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# **Effects of Information & Communication Technologies on Knowledge Transfer: An Employee Perspective**

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**Report No. 2011:063  
ISSN: 1651-4769**

## **Abstract**

*In recent years there has been a major direction in treating knowledge as an organizational benefit. Literature suggests that if properly managed, knowledge can be meaningful to develop organizational strength and innovation. Researchers and practitioners have identified knowledge transfer within an organization as an important process. They suggest that Information and Communication Technologies (ICT) play a central role in an organizations knowledge transfer. However, there is a certain risk associated with giving knowledge transfer (KT) a strictly technological approach, as it is not the IT solutions that create value, it is still the users. We therefore wanted to understand how different ICT affect the communication of knowledge from an employee's perspective. To elaborate this issue we conducted several qualitative interviews within a knowledge intensive company. We found that perceived attractiveness of ICT in supporting knowledge transfer depends not only on characteristics of ICT but to a great deal on the type of knowledge that is to be transferred as well as job and task specifics.*

**Keywords:** Knowledge management; Knowledge transfer; Information & communication technology; E-mail; Groupware; Blog; Instant messaging

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## 1. Introduction

With the emergence of the knowledge-based theory of the firm in the strategic management literature there has been a major direction in treating knowledge as an organizational benefit. This shift is stipulated with the transition into a knowledge economy, where knowledge is recognized as a major source of organizational value (Alavi & Leidner, 1999; Garavelli, Gorgoglione & Scozzi, 2002). Building upon the resource-based view of the firm (Penrose, 1959) the proponents of the knowledge-based theory argue that knowledge is the organizations major asset. Due to its complex nature knowledge is difficult to imitate and thus it provides organizations with sources for competitive advantage in the market and finer corporate performance (Alavi & Leidner, 1999). Researchers and practitioners have therefore started to investigate mechanisms to manage knowledge and to make it available for the organization as an asset (Anand, Ward & Tatikonda, 2010). Research has identified transferring (sharing and receiving) knowledge as one of the main processes of knowledge management (KM) (Allavi & Leidner, 2001; Collison & Parcell, 2004; McDermott, 1999) since if properly transferred and used, knowledge can be meaningful to develop organizational strength and innovation (Collison & Parcell, 2004).

Communication technologies play an important role in knowledge transfer processes as organizations rely heavily on IT solutions for their KM efforts (Ngai & Chan, 2005; McCampbell, Clare & Gitters, 1999; Nonaka, Umemoto & Senoo, 1996; Alavi & Leidner, 1999). In this study we will focus on the impact of technological tools which enable the communication of knowledge between individuals. The most common types of IT based KM tools are intranet, groupware, e-mail, instant messenger systems (IM), blogs, wikis (Ngai & Chan, 2005; Duffy, 2001; Lee & Hong, 2002). These communication technologies are aimed to increase the exchange of knowledge as well as the amount of people involved in a common sharing process with the final goal of reducing both time and costs of different working processes.

However, there is a certain risk associated with giving KM a strictly technological approach, as it is not the IT solutions that create transferred values, it is still the people who use them.

According to literature employees are more willing to transfer knowledge through ICT if it offers certain benefits (Hsu et al., 2007; Gupta & Govindarajan, 2000, Cowan et al., 2002). Hendriks (1999) identifies several of these benefits as: efficiency in helping to overcome temporal, physical and social distance constraints, as well as an increase in range and speed of information access. Phang and Foong (2010) argue further on that perceived attractiveness of ICT in supporting knowledge transfer might to a great deal depend on the type of knowledge that is to be transferred.

We therefore assume that different characteristics of ICT might be perceived attractive depending on which type of knowledge is to be transferred. Summarizing these issues our research question, from an employee perspective, will be:

**How do different characteristics of information and communication technologies affect individual knowledge transfer activity?**

We decided to study this topic based on qualitative interviews in a knowledge intensive company, namely Volvo IT. We hoped that Volvo IT being a part of a company acting worldwide would offer us a rich and interesting source of answers to our research question and possibly lead to new solving strategies and ideas regarding technologically enhanced knowledge transfer processes. As at the time the interviews were conducted, adapted communication technologies, respectively KM tools at Volvo IT included groupware, e-mail, blog and instant messenger we considered these to answer our research question.

The remaining of this thesis is structured as followed. In chapter two we will look at knowledge transfer in general and the different aspects of it in special. In chapter three we will describe the different ICTs we looked upon in our study and conclude with a summary of their characteristics. In chapter four and five we will explain our method and our technique of analysis before we will describe our results in chapter six. Finally we will add a discussion of our results in chapter seven. We will then end our thesis with a final conclusion and indications from our thesis for practical knowledge transfer work.

## **2. Knowledge Transfer**

Knowledge Transfer (KT) is identified as one important topic in the area of knowledge management/strategic management (Allavi & Leidner, 2001; Collison & Parcell, 2004; McDermott, 1999). At its most basic level, knowledge transfer occurs when employees transfer job relevant facts, ideas, suggestions and expertise with one another (Bartol & Srivastava, 2002). It has also been defined as: ‘the process by which knowledge of one actor is obtained by another respectively the dissemination of knowledge from one individual or group to another within the organization’ (Sajjad & Zhang, 2011, p .3). Thus, we consider KT to be a means of communicating knowledge between individuals.

According to Levine and Gilbert (1998) the importance of KT has grown for three reasons. First of all, knowledge itself was recognized as a business advantage by many organizations. Second, there has been a shift away from hierarchical to more decentralized organizational structures which aim to focus on employee’s knowledge to improve business processes. Finally, advances in information technology have created new means of knowledge transfer as knowledge can now be transferred faster and between a larger number of organizational members. Moreover according to Alavi and Leidner (2001) KT is important as, if handled accurately, knowledge can be shifted to locations where it is needed and can thus be used to create competitive advantage for organizations.

According to Sajjad and Zhang (2011, p.3) important issues concerning this process include the questions: ‘What knowledge is to be transferred?’, ‘How can knowledge be transferred?’, ‘Why is knowledge transferred?’

### **2.1 What knowledge is to be transferred?**

In order to answer the question: ‘What knowledge is to be transferred?’ - it is first of all important to define what we mean when we talk about knowledge. KM literature on the whole shows that there is no universally accepted definition of knowledge. Nonaka (1994) defines knowledge as justified personal belief. Davenport and Prusak (1998) define knowledge as a mix of experiences and insights meanwhile Bolisani and Scarso (1999) consider knowledge as a combination of information, ideas, procedures and perceptions that guide a person’s actions and

decisions. Moreover according to Stenmark (2002) literature often suggests a separation between data, information and knowledge, when talking about knowledge management. In this thesis we will however argue in line with more contemporary literature, that there is little practical utility in separating these concepts (Bartol & Srivastava, 2009; Alavi & Leidner, 2001; Earl, 2001). We will rather look at what knowledge Volvo IT employees actually transfer on a daily basis. For this purpose we will use a classification made by Johnson et al. (2002), who introduced a classification based on the notion of tacit and explicit knowledge. Tacit and explicit knowledge can be defined as following:

*‘The most commonly used definitions describe explicit knowledge as knowledge that has been captured and codified into manuals, procedures, and rules, and is easy to disseminate. Tacit knowledge, on the other hand, is then knowledge that cannot be easily articulated and thus only exists in people’s heads and minds, and manifests itself through their actions.’ (Stenmark, 2001, p.2)*

Johnsson et al. (2002) differentiate between four different types of knowledge that employees transfer when working, depending upon how easy or difficult it is to transfer or codify tacit into explicit knowledge:

- *Know-What* - This knowledge refers to facts, it can be broken down into bits and communicated as data, as such it is relatively easy to codify.
- *Know-Why* - This knowledge refers to principles and laws of motion in nature, in the human mind and society. Its codification is often incomplete as know-why activities often build on personal skills.
- *Know-How* - The ability to do something: respectively the use of skills and personal knowledge. Parts of know-how may be possible to articulate and parts of it may be codifiable, but there will always remain irreducible differences between the actual skill and the code-book of how to apply knowledge.
- *Know-Who* – This knowledge involves information about who knows what and who knows what to do. It also involves the social ability to co-operate and communicate with different kinds of people and experts. Know-who is highly context dependent. Its characteristics and usefulness depend on social capital in terms of trust, networks and openness. It is therefore rather difficult to codify.



## 2.2 Why is knowledge transferred?

According to literature employees are more willing to transfer knowledge through ICT if it offers certain benefits (Hsu et al., 2007; Gupta & Govindarajan, 2000, Cowan et al., 2002). Hendriks (1999) identifies several of these benefits as: efficiency in helping to overcome temporal, physical and social distance constraints, as well as an increase in range and speed of information access. Phang and Foong (2010) argue further on that perceived attractiveness of ICT in supporting knowledge transfer might to a great deal depend on the type of knowledge that is to be transferred.

Johnsson et al. (2002) argue further on that the easiness of codification of the knowledge that is to be shared and thus the ‘differences in the amount of competence that is lost in the transformation process’ are crucial for KT's attractiveness (p. 254). The authors write that the ‘*know-what*’ type of knowledge is relatively easy to transfer, meanwhile the ‘*know-why*’, ‘*know-how*’, and ‘*know-who*’ type of knowledge is often incomplete and will always present irreducible differences between the actual skill and the code-book of how to apply this knowledge (Johnson et al., 2002). We can thus assume that employees will rather transfer *know-what* knowledge then *know-why*, *know-how* and *know-who* knowledge as the complexity of the latter makes their transfer more work-intensive, less satisfactory in the outcome and thus less attractive to the employees.

## 2.3 How can knowledge be transferred?

Literature suggests that Information and Communication Technologies (ICT) play a central role in an organizations knowledge transfer (Sajjad & Zhang, 2011; Huber, 1991) due to the very nature of these technologies in coordinating and promoting communication (Phang & Foong, 2010). According to Hendriks (1999) the use of ICT in a company's KT process can be efficient by helping to overcome temporal, physical and social distance constraints; and increase in range and speed of information access. Temporal distance can be overcome through storing knowledge and making it available over time. For example through knowledge repositories, common schedules, online discussion groups, etc. Virtual teams can be used to overcome both temporal

and spatial constraints. Social distance (culture, language, differences in cognitive and conceptual frames, etc) can be overcome through: 'tools facilitating social translation (e.g. learning maps)' (Hendriks, 1999, p. 93). Moreover, according to the author, ICT can help to identify location and accessibility of relevant information as well as knowledge experts.

Phang and Foong (2010) however argue that the effectiveness of ICT in supporting knowledge transfer might to a great deal depend on the type of knowledge that is to be transferred. The authors argue that ICTs are generally used for managing and codifying knowledge as well as creating networks. Most commonly, ICT are said to facilitate the capture, storage, retrieval and distribution of explicit knowledge, in order to make explicit knowledge even more accessible and more transferable. On the other hand tacit knowledge is difficult to extract, codify and transfer as it is personal and embedded within the human brain. ICTs alone will therefore not be able to transfer tacit knowledge fully and effectively. Stenmark (2001) referring to Hansen et al. (1999) moreover suggest that if employees use mainly tacit knowledge to solve a problem, they should rather communicate face-to-face than trying to store it somehow. This is as face-to-face communication is richer in its nuances and communication cues and thus offers more possibilities to transfer the various facets of tacit knowledge. On the opposite it can lead to problems if employees try to codify their tacit knowledge to transfer it via ICT as important details might be lost in the process.

Thus, instead of codifying tacit knowledge, companies should utilize ICTs to make use of their networking capabilities (Phang & Foong, 2010, Stenmark, 2001) This will help to bring people together in sharing tacit knowledge without having to make it explicit. This can for example be achieved through various groupware applications and intranets that have features such as transferred databases, collaborative spaces, advanced communication features, electronic yellow pages, automated knowledge maps and expertise databases, through helping to locate and connect people who either seek or possess relevant or required knowledge (Phang & Foong, 2010).

Earlier studies focus generally on the relevance of ICTs in supporting or facilitating knowledge transfer, however they miss to examine the link between the type of knowledge that is to be transferred and the type of ICT that is used to do so:

*'Since the type of tacit or explicit knowledge needed for effective performance of tasks varies with the task complexity, an understanding of the relationship between type of ICT application and mode of knowledge sharing would provide insight into the appropriate matching of the type of ICT application with the type of knowledge needed to be transferred in a particular task setting' (Phang & Foong , 2010, p.26).*

Thus, we will look upon how the four types of knowledge classified by Johnson et al (2002) are transferred through the various ICT used at Volvo IT, and how the different characteristics inherent to these tools affect KT among the employees.

We will concentrate on four ICTs: e-mail; groupware, chat and blog as those exist to transfer knowledge within the company. Each of these tools has different characteristics which may affect the employee's choice to transfer tacit or explicit knowledge with their help. The following section will provide short summaries on these ICTs as well as the various characteristics that they possess.

### **3. Various Characteristics of ICT**

During the last years organizations started to use various ICT to facilitate knowledge transfer within the organization (O’Kane & Hargie, 2007). Each of these tools has different characteristics which we assume to affect knowledge transfer.

#### **3.1 E-Mail**

In the new technologically advanced world almost everyone has become used to the interaction through e-mails. Communication through e-mails is text-based and asynchronous; between one and more predefined addresses (Rice & Webster, 2002). Information is high in quality due to the tools reflective nature, which allows: ‘the writer to more carefully choose and review message content before sending it’ (Boneva et al., 2001, p. 544). When archived e-mail respectively mail boxes can serve as available knowledge repositories for their owners and contain high quantities of unstructured knowledge. (Whitaker & Sidner, 1996; Schirmer, 2003; Newman, 2002) This ICT tool might also result in ambiguity, stress and conflict due to the excess of information contained in long e-mails (Friedman & Currall, 2003; Sallis & Kassabova, 2000) and through the high amount of e-mails employees often receive (Whitaker & Sidner, 1996). Further on the number and size of the documents that can be sent and/or transferred through an e-mail are limited, which will result in increased time spent on knowledge sharing through sending a long file through multiple e-mail threads.

#### **3.2 Blog**

A blog is a web site that is highly structured as it contains dated entries in reverse chronological order (most recent first) about a particular topic. Blogs are easy to create, maintain and use and thus reduce the technical skill required from the users for exploiting their features (Godwin-Jones, 2003). Functioning as an online journal, blogs can be written by one person or a group of contributors, offering the possibility to make knowledge available for a wide range of users. Blogs are easy to create, maintain and use and thus reduce the technical skill required from the users for exploiting their features (Godwin-Jones, 2003). A blog further on allows the authors to include links to other web sites, images as well as a search facility (Boulos et al., 2006). Blogs

engage people in knowledge sharing, co-constructing knowledge, reflection, and debate. These activities are possible through asynchronous communication through posting commentaries, availability of knowledge through archives of previous posts as well as links to various other information resources (Boulos et al., 2006). However due to their open source nature, blogs are prone to vandalism thus reducing the quality and security of information posted on it (Boulos et al., 2006).

### **3.3 Groupware**

Lococo, and Yen (1998, p. 86) define groupware as: ‘computer software that functions to provide a means for human collaboration’. They provide several definitions of groupware, among which the one presented by Bidgoli, 1996, who identifies groupware as: ‘software systems that support a group of decision-makers engaged in a common decision-making task by providing access to the same transferred environment and information’ (Lococo, & Yen, 1998, p. 86). The goal of groupware is to assist groups in communicating, collaborating and coordinating their decision-making activities, which may facilitate the creation of a competitive advantage through the improvement of intra-group communication.

The effective functionality of groupware can be prescribed to its ability of supporting human interaction in terms of time and place. Groupware usually includes various different features. In this thesis we decided to focus mainly on TeamPlace which is used by Volvo IT as a part of MS SharePoint. TeamPlace, like groupware in general provides a possibility for groups to choose their own privacy settings and to allow/restrict access to a determined group of users (Lococo & Yen, 1998). TeamPlace is used to collaborate within different teams through for example file sharing, a document repository of both structured and unstructured data and a common calendar. Thus communication is mostly asynchronous (Lococo & Yen, 1998; Mohan, et al., 2000).

### **3.4 Instant Messaging**

Instant Messaging is a technology that allows users to set up a list of contacts that will be able to send notes to- and receive notes from each other including the possibility to send different kind of documents. In most IM systems users can only send messages to others if they use the same system. Looking at IM systems, the characteristic of 'presence awareness' is crucial. Presence awareness represents: a type of peer monitoring designed to enhance communication between colleagues (Cameron & Webster, 2005, p.3) It allows users to see status indicators representing other user's status – what they are doing at the time, if they are online, offline, available or occupied etc. - thus giving an indication of whom is available and what is going on (Cameron & Webster, 2005) In IM sending and receiving messages is possible in almost real time, which if a user is currently available, offers nearly instantaneous communication and fast feedback (Cameron & Webster, 2005; Czerwinski et al., 2000). IM is often used to receive quick answers; messages sent through IM are usually shorter than for example email messages (Cameron & Webster, 2005). Regarding the use of symbolic cues, communication via IM is described as: informal and non-authoritative thus breaking down hierarchical barriers (Cameron & Webster, 2005, p.3). It is possible to carry on several IM conversations at once, to communicate one-to-one or to include different persons in one conversation (Czerwinski et al., 2000).

### 3.5 Summary

In this research we will try to identify the effects of ICT on knowledge transfer from an employee perspective. For this purpose we will first summarize the ICT tool's major characteristics based on the various features identified in the previous chapter (see Tab. 1 below):

	<b>E-Mail</b>	<b>Blog</b>	<b>IM</b>	<b>Groupware</b>
<b>Availability</b> Being able to store knowledge in order to make it available for future usage (e.g. in a mail-box, an online blog entry, an online library). (Godwin-Jones, 2003; Bidgoli, 1996. In: Lococo, & Yen, 1998)	X	X		X
<b>Presence awareness</b> Being able to see status indicators representing other user's status; if they are online, offline, available or occupied etc. (Cameron & Webster, 2005)			X	
<b>Structured</b> Being able to store knowledge in a structured way, so it can be found by others later on. (Godwin-Jones, 2003)		X		
<b>Unstructured</b> Storing knowledge in a way that makes it hard to find it later on. (Whitaker & Sidner, 1996; Schirmer, 2003; Newman, 2002; Friedman & Currall, 2003; Sallis & Kassabova, 2000, Lococo & Yen, 1998; Mohan, et al., 2000)	X		X	X
<b>Synchronous</b> Sending and receiving messages in real time. (Cameron & Webster, 2005; Czerwinski et al., 2000)			X	
<b>Asynchronous</b> Sending one message at a time or storing it at different places. Leaving time and place of reception and response to the receiver/s. (Lococo & Yen, 1998; Boulos et al., 2006; Rice & Webster, 2002).	X	X		X
<b>Visibility of updates</b> Being automatically informed about up-dates, thus always being aware of the newest version. (Godwin-Jones, 2003)		X		
<b>Direct communication</b> Sending directly to- and receiving messages directly from a determined person/ group of persons.	X		X	

(Rice & Webster, 2002)				
<b>Indirect communication</b> Storing knowledge at a common place thus making it available for other undetermined receivers. (Godwin-Jones, 2003; Lococo & Yen, 1998)		X		X
<b>One-to-one communication</b> Sending messages to- and receiving messages from one person. (Czerwinski et al., 2000; Rice & Webster, 2002)	X		X	X
<b>One-to-many communication</b> Sending the same message/s to many persons at once. (Czerwinski et al., 2000; Rice & Webster, 2002; Lococo & Yen, 1998)	X	X	X	X

Tab. 1 ICT Tools and Characteristics (X indicate that the characteristics are applicable to the tools.)

We will analyze how these characteristics have an impact on the employees` knowledge sharing behavior including their choice of different media for sharing and receiving the different knowledge types *know-what*, *know-why*, *know-how* and *know-who* as defined by Johnsson et al. (2002).



## **4. Methodology**

### **4.1 Choice of the company and preliminary work**

We chose to do our case study with Volvo IT as it offered an interesting insight into communication technology based knowledge transfer in a big and global acting company.

The report is based on seven semi structured qualitative interviews with different persons inside the organization. Prior to these interviews we conducted an interview with the current director of Human Resources, Strategy & Competence Management at Volvo IT. In his interview we tried to get a first picture of the company's culture, different forms of socialization as well as about existing technological tools to communicate knowledge. Based on this information and the literature findings we formulated our question catalogue for the following interviews.

### **4.2 Interview**

In this study we worked with semi-structured qualitative interviews. This method is recommended if the researcher wants to get a deeper understanding of the context and the process of a certain action (Cope, 2009). We used this method as we were interested in the employee's point of view and as we wanted to get to know a broad spectrum of their experience when using communication tools. Through the interview the researcher can collect qualitative data; data that is descriptive and narrative, and that seeks to capture a persons experience in his or her own words (Patton, 2002). During the face-to-face interview we used open questions, which cannot be answered with a simple yes or no, giving the respondents freedom in expression (Patton, 2002). Such a freedom would not have been given if we would have used a questionnaire as here topics, questions and answers are mostly predetermined and thus may cut out a great deal of employee's experiences and opinions.

The interview method used was an interview guide (see Appendix A). An interview guide lists a number of questions or issues that are to be explored during the interview (Patton, 2002). It ensures that all important topics are covered but still allows the interviewer to explore, probe and ask new questions as the need for more information arises. The interview style is conversational,

and even though the focus lies on a predetermined subject it is possible for the interviewer to ask questions spontaneously (Patton, 2002).

### **4.3 Participants**

According to Guest, Bunce & Johnson (2006) most commonly used samples in research are purposive samples, which can be of different varieties. In our study we used the snowball-technique (Ericsson, 1979). This means that we have interviewed one individual and then asked for the name of another possible interviewee.

The number of interviewees was determined inductively in the sense that we continued until we reached data saturation, defined as: 'the point in data collection and analysis, when new information produces little or no change to the codebook' (Guest, Bunce & Johnson, 2006, p.8). Guest, Bunce & Johnson (2006) have showed that saturation often is achieved after six to twelve interviews, depending on the depth of the overall themes. In our case this was achieved after seven interviews.

For ethical considerations, respecting the wish of our interviewees to stay anonymous, we can only provide general information about our participants. The group of participants included both men and women which were approximately between 30 and 45 years old. The participants had worked at Volvo IT between seven months and 22 years. At the time the interviews were conducted they worked in different fields at Volvo IT such as HR, IT and Business development and held different positions such as director, manager, developer and consultant. Stating our results, we will refer to the participants as respondent 1-7 (R1-R7).

### **4.4 Limitations**

We are aware of the weaknesses of the qualitative method that will be used during the research; it may appear in form of false and hidden answers from the person interviewed as well as answers could have been influenced by personal opinions (Carmines & Zeller, 1979). Moreover the snowball-technique has been criticized as it can lead to biased samples (Ericksson, 1979). However as we have used different persons as starting points of the sample that were independent from each other, we hope that we have avoided this draw-back of the sample

method. Another limitation concerning this study was the lack of contact to the company. For example did some employees, as they were short of time, prefer less intense interviews. One employee was only available via a cell-phone, which included a bad sound quality. Moreover only some interviewees would answer follow-up questions which were meant to understand unclear quotes after the actual interview Therefore some information might be unclear, and hard to analyze. For example a strict differentiation between the company intranet – called Violin and the Microsoft SharePoint as well as a clearer differentiation of which type of knowledge was meant exactly when employees talked about sharing and receiving a ‘document’.

#### **4.5 Data Analysis**

In order to insure transparency it is necessary to explain our method of analyzing the data collected in the interviews. While analyzing it is critical to be aware of the connection between theory, design and data analysis right from the start as the process of data collection is directly related to how they can be analyzed (Guest, Bunce & Johnson, 2006). The interview guide was aimed to find answers to our research question. From an employee perspective: ‘How do different characteristics of communication technologies affect individual knowledge transfer activity?’

To analyze the collected data we used a process of coding. *Coding* refers to:

*‘A data reduction process of creating categories based either on inherent qualities of the data or on elements predetermined by the researchers to be of particular interest. It can reveal commonalities and disjunctures, investigate patterns and themes, and produce new knowledge and insights (Cope, 2009, p.350, 352).’*

As recommended by Cope (2009) before analyzing the data we went back to our research question and the theories mentioned above, in order to identify codes that are implicit in the topic. Thus primarily using the method of: *Axial Coding* (Cope, 2009), we took the knowledge typology identified by Johnsson et al. (2002) as well as the various characteristics of the ITCs identified in fig.1 and grouped the data into different categories (See Appendix B).

We went then, each author by herself, through the interviews and connected each new statement to one of the fields in the spread-sheets. Statements that would not fit to any of the fields were

put in the category of open code and looked at separately. After both had finished this process, we compared similarities and differences in the analysis. Differences were discussed intensively until both authors could agree to the same category. Like this we increased the reliability of the results as we diminished the influence of personal opinions and too one sided interpretations.

Following this part we will turn into chapter six where we will state our results as found through the coding process. We will then turn towards a discussion answering our research question.

## 5. Results

Generally employees' choice of ICT depended on which possibilities the various tools offered them to get their job done. It was hereby found that employees used the specific ICT which offered them the possibility to find or share knowledge in the fastest possible way without losing too many details in the KT process. This was perceived as more effective in case of *know-what* knowledge then for *know-why*, *know-how* and *know-who* knowledge. However, generally different ICTs were found to offer different possibilities depending on their characteristics to do so. We will now have a closer look in how far characteristics of the four ICT affected KT behavior in connection to the different knowledge types:

### 5.1 E-Mail

E-mail was often chosen when employees wanted to transfer *know-what* knowledge. E-mail was chosen to transfer *know-what* knowledge as e-mail offered the benefit to communicate directly one-to-one or one-to-many. Thus employees could reach colleagues and be sure that sooner or later the contacted person would read the mail and probably answer as opposed to trying to reach someone over the phone:

*'I do not use the phone very much. It's more over the e-mail I think. I think it is because everybody is so busy all the time so, so nobody is answering the phone. Everybody is sitting in meetings. And then you can communicate when they have time. As soon that they have a chance to read the e-mail they will answer back.'*(R1)

As e-mail was useful to communicate one-to-one it was often used to update someone specific about new information that was up-loaded within the TeamPlace:

*'Usually when I give some information it is to the management team. And then I usually send them an e-mail, often with a link exactly to the document on the TeamPlace for example.'*(R4)

Moreover employees often used e-mail when they needed *know-who* type of knowledge. Via e-mail they could post a question one-to-one or one-to-many to colleagues they already knew and receive an answer to their question:

*'I use our intranet. We have a huge I mean we have like Google, we have a hundred thousand employees, there is a lot of TeamPlace, so I just do free search or I know*

*certain communities where things are happening or I will post a question to a number of persons by e-mail: Does someone know about this? What is happening etc. '(R6)*

E-mail was not used by our interviewees to transfer *know-why/know-how* as employees found it difficult to transfer complex knowledge into written language. Employees described that sometimes it was hard to convey all the knowledge that they possessed regarding a certain issue in a written format and that it cost a lot of time to do so, if one did not want to risk misunderstandings. There were cases where they would have preferred to use a richer media, namely face-to-face communication, in order to be able to see people's reactions, however could not do so, as often special distance or time constraints were hindering them:

*'...it could be that you sometime have knowledge that is hard to express in such a condensed way that the reader takes the time to sort of fully understand what I'm trying to say. That's a negative thing. But it's sort of leveling between your time and your reader's time ... the people you're trying to communicate with. It's a when you're talking face-to-face it's more easy to sort of adjust to you can sort of elaborate on certain topics and you see that the person you're talking to doesn't really get what you're trying to say. That's not possible in written communication. '(R7)*

Structuredness as a characteristic of e-mail accounts was perceived by employees quite ambiguously. Some employees used their e-mail account as a knowledge repository. They did so as they liked to have certain knowledge written down for themselves to be able to track their actions:

*'I think it's easier for me to have responses and even information written down, because we work in HR and there is a lot you know legislation and different agreements and stuff like that. So it's good to have it in writing. '(R1)*

*'E-Mail is more for structured contacts. Customer contacts where you want to have a trail showing what you have done previously. '(R4)*

On the other hand there were also employees that perceived e-mail as unstructured. They felt that there were just too many messages in their mail-box. Further on they felt that knowledge that was stored there was not available for others and often not up-to-date anymore:

*'It could be hard to find information of course also. And as I said also, sometimes the information is no longer valid. '(R7)*

*'[About sharing knowledge via SharePoint vs. E-mail] I think it doesn't fill up the mailboxes with a lot of attachments... Yeah I think that's one of the advantages of*

*that. And if someone wants to look for something it's they know it it's stored in a central place and not on someone's PC.'*(R5)

## 5.2 Blog

Blog was found to be one of the only tools to transfer *know-why/know-how* knowledge with. This was first of all as employees had to transfer knowledge between different stakeholders. Here a blog offered the benefit of saving time as many people inside and outside Volvo IT could be reached at once and had access to knowledge without filling up once mail-box with unwanted mails:

*'So we are about at Volvo IT it's approximately 35, 40 Volvo HR business partners around on the globe. So to try to connect with them instead of sending spam mails or something so I call it. So I make an update the blog and then you have the link there as well.'*(R2)

One could say that e-mail could have done the job. However a blog further on diminished the drawback of possible misunderstandings through more synchronous communication possibilities. Updates are immediately visible and users can communicate one-to-many with the author/s and other readers through posting comments:

*'[About sharing] We agreed in the global HR team that the global HR-org would benefit from a faster more transparent information tool, with the possibility to have a dialogue (really we would have liked to set up a discussion forum, but in the current version of SharePoint , the blog-functionality provided us with the best technology support.'*(R2)

*'And in my group we also have an external side based on world press about where we share information about what we are doing. Where we write blog post in order to keep the external customers and actors informed and collaborate with them a little bit.'*(R4)

## 5.3 Groupware

Regarding TeamPlace, which is a groupware application used at Volvo IT, it can be stated that this ICT was used to transfer *know-what* knowledge as well as *know-why/how* and *know-who*. However the last two to a minor degree. Most of the people used the TeamPlace application in order to transfer knowledge within their project groups and teams. Here TeamPlace offered the benefit that knowledge was accessible to everyone in the team, but that at the same time certain areas within the TeamPlace could be restricted for just some members:

*'[About sharing] I use our team place a lot. And I actually have a restricted team place for or parts of it I segmented into three levels. The board, the people that are engaged in different projects, external organizations, but we only talk about internal communication here but I have external thought of partners, vendors, students etc. So I categorize a bit of information about that kind of sensibility level or so on.'*(R6)

However many employees considered TeamPlace as highly unstructured as there is many different TeamPlaces that exist independent from each other and are structured in different ways. This makes it hard to actually find relevant knowledge and therefore caused a lot of dissatisfaction among employees:

*'I think it is a lot of different team places. Every group has a team place and it's a mess. Just to find the right team place. And to find the way in the structure in that team place. Nowadays it is just very very common that someone is just writing an e-mail: It's in team place' - and then you go there to look into this team place. And it's this big. And you can't find where is that information. It's a lot of different versions maybe. It's very hard to find the right information I think. When it comes to team space and stuff like that. I think it's a good thing to have it but everyone uses it in every group and we have a list of hundred team places. It's really impossible to stay updated and really to find the way forward.'*(R1)

Moreover employees consider the quality of information stored on TeamPlace to be low, due to the fact that documents search returns only very unspecific hits and often documents that are not up to date. Search results contained both relevant and irrelevant documents, where sometimes it is hard to find which versions of the same document were the latest and which were already irrelevant:

*'I mean SharePoint is not optimal when it comes to indexing of information. In fact it's quite hard to find good information. You get so many hits on non relevant stuff and also very old versions of documents and so forth, so would there be I mean more better tools then I for sure would use that... but at least the thing that we do have it works at least right now.'*(R7)

Another factor hindering a smooth knowledge transfer process is the excess of knowledge stored into TeamPlace. This makes it very hard if not impossible for employees to find the right knowledge in a short period of time. Further on updates of documents can easily be overseen:

*'We have a list of hundred TeamPlaces. It's really impossible to stay updated... And it's this big. And you can't find where is that information. It's a lot of different versions maybe.'*(R1)



Another drawback of TeamPlace was the relative stability of knowledge in TeamSpace. One could not just make a comment or edit text directly but had to update a whole new version of a document each time a change should be made. Further-on these updates were not announced automatically to the other group members:

*'I think it is very clumsy. I mean I need to save down my file locally and then I have to move it to SharePoint. And I mean it's really hard there is a trillion team-places and you can't keep track of all of them. You need to remember these horrible long address URL's and you are, and everyone tries to store them and no one remembers sort of which one was which.'* (R4)

The high level of asynchrony when communicating over TeamSpace lead to the fact that employees considered SharePoint rather as a database then as a tool for collaboration:

*'[About SharePoint] but that's not really direct communication with people, it's not like you know chats or forums or so it's more like a repository of information.'* (R7)

It was found that employees reacted to these draw-backs by switching over to other ICTs. Some employees used e-mail or IM additionally to inform their team colleagues about updates in their TeamPlace. Others had invented a drop-box which would give the employees opportunity to edit and update the existing information. Still others had introduced a blog to enhance better team collaboration.

On the other hand its huge amount of stored knowledge was also seen as something positive in some cases. Mainly by those employees, who due to the nature of their job had to search for rather general *know-what/know-why/know-how* within their area of expertise and did not depend on a specific search result:

*'Yeah searching SharePoint of course is that you may come over information by coincidence, which maybe surprising but open up new possibilities.'* (R3)

Employees also chose TeamPlace to do search for know-who in case they did not know an expert they could turn to, and had no one in their close network that could give them a hint whom to ask. In this cases TeamPlace offered them a wide range of people available within Volvo. On the other hand TeamPlace in TeamPlace employees could have a personal site, were one could publish a personal profile in order to be available as an expert for other persons:

*'I use our intranet. We have a huge I mean we have like Google, we have a hundred thousand employees, there is a lot of team-places , so I just do free search or I know certain communities where things are happening (...)'(R6)*

*'[About being found as a expert] I have an updated..we have something called "my site" on the intranet. It's a kind of a personal share point site so there have my profile.'(R5)*

## 5.4 Instant Messaging

This ICT was preferred when the questions and their answers were considerably short and precise, indicating that most of the time people used IM to share knowledge that was *know-what*. Through the characteristic presence awareness employees could see who was available and contact that person directly. Thus receiving an almost synchronous feed-back to their questions, wherever the colleague would be at that moment:

*'I think that the communicator for instance is very good since you get a very direct access to people and you can often you just have short questions and you could reach them when ever and you could see if they're available or not...quite often also get hold of people even though they're in meetings since people tend to be in meetings all the time but you cannot really wait for slots. So I mean the alternative to that is to use e-mails, but I think that the communicator is a really good tool.'(R7)*

As people could be reached directly and with few effort IM was also used to make quick updates to other employees about new information stored in TeamSpace:

*'We use e-mails or communicator ping just to update people that ok now there is new information available for you here at the TeamPlace site.'(R5)*

IM was however was not useful as soon as questions or transferred knowledge would become more complex, respectively switched from being *know-what* to *know-why/know-how*:

*'Actually communicator is quite inefficient. It's good to get a yes no, but once you start to get into dialogue you love to type the dialogue and it's engaging but it's not productive it takes a longer time its more misunderstanding then to pick up the phone actually (...).'(R6)*

## 5.5 General Findings

The type of knowledge that employees usually transferred in their daily activities through the use of the five types of ICTs was predominantly *know-what*. *Know-what* knowledge that was transferred was usually comprised of routine activities such as setting up meetings; sending meeting invitations; writing and receiving meeting minutes; transferring project information, documentation, status, update notifications, etc.:

*'Usually I want to have ..some kind of an (...) news of things. Specific things going on. When it comes for training for example it would be interesting for example to know, when are the next planning sessions so I can plan my work to that. Another thing is also related to the ability to plan. That for example we have an HR calendar to see when are the deadlines for some processes. When are, when will some processes start. So those dates are important. And as in any big company you have the reporting dates. That`s you have to do the monthly reporting or the quarter reports. That they need to be finalized at certain dates..so that`s good information to have.(R2)*

*'[When I share] its instructions. Now we have this HR Process here. We should start with the salary review. This is what we should do, and then different steps we want. And then it`s just information, you know the outcome of the salary review was this percent for example.'*(R2)

When it came to clearly defining *know-why* and *know-how* knowledge we found that employees did not make a clear distinction between these two types of knowledge, we will therefore treat them as one unit in our result and discussion part. *Know-how*, and *know-why* types of knowledge were generally transferred to a lesser degree. They were usually transferred in cases when employees needed a deeper insight into the issue at hand. For example to get the whole background of a conflict situation, or to provide external customers with the full picture of a current project status:

*'[I share] project information kind of you know stakeholder reporting. I work you know a lot with stakeholders and to bring their input into what I`m doing and I need to sort of give feedback back to them and have an ongoing dialog and try to do it formalized also that`s sort of to keep track of things that we`re doing so that`s on a daily basis and that we quite often do in terms of documents.'*(R7)

*'If somebody has a question. They, I advice them. A lot of things (...) So I think it`s both instructions and giving them guidelines. Also to advice them. In more hard you know tuff situations.'*(R1)

*Know-how* and *know-why* were also transferred when employees were lobbying for certain issues; were involved in administrative processes and negotiating decisions; searched for technical news and inventions, etc. Moreover employees searched for *know-why* / *know-how* if they wanted to get new input for their areas of expertise such as different available solutions or new insights into different areas of technology:

*'In my job I look at trends and new IT technologies. That could be bringing business value to the Volvo group. I search for new IT technology trends. A lot of general surfing basically. To understand what is happening.'* (R4)

The *know-who* type of knowledge that was usually transferred was needed to identify experts and to gain first-hand knowledge from them through online profiles, expert databases and individual networks:

*'You have to find some information that can lead you to experts. And then you want the experts to lead you to new information that can lead you to other people. Because Volvo is kind of a very much relationship oriented company with lots of networks. So you need to get connected to these networks. And then you need to find the persons that can direct you to other persons. So that kind of information is most important for my life.'* (R6)

As mentioned above, we observed that there was a clear difference in the amounts of the different knowledge types that were being transferred. *Know-what* knowledge was generally found to be transferred through different ICT to a high degree. On the other hand the types of knowledge *know-why* and *know-how* were generally transferred to a considerably lower degree via the different ICTs, but rather through phone or face-to-face. As reason for this we identified the difficulty employees felt they had with codifying more complex knowledge in a written format:

*'I mean it would probably be that it's hard to share information that in a good way. Meaning that it could be that you sometime have knowledge that is hard to express in such a condensed way that the reader takes the time to sort of fully understand what I'm trying to say. That's a negative thing. But it's sort of leveling between your time and your readers time ... the people you're trying to communicate with. It's a when you're talking face-to-face it's more easy to sort of adjust to you can sort of elaborate o certain topics and you see that the person you're talking to doesn't really get what you're trying to say. That's not possible in written communication.'* (R7)

*'Well. You know, when you don't meet people in person it's you always get lost, or you lose some of the communication when you cannot see the other people that*

*you're speaking to. And also when considering communication it's hard to sort of put everything on paper that you know.'*(R7)

Apart from the actual difficulty of codification, it showed that a high complexity of the knowledge that had to be transferred was another reason for not choosing ICTs to transfer it but rather phone or face-to-face conversations:

*'It's because I need a full background when I have an issue. If there is maybe a person – If a manager has a problem with an employee for example and they send me an e-mail maybe about that then I have to phone them and ask them you know: What has happened? Can you tell me all about it. So it I need the background to have this full picture. And also if it comes to more difficult HR issues there is not one single answer. It could be different answers. So you need to talk to them and discuss and ask the manager what do you want to do with this – and how do you feel about that. It's a lot of, it's not any you know black and white answer to the questions usually.'*(R1)

Thus it seemed important for employees to get a feeling for the person they exchanged knowledge with and for what was actually going on. It showed that knowledge about the actual context of a situation was important for employees; however informal opinions or feelings of people involved in a process could not be transferred sufficiently through the ICT, as obviously important cues got lost in the process of codification. This was problematic further on as employees did experience that missing cues could lead to misunderstandings which would cost them working time and could moreover have a bad effect on the work environment:

*'[About IM] (...) decisions are never white or black. There is always a shade there and when you take decisions you need to be very clear about what you are communicating otherwise it will just be misunderstood and it will become the whispering [meaning whistle blowing] thing (...).'*(R6)

## 6. Discussion

From an employee perspective: How do different characteristics of information and communication technologies affect individual knowledge transfer activity?

As we saw perceived benefits are dependent upon the various characteristics that technologies can possess. We will therefore discuss different characteristics of the various ICT from the employee's point of view and its effect on their knowledge transfer behavior.

### 6.1 E-Mail

E-mails were used for transferring knowledge due to its most common characteristics of asynchronous communication over time and space; direct communication; one-to-one as well as one-to-many communication. Moreover this ICT was used to communicate with people, who were either external stakeholders or were not part of a closed project group within SharePoint. Employees used e-mail mostly to transfer *know-what* knowledge. As we looked in more detail at the use of e-mail we saw that employees used one-to-one; one-to-many communication, in matters that were not urgent as they knew that they would receive an answer, however the recipient could decide when exactly this would be. This asynchronous communication was also preferred over phone contact as this way the question would surely reach the respondent, and he/she could choose the most convenient time for them to respond.

E-mails were also used for their basic characteristic of facilitating communication, when people needed to send short messages about updates in SharePoint sites, a feature that was not available in the latter.

In two cases it was interesting to see that e-mail as an ICT supporting the KT process was chosen because of its ability to serve as a document database: a knowledge repository of a sort, which was used to track conversations and actions over time. Indeed, in the recent years, e-mail has been used more and more as more than just a communications application, but rather as a tool that provides additional functions of task management and personal archiving (Whittaker & Snider, 1996). On the other hand other employees said e-mail as a knowledge repository was not

efficient as the knowledge stored there was not updated and it was only available to the people involved in the e-mail communication, thus making it less accessible.

It was also interesting to see that this ICT was not used to transfer *know-how* and *know-why* type of knowledge as they are usually comprised of more tacit knowledge. Employees described that written communication available through e-mail was not useful in these cases as it was hard to describe all the knowledge in a written text, without losing important cues and parts of the message. Moreover, employees felt that it would take too much time actually codifying this knowledge into a written form in a meaningful way.

## 6.2 Blog

Blogs were mainly used for two reasons. First, because through a blog a wider audience, both internal and external, could be reached at the same time. The second reason was its characteristic of providing an opportunity for more synchronous communication through visibility of updates and immediate feedback through comments. This second characteristic was essential in an employee's choice to transfer *know-how* and *know-why* type of knowledge through this ICT. The synchronicity and the possibility to collaborate with each other aided knowledge transfer when it came to transferring more tacit knowledge. It saved time and effort reaching people but as opposed to e-mail, decreased possible misunderstandings and out-dated data storing. This indicates that social interaction and collaboration are indeed important for KT when it comes to transfer *know-how/know-why* types of knowledge, thus confirming the theory of Phang and Foong (2010) and Stenmark (2000-2001).

We can therefore say that tool characteristics can influence possibilities of interaction and thus have an impact on whether or not tacit knowledge is transferred via specific tools. However, it should also be noted that the choice of the Blog as an ICT to transfer *know-how* and *know-why* knowledge was also influenced by the fact that the collaborative group had both internal and external members which they needed to stay in touch with. This indicates that job specifics and overall context does also affect KT behavior.

### 6.3 Groupware

First of all the high level of asynchrony when communicating over TeamPlace (as an application within Microsoft SharePoint) lead to the fact that employees considered SharePoint rather as a database then as a groupware collaboration tool. *Know-why/how* was also transferred via this TeamPlace (as part of the MS SharePoint group) but to a minor degree.

TeamPlace was used as a tool to codify, store and transfer these types of knowledge in case employees wanted to transfer it internally within closed groups of people immediately engaged in the project at hand. The feature of setting your own privacy settings within a group and thus controlling which knowledge should be accessible to who was identified by several employees as a benefit. One employee mentioned that this way all members of a group had access to a document instead of having it stored on someone's PC. However this characteristic could also cause problems. If employees needed for example to transfer knowledge towards other employees not included in a project team as well as with external sources such as customers and stakeholders, privacy setting could act as a hindrance to do so. In these cases some groups of employees had to switch to other ICT solve this problem.

Further on the lack of a common structure within TeamPlace; an overall excess of knowledge; hardly searchable and often out-dated documents as well as the difficulty of keeping track with the newest changes, were perceived as major drawbacks for this ICT. These factors made it too time consuming for KT to be perceived as effective. For example as it was hard to see which documents had been updated employees spent additional time on using other ICTs like communicator or e-mail to inform colleagues about available updates. Another drawback associated with the unstructured nature of knowledge in SharePoint application was the fact that the search for all four types of knowledge resulted in too many hits, which were most of the time not relevant to the specific search and/or documents that were out-dated (search returned older versions of documents that had already been updated). Employees saw this as a negative effect if they needed specific knowledge that was hard to find. One group of employees had therefore chosen to work over a drop-box within their project instead. Yet another employee was



developing a dash-board which should help employees to track all there important document activities at once, thus not missing important new knowledge and/or updates.

However the general excess of knowledge in SharePoint was also viewed positive by individual employees. Depending on the nature of their search and their overall tasks, these employees often wanted to get a general insight about what was going on within their field of expertise and thus had no problem with getting a broad spectrum of search results back. Here we see that individual preferences dictated by job specifics played a role on whether the ICT characteristic was perceived a benefit or cost when transferring knowledge.

Several employees used SharePoint also as a knowledge repository for the *know-who* type of knowledge. The *know-who* type of knowledge was usually transferred through the use of expert databases and expert profiles within the SharePoint as well as the company intranet. This was the cases when employees could not reach an expert through their personal network and thus needed to locate still unknown experts. SharePoint also offered them the possibility to have a personal site, where one could publish a personal profile. This characteristic of SharePoint serving as a knowledge repository and expert database was considered beneficial as it offered a possibility to search and identify experts within the company. However it also showed that as soon as employees felt that they needed other knowledge about an expert rather than purely who-knows what and who-know what to do, they would turn towards colleagues in their personal network either face-to-face or via phone. This was as SharePoint could not offer those additional personal recommendations such as who was trustworthy, more or most knowledgeable and actually open for cooperation.

#### **6.4 Instant Messaging**

Instant messenger (IM) was generally used to transfer *know-what*, small facts and data important for already existing documents or processes, in a synchronous manner. This *know-what* knowledge usually did not have to be stored and accessed later on. As an example we found that knowledge transferred through IM was meant to inform colleagues about an update made in TeamPlace or to ask for quick additional knowledge that was not mentioned in a document. As for this cases employees often needed a quick feed-back to continue working with, the presence awareness was an important benefit of IM. As employees could see who was available at that

time they knew whom to ask to get a quick answer. Most of the times these were cases, where people already knew what type of *know-what* they needed and whom they could ask about it. Further on IM was used in case people needed a short and quick references regarding possible know-who knowledge.

However the synchronicity of communication, basically enabling people to interact in real time, was generally identified as a plus our results showed that in certain cases employees preferred face-to-face or phone over IM. This was as IM was usually used for short questions however was not satisfactory when one wanted to transfer more complex information. Similar to e-mail employees felt that as soon as the knowledge to be transferred was too hard to codify and transfer as a written text phone or to face-to-face communication was more effective. This indicates that the knowledge transfer behavior was not only affected by the specific ICT characteristic but actually by the lack of it. Here, it becomes apparent that certain knowledge is still impossible to fully transfer through ICT thus making employees switch to a richer media (i.e. phone or face-to-face communication).

## 6.5 General Findings

Based on the results we generally identified *know-what* as most commonly shared through ICT. When transferring this kind of knowledge codification was easy while at the same time benefits such as reaching people at different times and spaces could be used. We can therefore confirm the theory of Johnsson et al. (2002) who claim that *know-what* is the type of knowledge that is the easiest to break down into bits to communicated as data and thus to transfer through ICTs. It is therefore highly beneficial for employees to transfer this type of knowledge. Thus our results indicate that ICT most commonly facilitate the capture, storage, retrieval and distribution of explicit knowledge, in order to make explicit knowledge even more accessible and more transferable. We thus confirm the findings of Phang and Foong (2010) who argued in the same direction.

When it came to transferring *know-why/ know-how* knowledge most employees mentioned that they actually preferred to transfer these types of knowledge through face-to-face communication and telephone rather than through an ICT. We found that *know-why/ know-how* knowledge

transfer was often connected to activities such as decision making; lobbying and/or conflict resolution. In these situations it was important for employees searching for knowledge to acquire a full background of a situation, which included for example being able to see the other persons' reactions. ICTs we looked at were perceived as not suitable for these kinds of interaction as they could not offer synchronous, direct communication while providing richness of cues, usually attributed to phone and face-to-face communication, at the same time.

Further on when employees tried to share *know-why/ know-how* they often felt that they were not able to actually codify their complete knowledge into a written format. They felt that they would spend too much time formulating it while at the same time probably losing important parts of the message anyhow. This was feared by employees to result in misunderstandings, which could cost additional working time and have a negative effect on the working environment. The only exception here seemed to be the blog. A decisive factor why it was actually used for *know-why/know-how* was its increased collaboration possibilities which diminished draw backs, e.g. misunderstandings through missing cues, of other ICT.

Face-to-face communication and phone were also preferred over the ICT for transferring *know-who* type of knowledge in case when employees felt that their colleagues could help them to find an expert within Volvo and/or if employees were actually insecure for which kind of expert to look for. According to our results employees preferred synchronous, face-to-face communication in these cases as they needed more personal information about an expert, e.g. a personal recommendation whom was knowledgeable and trustworthy. We therefore argue in line with Johnsson et. al (2002) that *know-who* knowledge does obviously not only contain information regarding who knows what and who knows what to do but is also highly context dependent as it also includes knowledge about who is actually more or most knowledgeable, trustworthy, and open for collaboration and knowledge transfer.

Johnsson et al. (2002) argue that *know-why, know-how and know-who* knowledge types are generally built on personal skills and experiences. They are context dependent and their codification is often complicated and/or incomplete as factors such as mutual trust, networks and openness are hard to transfer through ICTs. Our findings show that employees actually perceived it as complicated to transfer these types of knowledge via ICT as certain background information

could not be transferred in a satisfying way. This was feared to cause misunderstandings, which could only be prevented to some degree by putting a lot of time into careful formulations. Since Johnson et al. (2002) identify these types of knowledge as more tacit than *know-what*, these results were in line with Phang and Foong (2010), who argue that ICTs alone will not be able to transfer tacit knowledge fully and effectively. Our results also prove Hanson et al. (1999) right, who suggested that a face-to-face approach would be more effective when transferring tacit knowledge.

According to previous literature employees should be more willing to transfer knowledge through ICT if it offered certain benefits (Hsu et al., 2007; Gupta & Govindarajan, 2000, Cowan et al., 2002) e.g. efficiency in helping to overcome temporal, physical and social distance constraints, as well as an increase in range and speed of information access (Hendriks, 1999). However, Phang and Foong (2010) argued further on that perceived attractiveness of ICT in supporting knowledge transfer might to a great deal depend on the type of knowledge that is to be transferred. Indeed our results indicate that a major factor influencing the choice to transfer a certain knowledge type can be attributed to the easiness of its codification compared to the benefits for the employees, offered by the specific ICTs. On the other hand we found that also job and task specifics could play a major role in this process.

## 7. Conclusion

This paper tried to identify the employees' perspective on transferring knowledge through ICT on a daily basis. We argued that employees should be more willing to transfer knowledge through ICT if it offered certain benefits, e.g. efficiency in helping to overcome temporal, physical and social distance constraints, as well as an increase in range and speed of information access (Hendriks, 1999). Further on we argued that perceived attractiveness of ICT in supporting knowledge transfer depends to a great deal on the type of knowledge that is to be transferred. We therefore classified knowledge according to Johnson et al. (2002) into *know-what*, *know-how*, *know-why*, and *know-who*, where *know-what* was predominantly seen as explicit knowledge and easy to codify and the remaining three as tacit knowledge and more complex to codify.

Our results showed that the type of knowledge that was to be transferred respectively its easiness of codification were indeed decisive for how employees perceived the attractiveness of an ICT to transfer this type of knowledge with. As a result we can say that generally ICT was used to transfer *know-what*. When transferring this kind of knowledge codification was easy while at the same time benefits such as communicating one-to-one or one-to-many at different times and over spaces could be used. We also saw that if *know-what* needed to be stored for later access employees often used TeamPlace as knowledge repositories. However, its unstructured nature was often criticized and actually lead to employees using additional ICT to compensate this cost. When knowledge needed to be transferred within short time constraints people chose IM for its synchronous communication characteristic. When there were no urgent time constraints and knowledge needed to be transferred over space and time constraints both within and outside the company than e-mail's asynchronous characteristic was a decisive factor in the choice of the ICT as it left time and place to answer at the receiver. Thus we saw that the actual job and task specifics were decisive to some degree for whether ICT characteristics were observed as beneficial or not.

Looking at *know-why/know-how* and *know-who* we must acknowledge that they were transferred to a way minor degree via ICT but most often employees preferred phone and/or face-to-face

communication to do so. This was as employees identified this type of knowledge as hard to codify and to transfer accurately via ICT as certain cues would get lost in this process.

It was however interesting to see that if employees had to transfer this type of knowledge via ICT, in case that a personal meeting was not possible or if they wanted to communicate one-to-many in order to save time, ICT that came closer to face-to-face communication was chosen.

Here characteristics such as providing possibilities for more synchronous communication and giving immediate feedback were perceived as beneficial and decisive as it often affected employees' choice of ICT when transferring *know-why/know-how* and *know-who*.

Thus we can argue in line with Hendriks (1999), who claim that the use of ICT in a company's KT process can be efficient by helping to overcome temporal, physical and social distance constraints; increase in range and speed of information access; and help identify location and accessibility of relevant knowledge as well as knowledge experts. But as our results showed this is true only in the case of *know-what* knowledge transfer. When it comes to *know-why/know-how* and *know-who* we can confirm Phang and Foong (2010), who argue that since tacit knowledge is difficult to extract, codify and transfer ICTs alone will not be able to transfer this knowledge fully and effectively. Nevertheless if employees have to work with each other over spatial distance ICT that offers possibilities for more synchronous communication and collaboration is more likely to be perceived as attractive and thus is more likely to be used.

For practical KT efforts in a company our findings indicate that most ICTs will be useful for transferring *know-what* knowledge due to their characteristics that help overcome temporal and physical distance, however when it comes to transferring *know-why/know-how* and *know*, ICT has to offer more possibilities for employees to collaborate synchronously in order to be actually used. Further on ICT could help to build a wide professional network and bring its members together to exchange these types of knowledge.

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## **Appendix A**

### **Interview Guide**

#### **Introduction:**

In this study we will focus on your internal communication tools. For example e-mail, groupware etc. We are interested in how you search knowledge inside your organization and how you share it inside your organization. Our data is just for university studies and we will keep your answers and your identity private/anonymous.

#### **Interview guide: (name, position, age, period spent in the company/position)**

##### **Theme 1: Receiver (benefits/costs)**

For which information are you usually searching in your company?

From whom do you usually get your information?

Which tools do you use when you look for information inside your organization?

→ Why do you use this/these tools?

→ What do you like about this/these tools?

→ Is there smth. you do not like about these tools?

→ When do you use this/these tools?

Why do you not use another tool? (e-mail, groupware)

##### **Theme 1b: Message / Type of knowledge**

→ Which kind of information would you search through groupware, e-mail, etc.? / Why?

→ Is there situations where you use a specific tool?

##### **Theme 2: Sending (benefits/costs)**

Which kind of information are you usually sharing inside your organization?

With whom are you usually sharing information?

Which tools do you use when you transferred information inside your organization?

→ Why do you use this/these tools?

→ What do you like about this/these tools?

→ Is there smth. you do not like about these tools?

→ When do you use this/these tools?

Why do you not use another tool? ( e-mail, groupware, etc.)

**Theme 2b: Message / Type of knowledge**

- Which kind of information would you transferred through groupware, e-mail, etc.? /Why?
- Is there situations where you use a specific tool?

**Theme 3: Back-up questions:**

Accessibility of Knowledge

Synchronous/Asynchronous Communication

Time/Distance

Privacy/Security

Accessibility of Knowledge

Language use High Quality of Knowledge

Recognition

## Appendix B

### Coding Sheet 1 Characteristics of Communication Tools

	<b>E-Mail</b>	<b>Blog</b>	<b>IM</b>	<b>Groupware</b>
Availability				
Presence awareness				
Unstructured				
Structured				
Synchronous				
Asynchronous				
Visibility of updates				
Direct communication				
Indirect communication				
One-to-one communication				
One-to-many communication				

### Coding Sheet 2 Types of Knowledge

<b>Tools</b>	<b>Know-what /declarative knowledge</b> Knowing “facts”, such as the name of a department or the birthday of a co-worker. In this interpretation, know-what is very close to information.	<b>Know-why / Causal knowledge</b> Law of causality and the understanding of cause effect relationship.	<b>Know-how /procedural knowledge</b> The skill or competence of actually being able to do something, such as programming in java, managing a large project or analyzing a business proposition.	<b>Know-who /social knowledge</b> Relational aspect of being able to connect to knowledgeable people when one’s own know-what, know-why or know-how is insufficient.
Internet				
Intranet				
E-mail				
Sharepoint /TeamSpace				
Chat				
Phone				
Face-to-Face				

