies. This assumption is based on the flexibility of the team structure that allows new ideas to be outspoken easier. While the larger organizations are stronger in managing the resources and putting the necessary efforts to develop both the teams and members, the smaller were more dynamic but lacked in some vital strategic aspects for example, the management support for an interaction in both external and internal views.

Another issue that we discovered is what happens when organizations lose control over knowledge storage. The organization that speaks for using ICTs and KM tools, could risk loosing the control over the information flow in the organization. This is clearly shown in our research where the employees have problems to find the searched topic due to overload of information. The conclusions that can be made from these findings are that an organization should know how to control the flow and size of information. When the amount of information is becoming so extensive and wide, the organization then could loose efficiency due to the time taken to search and keep track of the necessary data. Today it is also crucial for management to put in systems

that work well in the filtering of undesired e-mails that interrupts workflows and efficiency.

To summarize this section, we found that:

- A strategy for the usage and storage of the databases (storage medias) in the organization is needed
- Information structure will dissolve and employee might abandon the tools if not proper education is maintained
- Databases and storage tools could, when the company loses the control over the growth and usage create a “database disease”
- Symptoms indicating on information overload, make eventually employees unable to find proper information due to problems of retrieving it from the databases
- Organizations should appoint a responsible position for the strategic KM implications, especially in knowledge intensive organizations because of the importance of knowledge to them

It is clear that strategically questions and aspects are implicated by the management in order to success and reach the objectives. In the next section, the critical success factors are presented.

7.3 How can the Critical Success Factors of KM in virtual teams be described?

Our research shows that there are some critical success factors that organizations are more concerned about than others. The different values of the factors such as trust, communication and culture were obvious. Building trust is essential in virtual teams and network. ICTs and other KM tools replace aspects like face-to-face communication. We also believe that the communication factors are becoming more important for the success, because people want to understand each other. However, the importance of culture will become less vital for the virtual teams. This is explained by the increased globalization and the increased interaction between dispersed employees has made it easier to handle diverse backgrounds and cultures.

Our study showed that organizations that encourage the employees to be open to new ideas and interact with others outside the organization, in the content of work are less sensitive to cultural aspects. The open organization drills the employees and encourages them to work with different kind of people both inside and outside the organization, which make culture a less essential obstacle in adapting KM in virtual teams. Our research also showed that these employees favored communication and knowledge as important factors for them to succeed in a virtual team. Another important factor that an open organization brings when dealing with KM in virtual teams, are the increased knowledge sharing and the interaction level. Otherwise, the employees' exchange of ideas and knowledge will drop.

Another issue found was the policie regarding communication. At the investigated companies, we found that the communication level were higher at those sample companies that did not have any policies. We believe that these policies could prevent other informal knowledge sharing channels between the members of the team. As a last point of our conclusion, we found that stress is of an essence. The sample

company that agitated for an open organization also complained that they lacked of time due to that the interaction takes up time from the employees.

To summarize this section, we found that:

- Open organizations are less sensitive to individual cultural aspects and allows internal/external communication
- Culture are becoming less important in understanding team members in the virtual teams when emphasizing the open organization mode
- Communication policies are limiting the knowledge exchange rate and level
- Stress is becoming a far more important success factor in the virtual teams

7.4 Implications for management

The research has investigated how three companies use KM in virtual teams. The management implications are made to help the investigated companies, as well as other companies that practice the use KM in virtual teams.

The study has showed that it is necessary to facilitate and encourage both external and internal interaction. Therefore, it is relevant to consider such an approach to the development of knowledge and the knowledge sharing process. An organizational model, where the company promotes for an open external sharing shows a higher degree of knowledge flow and interaction.

Furthermore, it is important to remember that the development towards ICTs and KM tools should be brought under controlled forms. As the study showed, companies that reaches a critical level of information storage, loses the overview on the structure and content of knowledge. This scenario could lead to a risk of abundance of the tools by the team members.

Finally, the organizations should focus on solutions that offer great flexibility in exercising control over shifting interactions from "direct" to "IT-enabled". Sometimes a fascination with technology may result in the assumption that employees must adjust to the ICTs instead of the other way around. Organizations must create a KM strategy that unifies both the intellectual assets with the technology being used. Viewing ICTs as an enabler of learning allows intellectual assets to make more informed decisions about the appropriate use for various learning tasks.

7.5 Implications for theory

The concept of KM is not new as we have mentioned before, but the combination of using KM in virtual teams is relatively new. As this study are looking at this combination in a wide but focused perspective, it is considered to contribute to the theory surrounding KM in virtual teams

The fitness of our theories involved in this research is presented in our analysis. Much of the theories on the subject cover the collected data, but some considerations are raising questions.

One of the investigated companies had a view on how interaction should take form. They did this by emphasizing the “open organization” with internal and external interaction modes at the same time. These modes, combined showed a larger development of the knowledge process in the company. This is not mentioned in the theories, and thereby considered as a contribution to the research area.

Further, the development of ICTs and KM tools needs a given strategy in obtaining and controlling the growth of information storage. There are a risk of reaching a critical level, where the organization loses the overview on the flow and structure of the knowledge. Otherwise, there are a risk that employees decrease their use of them and the risk of abandons in the end. this is nothing brought up in the theory, but worth to notice.

Jarvenpaa and Leidner (1998) mention trust, communication and culture as the most important critical factors for KM in virtual teams. However, our research showed that external interaction shifts the importance of culture aside in favor to another factor, namely stress. Although already mentioned as a contributing factor to the success in the literature review, its importance will grow when external interaction occurs. This is due to the time taken to conduct this increased interaction.

This section has explained the main points where the theory is of another view. It also presents our small contribution to the theory, although many of the areas are covered by the proper theories.

7.6 Further research

This study has provided a wide but focused insight into the topic of managing KM in virtual teams. It would be interesting to investigate how ICTs like intelligent agents could affect the interaction and learning pattern in the end in an organization. Since none of the companies in our study had taken in the use of any intelligent agents, this could become an interesting topic to further investigate. In the literature review, we mentioned that more attention has been given the intelligent agents.

We would recommend using the technique of conducting a multiple-case study including a certain amount of interviews, combined with a number of questionnaire's to investigate the this new area. As we mentioned in the reliability section under methodology the accuracy and precision might improve using a set of double interviews at each responding company. A quantitative study could also be made to see, when and to what extent each of the ICTs and KM tools are used in different situations. Since we did this study at the local offices of large multi-international organizations this open up interesting perspectives for other researchers. They could make multiple-case study analysis in a single company and deepen their effort on how different nodes in their internal network share knowledge with each other.

Furthermore, the strategy theories are discussing tacit knowledge in a limited way, and not many writers are mentioning it at all. Therefore, it would be very interesting to investigate how tacit knowledge could be strategically blended into the rest of the KM strategy in the organization. In order to find this out, a one-case study with deep interviews could be implied.

Finally, our research has indicated that the issue of stress is increasing as a success factor for KM in virtual teams. The research also showed that developed organizations in the use of virtual teams are becoming sensitive to stress. We suggest that the research should continue in the same area. This research could be done through a survey, a case study or a combination of both. This is done in order to obtain accurate and sufficient results from the researched data.

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APPENDIX A

Interview guide

- Respondent
 - Name
 - Position in company
 - Background
 - Time in company
 - Time on current position

- How do you view the concept of knowledge?
 - Information processes
 - How is knowledge best used within the company?

- How is knowledge best managed within the company?
 - Any need for a strategy? (if so, what should it include?)

- Is your organization familiar with the concept of "Knowledge Management"?
 - Other definition?

- What is the company's objective with the used KM strategy?
 - Knowledge consolidation
 - Standardisation of existing knowledge in the form of procedures/protocols
 - Combination of external knowledge and internal know-how
 - Acquisition of new knowledge from external sources
 - Generation of new knowledge inside the organization
 - Transformation individual knowledge into collective knowledge

- Is KM included in the organizational overall strategic objectives?
 - Involved individuals
 - Knowledge barriers
 - Details/parts that specifically supports the used/planned KM strategy

- What "norms" and "guidelines" has the company in order to take use of the existing knowledge?
 - Knowledge distributors
 - Where can these "norms" be found?
 - Considering virtual teams

- How would you like to describe the knowledge transfer within the company?
 - In virtual teams
 - Group level versus individual level
 - Which aid? (NOTE! Examples if the respondent are facing problems)
 - How important today? Future?

- How much of the company's daily internal work is made through teamwork?
 - Development (historical and future perspective)
- To what extent do you and your co-workers use of electronic devices in your daily work?
 - Creating value (how?)
 - Different levels within the company (differences)
 - Other effects on the use
 - Replacement for face-to-face
- What is your view towards virtual teams?
 - Critical Success Factors
 - What is there to win (short term, long term)
 - Lasting coherence (timeframe, pros and cons)
 - Failed efforts (reasons)
 - Storing methods
 - Future expectations on the use (more or less, why?)
- Do you consider e-mail and Intranet to work as knowledge transfers and storing places for knowledge? (If yes; use of today, desired use)

APPENDIX B

Intervjuguide

- Respondenten
 - Namn
 - Position i företaget
 - Bakgrund
 - Anställningstid
 - Tid på nuvarande post

- Hur ser du på begreppet kunskap?
 - Informationshantering
 - Hur kommer det bäst till sin rätt inom företaget?

- Hur hanteras kunskap bäst inom företaget, finns det behov av en strategi och vad behöver i sådana fall den innehålla?

- Är din organisation bekant med termen ”Knowledge Management”?
 - Annan definition? Hur lyder den?

- Vilka är företagets mål med den KM strategi som tillämpas?
 - Kunskapskonsolidering
 - Standardisering av existerande kundskaper (processer och protokoll)
 - Extern och intern kunskap (kombinationer?)
 - Ny kunskap (varifrån?)
 - Generalisering av ny kunskap
 - Transformerings av individuell kunskap till kollektiv kunskap (hur?)

- Inkluderas KM i din organisations totala strategiska mål?
 - Involverade personer
 - Kunskapskrav
 - Detaljer/delar som särskilt stödjer använd/planerad KM strategi

- Vilka riktlinjer och ”normer” har företaget för att tillvarata den kunskap som finns inom företaget?
 - Kunskapsförmedlare
 - Var finns dessa "normer"?
 - För distansarbete (virtual teams)

- Hur skulle du vilja beskriva att kunskapsutbyte sker inom företaget?
 - Vid distansarbete
 - Gruppnivå kontra individnivå
 - Vilka hjälpmedel? (OBS! Nämn förslag om respondenten har problem)
 - Hur viktiga idag? Framtiden?

- Hur mycket av företagets dagliga interna arbete sker via grupparbeten?
 - Utveckling (historiskt perspektiv och i framtiden)

- Hur utbredd är användningen av elektroniska hjälpmedel i ditt och dina medarbetares dagliga arbete?
 - Mervärdeskapande (hur?)
 - Olika nivåer inom företaget (skillnader?)
 - Övriga effekter av användandet
 - Ersättning för ansikte-mot-ansikte

- Vad är din ställning gentemot distansarbete?
 - Nyckelfaktorer för framgång
 - Vad finns att vinna (kort sikt, lång sikt)
 - Bestående sammanhållning (tidsram, fördelar/nackdelar)
 - Misslyckade försök (orsaksfaktorer)
 - Lagringsmetoder
 - Framtida förväntningar på användningen (mer eller mindre, varför?)

- Anser du att e-post och Intranet fungerar som kunskapsspridare respektive lagringsplats för kunskap? (Om svar ja; användning idag, önskad användning)

APPENDIX C

Questionnaire

In the context of this study, we consider "Knowledge Management" to include the strategies and support mechanisms for the creation, identification, collection and sharing of knowledge. This also includes the practices in how knowledge functions as an appliance within the organization. The purpose of Knowledge Management (KM) is to improve your organization's effectiveness by leveraging the knowledge you have and need to use to compete. Depending on your business and strategy, important knowledge can range from:

- the intellectual assets (employees) that underlie products and services
- knowledge about customers and markets
- the identification and transfer of "best practices"
- the individual expertise

We believe knowledge is a fundamental factor in the effectiveness of modern organizations. Therefore we want to understand how **you** address this subject. You would contribute to a perhaps making **your** work and whole organization more effective by participating in this questionnaire.

- Position in company:
- Tenure:
- Are your organization unfamiliar with the term "Knowledge Management", are there any definitions given to knowledge initiatives internally? If so, what are they?

Intellectual capital	Intellectual assets	Learning organization
Other.....		
- Please rate the following KM objectives in the context of the business strategy? (1 as most important until 6 as the lowest importance)

..... Facilitation of the "re-use" and consolidation of knowledge about operations
..... Standardisation of existing knowledge in the form of procedures/protocols
..... Combination of external knowledge and internal know-how
..... Acquisition of new knowledge from external sources
..... Generation of new knowledge inside the organization
..... Transformation from individual knowledge into collective knowledge
..... Other.....

- Do your organizations' overall strategic goals include KM explicitly? If yes, are there people assigned to KM; please specify the functions and explain?

.....

- What "guidelines" does the company have to attain knowledge and manage it?

.....

- How is yours or other individuals knowledge shared internally in the company?

Face-to-face	E-mail	Databases
Virtual meetings	Telephone	Reports
Courses	Group sessions	Videoconferences
Intranet/GroupWare	Courses	Other.....

- To what extent is knowledge used and shared through the following devices?

..... E-mail	..... Intranet/GroupWare
..... Teleconference	..... Computerized advisors (Intelligent agents)
..... Videoconference	..... Database applications
..... Other.....	

- How much groupwork do you conduct in your daily work?

5 (Always) 4 (Often) 3 (Sometimes) 2 (Occasionally) 1 (Never)

- What are the most important knowledge-carriers in your organization?

People	Paper	Medias
Routines	Services	Other.....

- Where in the organization could you find "guidelines" to remote, manage or participate in virtual teams?

At the regular management	The company culture
Outside consultants	In databases or other written forms
Co-workers experiences	Other.....

- To what extent is electronic tools used in the daily work?

5 (Always) 4 (Often) 3 (Sometimes) 2 (Occasionally) 1 (Never)

- In what way do you think electronic tools are adding value to individual and overall performance?

Increasing performance	Lowering costs
Better work access	Creating new contacts
New knowledge into the company	Other.....

- How often do you update these tools?

5 (Always) 4 (Often) 3 (Sometimes) 2 (Occasionally) 1 (Never)

- How are your daily communication divided? (place a %-part of the overall communication through that specific channel)

.....Face-to-face	.....Telephone
.....E-mails	.....Others.....

- To what extent do you think electronic tools can replace face-to-face communication?

5 (Always) 4 (Often) 3 (Sometimes) 2 (Occasionally) 1 (Never)

- What are the key factors when interacting with others? Rate the different options below with number 1 as most important and upwards to number 8 as the least important:

..... Cultural background (both organizational and geographical)
 Communication
 Professional skills
 Knowledge background
 Early experiences from working together
 Trust
 Social skills
 Physical attractiveness

- Which advantages/disadvantages have you experienced working in virtual relations? Expectation for the future?

.....

- How do you store knowledge established in virtual teams?

Reports	Meeting Protocols	Databases
Seminars/Courses	Other.....	

- How do you expect your work in virtual teams will expand for the future (plans)?

More virtual team works The same as today Less virtual team work
No more virtual teamwork

- Which aspects of your organizational culture seem to support effective KM?

.....

- What aspects of your culture changed because of the implemented KM process?

.....

- Have any of your virtual relations ever failed? If so, what were the major causes?

Cultural issues	Communication issues
Trust issues	Social issues
Knowledge skill issues	Other.....

APPENDIX D

Frågeformulär

I detta frågeformulär försöker vi utreda organisationers kunskapsverksamhet även kallat "Knowledge Management". Detta ämne inkluderar strategier och hjälpmekanismer för skapande, identifiering, insamling och utbyte av kunskap. Vidare så omfattar det även tillämpningar av hur kunskap fungerar som ett hjälpmedel inom organisationen. Syftet med Knowledge Management (KM) är att förbättra Er organisations effektivitet och skapa konkurrensfördelar. Detta åstadkoms genom att höja kunskapsnivåer och användandet av densamma. Beroende på den marknad Ert företag agerar inom och den strategi ditt företag tillämpar kan de mest viktiga kunskapsområden skifta. De kan variera inom bland annat följande:

- kunskapstillgångar (anställda) vilka utformar företagets produkter och tjänster
- kunskap om kunder och marknaden
- identifiering och överföring av "smarta lösningar" ("best practices")
- individuell expertis

Vi anser att kunskap är en viktig punkt i fråga om effektivitet i en modern organisation. Med anledning av detta så vill vi försöka förstå hur **Ert** företag arbetar på denna punkt. Förhoppningsvis kan Ert bidrag till denna undersökning göra att Ert arbete och tillika organisation blir effektivare.

- Position i företaget:
- Tjänstear:
- Är din organisation bekant med termen "Knowledge Management" finns det några interna definitioner för kunskap? isåfall, hur lyder den?

Intellektuellt kapital

Kunskapstillgångar

Lärande organisation

Annan.....

- Kan du rangordna följande KM-mål och deras innebörd i företagsstrategin? (1 som mest viktigt, och 6 som det minst viktiga)

..... Förbättringen av "återanvändning" och konsolidering av kunskap

..... Standardisering av existerande kundskap i form av processer/protokoll

..... Kombination av extern kunskap och intern kunskap

..... Införsel av ny kunskap från en extern källa

..... Generalisering av ny kunskap inne i organizationen

..... Transformerig av individuell kunskap till kollektiv kunskap

..... Annat.....

- Inkluderas KM i din organisations totala strategiska mål? Om så, finns det personer som behandlar aspekterna med KM?

.....

- Vilka riktlinjer och ”normer” har företaget för att tillvarata den kunskap som finns inom företaget ?

.....

- Hur delar du med dig av dina kunskaper med andra inom företaget (rangordna alternativen med det som överstämmer bäst, börja med 1 för mest viktiga)?

.....Informella möten	.....E-post	.....Databaser
.....Virtuella möten	.....Telefon	.....Rapporter
.....Kurser	.....Gruppmöten	.....Videokonferens
.....Intranet/GroupWare		
.....Databaserade hjälpedor (Intelligent agents)		
.....Annat.....		

- Till vilken grad delas kunskap med hjälp av följande verktyg?

..... E-post	..... Intranet/GroupWare
..... Telefon	.....Databaserade hjälpedor (Intelligent agents)
..... Videokonferens	..... Databassystem
..... Annat.....	

- Hur mycket av ditt dagliga interna arbete sker genom grupparbeten?

5 (Alltid) 4 (Ofta) 3 (Ibland) 2 (Sällan) 1 (Aldrig)

- Vilka är de mest viktiga kunskapsförmedlarna i din organisation?

Människor	Papper	Media
Rutiner	Tjänster	Annat.....

- Var i företaget kan man hitta ”normerna” och ”riktlinjerna” för att kunna styra och delta i distansarbete med andra medarbetare inom företaget?

Hos ledningen	Företagskulturen
Konsulter utifrån	I databaser eller annat skrivet material
Medarbetares erfarenheter	Annat.....

- Till vilken grad använder du dig av elektroniska verktyg i ditt interna dagliga arbetet?

5 (Alltid) 4 (Ofta) 3 (Ibland) 2 (Sällan) 1 (Aldrig)

- På vilket sätt tror du att elektroniska verktyg skapar mervärde för individuell prestation och allmänt inom företaget? (Rangordna alternativen med den som överstämmer bäst, börja med 1 för mest viktiga)

.....Ökar effektiviteten Minskar kostaderna
Bättre tillgång till arbetet Skapa nya kontakter
Ny kunskap in i företaget Annat.....

- Hur ofta uppdateras dessa verktyg?

5 (Alltid) 4 (Ofta) 3 (Ibland) 2 (Sällan) 1 (Aldrig)

- Hur fördelar du din interaktion genom dagen? (ange den fördelade %-satsen för alternativen)

.....Ansikte-mot-ansikte Telefon
E-mail Annat.....

- Till vilken utsträckning kan elektroniska verktyg ersätta ansikte-mot-ansikte kommunikationen internt inom företaget?

5 (Alltid) 4 (Ofta) 3 (Ibland) 2 (Sällan) 1 (Aldrig)

- Vilka nyckelfaktorer anser du viktiga vid distansarbete? Betygsätt vad som du anser viktigast för dig med 1 och minst viktig med 8:

..... Kulturbakgrund (både geografisk och företagsspecifik)
 Kommunikation
 Professionellt beteende och uppträdande
 Kunskapsbakgrund
 Tidigare erfarenheter andra utförda arbeten tillsammans
 Tillit
 Social kompetens
 Fysisk attraktion

- Vilka för- och nackdelar har du upplevt med att arbeta med andra på distans?
 Förväntningar för framtiden?

.....

- Hur lagras information genererad från distansarbete?

Rapporter	Mötesprotokoll	Databaser
Seminarier/kurser	Annat.....	

- Hur förväntar du dig att distansarbete kommer att förändras för din del i framtiden?

Mer distansarbete	Samma som idag	Mindre distansarbete
Inget mer distansarbete		

- Vilka delar av din organisationskultur som du tror stödjer KM?

.....

- Har du varit med om att något distansarbete havererat? I så fall, vad var de främsta orsakerna?

Kulturella aspekter	Kommunikationsaspekter
Tillit	Sociala angelägenheter
Kunskapsnivån/ kompetensen	Annat.....