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Factors Influencing Knowledge Sharing in Software Development:

A Case Study at Volvo Cars IT Torslanda

Bachelor of Science Thesis in Software Engineering and Management

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ABSTRACT

Software development industry is noted for its innovative IT products. This is due to the focus on knowledge sharing as a key driver for the creation of innovations. However, the handling of organisational factors that influence knowledge sharing in many organisations is far from being complete. This study seeks to explore the organisational factors that have positive and significant impacts on knowledge sharing. A case study was carried out at Volvo Cars IT (VCIT), Torslanda. Software development professionals were asked to identify their perspectives on organisational factors that influence knowledge sharing. Their accounts were recorded as text using workshops and interviews. Data were condensed thematically. Our research shows that: "social relations and network", "physical closeness to colleagues", "no stupid question culture", "mutual exchange" "interest and work involvement", "satisfaction of helping each other", "being listened to and taken seriously", and "satisfaction from personal goal" are the different perspectives that the software development professionals have regarding the organisational factors that influence knowledge sharing at VCIT.

Keywords: SECI Model; Knowledge Sharing; Knowledge Creation; Software Development

1. INTRODUCTION

In recent years, knowledge sharing has received immense attention due to the recognition of its value in organisational learning, knowledge creation (van den Hooff & de Ridder 2004) and innovation (Donate & Guadamillas 2011). Individuals sharing knowledge with each other are what drives the knowledge-creating company (Nonaka 1994) and competitiveness (Verbeke, Belschak, and Bagozzi & Wuyts 2011). The knowledge embedded within the people and systems of an organisation can result in sustainable competitive advantage for the firm because such knowledge is valuable, rare, inimitable, and non-substitutable (Afiouni 2007). This has facilitated the paradigm shift towards the focus on enabling new innovative products to be developed at greater speed.

The software development industry has been known for its innovative IT products (Damian & Moitra 2006, p. 17; Quintas 1994, p. 4). However, the industry's innovative pipeline has dried out over the last decade. This is akin to an industrial case which is described in section 1.1. The software professionals at the studied site have had a shortage of radical innovations; this is mainly because there are insufficient support and maintenance employees who are moving towards retirement. This creates a number of challenges such as inability to keep pace with the increasing demand in complexity and uncertainty of software development (Manlu, Jiannan & J 2012, p. 2921). Thus, it could take a long period of time to act in case of increased demands from business on new or enhanced functions during the software development processes. The main focus in the software development industry is, therefore, to be flexible enough to respond quickly to business demands thereby shortening time-to-market. In order to stay competitive, companies have focused on other initiatives such as maximizing the potential of existing product portfolio and practicing incremental innovation (Robertson, Casali & Jacobson 2012, p. 823) with focus on life cycle management and technical solutions particularly reducing time-to-market. This focus has meant that other aspects of this innovative shortage have been overlooked or at least not fully discussed in the extant literature. One of these aspects is the potential of individuals and their actions within the software development organisations.

One area where organisations may be able to increase their innovative performance is knowledge sharing through

interactions among individuals. Innovation often arises from the re-combination of pieces of knowledge that may exist in different places in the organisation (Galunic & Rodan 1998). The value of knowledge sharing is related to the fact that organisational knowledge is unique asset difficult to imitate (Gupta & Govindarajan 2000; Sapienza & Lombardino 2006). Gupta & Govindarajan argue that a key task for software development organisation is to mobilize these pieces of knowledge and integrate them into the knowledge creation process (2000). Knowledge sharing is a means of accelerating this process. The development of innovative IT products requires specific knowledge within several scientific fields. Due to the limitations of human cognition, it is impossible for any individual to be an expert in all of them (Berends, Van der Bij, Debackere & Weggeman 2006). Thus, the expertise of the software development professionals and the knowledge stock available within the software company holds great potential if shared.

The purpose of knowledge sharing in an organisation is to enhance knowledge creation which facilitates new innovative products to be developed at greater speed (Block 2012). However, as knowledge sharing does not come easily, VCIT like many other companies is fraught with knowledge sharing challenges because many employees lack the desire to share knowledge with other members of organisation (Denning 2006). To mitigate the challenges in knowledge sharing, it is imperative to specifically investigate the factors which could influence the setting, various personal beliefs, and the actions and practices among the employees at VCIT. By organisational factors, we mean factors related to organisational and individual attitudes which enhance knowledge sharing at VCIT. Thus, in order to investigate and to answer the research question, as stated in section 1.2, our framework was designed to uncover those factors which might influence how knowledge is shared within VCIT.

Qualitative data is needed to establish the factors that influence the organisational knowledge sharing (Creswell 2009). Case study method is proven to be one good way to carry out this research. Qualitative data is gathered from a selected team from the software development company that takes part in this research. The data is collected through semi-structured interviews, workshops, and observations (Creswell 2009). The collected data is then coded and analysed using a thematic analysis techniques, for example thematic analysis (Braun & Clark 2006).

The purpose of this research is to increase the understanding of the impact particular organisational factors could have on knowledge sharing within an organisation. This paper explores the factors that influence organisational knowledge sharing at VCIT as experienced by different professional software development teams, i.e. IT application managers, project managers and common application developers. This contributes to the literature on knowledge management and addresses practical need of VCIT employees who have been facing challenges with knowledge sharing that needs to be optimised in order to enhance innovative performance. Also, our research applies the conceptualisation of knowledge creation proposed by Nonaka and co-worker (Nonaka & Takeuchi 1995).

The remainder of this report is structured as follows. The theoretical framework is presented in section 2. In section 3, we describe method used to collect and analyse the data as well as the research process and research setting. We present the findings of our study in section 4. Section 5 explores the discussion of the theoretical relevance covered in our framework and the practical implications. The conclusion work of our thesis is presented in section 6. Finally, we present the future work of our study in section 7.

1.1 Problem Description

In this study, an application support and maintenance unit within a multinational IT company, VCIT, has been investigated. Their main problem has to do with the vulnerable areas of competence which would not potentially lead to sustainable competitive advantage. This would affect the support and maintenance staff members that are mostly moving towards retirement. In the same vein, the available resources are mostly seen as experienced and knowledgeable not only when it comes to the function of the application, but also they are the ones with the deepest knowledge about business processes that form part and parcel of those applications. In addition, the problem with the application support and maintenance is further compounded by the proliferation of systems that have single competence availability which makes it hard to handle because of non-existing available resources as well as non-reasonable levels of documentation. Thus, the entire scenario has hampered the transformation of ideas into innovations at VCIT.

This scenario has prompted VCIT to begin investigating a way of improving knowledge sharing among its employees. Our research is poised to investigate the organisational

factors which could influence or motivate the employees at VCIT to share their knowledge. The combination of factors that motivate knowledge sharing would help other employees to gain knowledge from those with deepest knowledge about other areas of business processes. This would drastically reduce the issue of single competence availability where only one individual knows the technical details about specific areas in software development processes.

1.2 Research Question

The research question answered in this thesis is: *"What are the organisational factors which could have both positive and significant influence on knowledge sharing at VCIT?"*

2. THEORETICAL FRAMEWORK

In this section, we present the theoretical framework of this study. Using a vast literature from related sources, we will explore the concepts of knowledge creation, knowledge sharing, and known factors which motivate employees to share their knowledge.

2.1 Knowledge Creation

Nonaka and Takeuchi conceptualised knowledge creation processes as a theoretical framework. They made a distinction between tacit and explicit knowledge and proposed that the key to knowledge creation lies in the mobilisation and conversion of tacit to explicit knowledge (Nonaka & Takeuchi 1995; Nonaka, Toyama & Konno 2000, p. 5). Explicit knowledge is defined as knowledge that can easily be expressed in formal, systemic language such as written documents. On the other hand, tacit knowledge becomes codified through mentoring and learning-by-observation. According to Nonaka & Takeuchi, knowledge creation in an organisation happens through the sharing of tacit and explicit knowledge, which turns into a knowledge creation spiral (1995). This conceptualisation is often labelled with the acronym SECI, referring to four knowledge-creation modes. Each mode in SECI takes place in a "Ba", a Japanese concept referring to a shared space for emerging relationships where knowledge is embedded (Nonaka & Konno 1998). This space could be virtual, mental, or any combination. The four modes are:

- **S** - Socialisation (tacit to tacit knowledge) occurring in the originating "Ba" (sharing of feelings, mental models, and experiences).

- **E** - Externalisation (tacit to explicit knowledge) occurring in the interacting "Ba" (mental models are converted into terms).

- **C** – Combination (explicit to explicit knowledge) occurring in cyber "Ba" (place of interaction in the virtual world).

- **I** – Internalisation (explicit to tacit knowledge) occurring in the exercising "Ba" (place facilitating conversion of explicit to tacit knowledge).

In accordance with Nonaka and colleague, knowledge is not created until all four modes of the SECI have interacted. Figure 1 illustrates the four modes of knowledge creation and conversion and the evolving spiral movement of knowledge through the SECI modes. Using the spiral as a metaphor, SECI represents a cyclic and iterative process in which each circuit of the spiral builds on the previous (Nonaka & Takeuchi 1995; Ying & Chouyong 2010, p. 2).

2.2 Knowledge Sharing

Knowledge sharing can be conceptualised in various ways ranging from the exploration of new knowledge through renewed combinations of existing knowledge to the exploitation of existing knowledge (Szulanski 1996; Uzzi & Lancaster 2003). Knowledge sharing can also be seen as a process of knowledge exchange. It has been argued that the motivation for these different exchanges is related to the expectation of receiving something in return (Fiske 1991). Grant argues that knowledge sharing is about ensuring that existing knowledge is distributed within or across organisational boundaries (1996). At this juncture, the socialisation mode in the SECI model is strengthened in a way that voluntarily contributes to an organisation's competitive advantage.

According to McDermott & O'Dell, knowledge sharing appears as a social process through which best practices are promoted and duplication reduced (2001). Similarly, social capital theory explains that knowledge sharing occurs because it provides social benefits (e.g. enhanced reputation) for both the sharer and the organisation (Nahapiet & Ghoshal 1998). Social capital serves as a system of norms and hence may be a source of social control to encourage individuals to refrain from undesirable behaviours, such as social loafing, which is a common risk in knowledge sharing (Lang 2004).
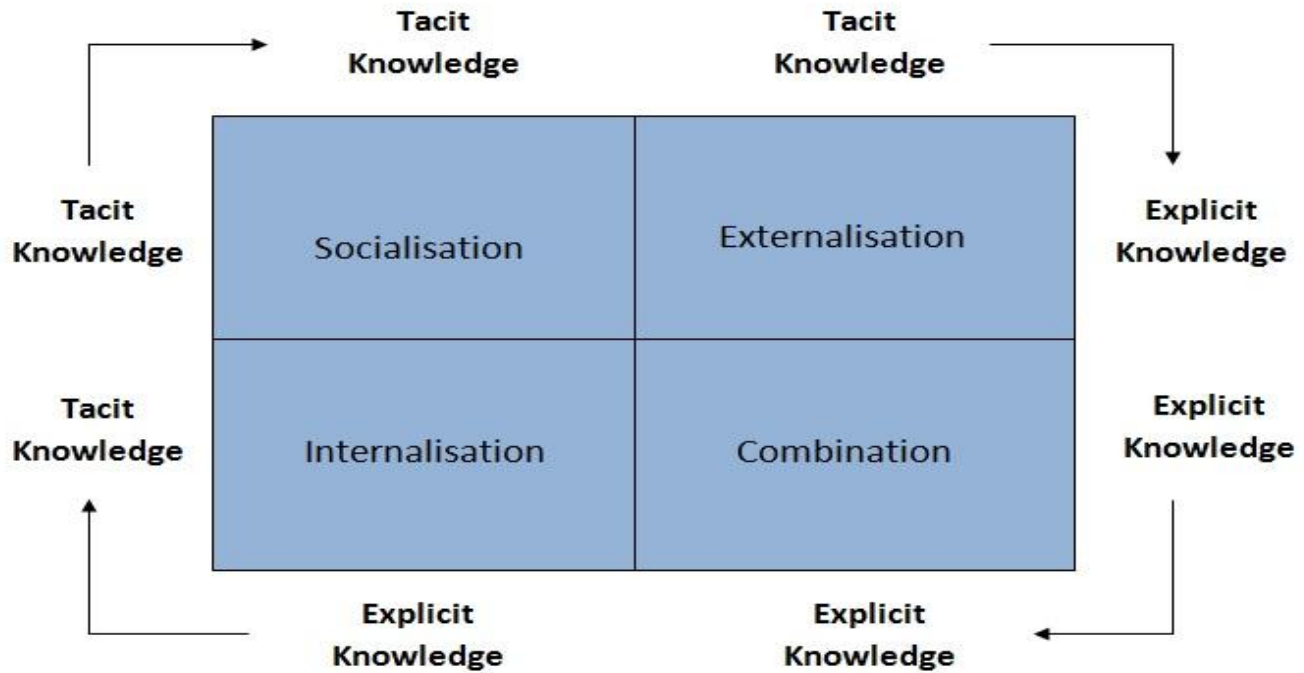
Figure 1. SECI Model

Knowledge sharing requires a willingness to collaborate with others within an organisation (Assudani 2005: Zboralski 2009) in that any indisposition to share knowledge may result in inaccurate, incomplete, ill-timed, and in extremes cases, false information being shared. The integrity of shared knowledge is critical because it aggregates into organisational knowledge, which helps both employees and organisations to improve their competitiveness (Donate & Guadamillas 2011; Ipe 2003). However, considering that knowledge is a personal asset over which an individual has complete control, the decision on whether or not to share knowledge depends on costs and benefits evaluations (Cabrera & Cabrera 2005).

Published empirical studies dealing with the exploration of knowledge sharing have been performed in the software development organisation. For instance, an empirical study by Hopes & Postrel carried out in a software company developing scientific software demonstrated that shared knowledge, collegial cooperation, and project coordination influenced staff performance in product specifications, and when interdisciplinary colleagues were involved (1999). Knowledge-sharing gaps added significant product development costs to the software company. Among others, these gaps were related to sub-unit separation, the nature of organisational practices, and time pressure. An empirical

study by Berends, van der Bij, Debackere & Weggeman, carried out in the research laboratories of Shell and Phillips, demonstrated the existence of six knowledge-sharing mechanisms with different origins: information retrieval, information pooling, collaborative problem solving, pushing, thinking along, and self-suggestion (2006). It was concluded that all identified knowledge-sharing mechanisms contributed in distinctive ways to the outcomes of the software development professionals and were valuable to the organisation.

2.3 Motivation for Sharing Knowledge

Elloit & Covington defined motivation as the energisation and direction of behaviour to do something (2001). Employing this perspective, the motivators, in this study is thus a valid approach. The following sections introduce such motivational factors known from the research literature.

2.3.1 Reciprocity

According to Nowak & Sigmund, there are two possible types of reciprocity: direct and indirect (2000). In direct reciprocity, two individuals play the roles of receiver and giver of favour, while indirect reciprocity, also called generalized reciprocity, occurs when help given to one person is reciprocated by someone else and not by the

original recipient of the help (Ekeh 1974). For example, Wasko & Faraj found that, for some individuals, the willingness to help others stems from the belief that it is only fair to help others if the helpers themselves had received help from the community (2000). Furthermore, many of the individuals' comments demonstrated that people do not expect to receive help from the same individual but from someone else (referring to generalized reciprocity).

Another perspective of the general reciprocity could be seen in the area of personal wealth of the employees. The ultimate goal in personal gain related motivators is to increase one's own welfare. There can be many varieties of personal gain related motivator including pay, prizes, recognition, and self-esteem enhancement. For example, Wasko & Faraj found that a significant predictor of individual knowledge sharing in an electronic network is the perception that knowledge sharing enhances one's professional reputation (2005).

2.3.2 Communication

Communication is another organisational factor through which knowledge sharing could be facilitated in software development organisation. It encompasses dialogues, meetings, partnerships, face-to-face interaction and collective reflection. Davenport & Prusak in their paper emphasise the use of dialogue, meetings as well as partnership as a veritable method that could enhance the creation and sharing of knowledge in an organisation (1998). For example, in any software development process, through group discussions and conversations, software professionals can exchange and reflect upon each other's ideas. Similarly, by assigning someone who manages the conversations or group discussions, the organisation can share a certain etiquette and standard of these meetings. According to Von Krogh, Ross & Kleine, this is one of the best ways to share and create knowledge which has often been overlooked by most organisations (1998). This creates a forum through which the exchange of ideas would definitely result in the overall promotion of the organisational knowledge sharing.

Face-to-face interaction often is the primary method for transferring knowledge (Nonaka & Takeuchi 1995; Spender & Grant 1996; Sweeny 1996). The levels of risk and uncertainty that are associated with knowledge sharing and transfer are reduced by trusting relationship (Foos, Schum & Rothenburg 2006). Thus, face-to-to interaction is pivotal in

the sense that it fuels the building of trust which in turn boosts the sharing of knowledge.

In software development, knowledge sharing is vital in facilitating organisational change processes. For example, communication about the roles of various individuals and about projects, visions and strategy can enhance knowledge sharing (Deming 1986). As Ng, Butts, Vandenberg, DeJoy & Wilson have discussed, good communication leads to greater worker commitment in knowledge sharing within an organisation (2006).

2.4 Factors Facilitating Knowledge Sharing

In this section, we describe the factors that facilitate the sharing of knowledge.

2.4.1 Social Dimension

Social dimension is a vital factor which could facilitate the sharing of knowledge in the software development organisation. Alvesson argues that knowledge sharing has a strong social dimension through which knowledge work may best be practiced in informal settings that assimilate social exchanges (2004). Corti & Lo Storto affirm that common coffee and lunch breaks are settings that facilitate knowledge sharing due to the fostering of personal closeness (2000). Physical proximity was stimulated via change in work content which thus enables knowledge sharing and creation (Leenders & Wierenga 2002).

2.4.2 Human Network

In an empirical study, Cardinal & Hatfield found that human networks were one of the key vehicles for sharing knowledge and that trust among individuals was related to informal networks (2000). Levin, Whitener & Cross; Abrams, Cross, Lesser, & Levin identified trust as one individual level factor which ameliorates knowledge sharing in the workplace (2006; 2003). In this context, trust is the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustee, irrespective of the ability to monitor or control that other party (Mayer, Davis & Schoorman 1995, p. 712). Thus, this facilitates strong and robust influence on a variety of organisational phenomena including job satisfaction, stress, organisational commitment, productivity as well as knowledge sharing (Levin & Cross 2004). From this perspective, it is apparent that trust leads to increased overall knowledge exchange, makes knowledge exchanges less costly and increases overall knowledge exchange.

Also, this increases the likelihood that knowledge acquired from a colleague is sufficiently understood and absorbed that a person can put it to use.

2.4.3 Social Ties

Tsai & Ghoshal emphasised the role of social ties as channels for knowledge sharing (1998). Social ties have also been found valuable; empirical findings by Levin & Cross demonstrated that individuals are five times more likely to contact other individuals than to use technical systems (2004). This is possible because of the presence of mentor and mentee relationship in such an organisation where there is high level of knowledge exchange. For example, social factors such as having mentors and being part of network can help men and women advance in the management of knowledge sharing and creation (Burt 1998; Ragins 1999; Wanberg, Welsh, & Hezlett 2003; Wirth 2001). This is because mentors are more experienced, highly ranked, and influential members of the organisation who provide support to the career development of less experienced individuals (Kram 1985), and network involve "contacts with a variety of colleagues for the purpose of mutual work benefits" (Linehan 2001, p. 823). In addition, Campbell, Marsden, & Hulbert explained that networks have characteristics of status (or managerial level of contacts), degree of closeness (between the individual and his/her network contact) (1986).

2.4.4 Trust

Von Krogh, Kazou & Nonaka proposed relationships which exhibit a high degree of care for the other, i.e. mutual trust, active empathy, access to help, leniency in judgement, and courage as factors which leverage the sharing of knowledge (2000). In another study, Styhre, Roth & Ingelga suggested that care was the underlying factor behind knowledge creation in team-based organisations (2002). Thus, an employee feels motivated to share knowledge once he or she has a good relationship with another person, or social relations have proven to be helpful (Von Krogh et al. 2000). In addition, an empirical study suggests that social dilemmas are also embedded in knowledge practices, because organisational knowledge is more likely to be shared with a person who is highly likeable rather than with someone who is highly competent (Casciaro & Lobo 2005). Furthermore, common identity enhances knowledge sharing in that the individuals within one group understand each other better than people from outside the group. Consequently, people are embedded in the same practice, speak the same technical language and have a similar identity (Adler & Kwon 2002; Borgatti & Cross 2003).

2.4.5 Commitment

Commitment refers to an employee's emotional attachment to and involvement in an organisation (Meyer & Allen 1997; Lee & Goa 2005, p. 377; Nijhof, de Jong & Beukhof 1998, p. 243) and it empowers the employees to do more than what is formally required of them (Choi 2006; Van Den Hoof & De Ridder 2003) over a sustained period (Van Steenbergen & Ellemers 2009).The commitment to the group motivator may be termed collectivism, a term borrowed from Batson, Ahmad & Tsang, who referred it to a desire to increase the welfare of a collective (i.e., any form of a group of people) (2002). People typically act from collectivist motives because they identify with or value the group's vision or purpose. Individuals may treat other group members as kin and thus be willing to do something beneficial for them; hence, collectivism may be viewed as a variant of altruism (Hars & Ou, 2002). Altruistic behaviour of this type is called "kin-selection altruism" by social-psychological researchers (Hoffman 1981). Prior research, such as that of Yoo, Suh & Lee, suggest that collectivism can be a reason why people share their knowledge in online environments (2002).

Furthermore, in any committed organisation, there is a collective sense of identity among individuals which not only result in pro-social behaviours (Dewitte & De Cremer 2001), but also voluntarily sharing knowledge. A collective identity is a feeling of belongingness that leads to a sense of shared purpose (Van Steenbergen & Ellemers 2009). This proud sense of purpose increases the likelihood that individuals share knowledge for the betterment of the organisation (Kelloway & Barling 2000). Also, this stimulates the desire to help the organisation to be successful not only through actions such as working hard but also by sacrificing self-interest.

Commitment is of particular relevance in a knowledge economy and in knowledge-intensive firms because the development and the use of the knowledge capital in an organisation are to some extent dependent on employees' level of commitment to their organisation (Robertson & O'Malley-Hammersley 2000). Consequently, the departure of an employee would not dramatically result in any definite loss of knowledge because everyone is committed to knowledge creation and sharing which would be required to ensure a higher level of service to IT businesses.

3. RESEARCH METHOD

This research is approached by a single-case case study method. A case study is "*an investigation of a contemporary phenomenon in depth and within a real life context, where the boundaries between the phenomenon and the context are unclear*" (Yin 2009; Walsham 1993). In the same vein, Benbasat, Goldstein & Mead mentioned that employing a case study is useful in examining a phenomenon in its natural setting which involves multiple methods of data collection to gather information from one or few entities (people, groups, or organisations) (1987, p. 370). This study is based on real life experiences that involve the personnel at VCIT unit who are deeply involved in the delivery of cutting age IT services. Use of case study as a method enabled us to study and investigate factors which influence organisational knowledge sharing at VCIT.

The primary data was collected using semi-structured interviews and literature search. This was complemented by workshop, informal chat and notes-taking during or after the meetings. Thematic analysis was used to analyse the collected data (Braun & Clark 2006).

3.1 Research Setting

To perform this research, we have approached VCIT as our industrial partner. VCIT is one of the market leaders in the delivery of innovative IT services. They also develop new tools that support business development and manage daily operations in the global Volvo Car Corporations (VCC) organisations. The transformation of ideas into innovation, which could only be possible through sharing of knowledge, is the prerequisite factor that would advance the delivery of innovative IT products. That provides an underpinning to the very site where this study was carried out.

VCIT is highly noted for the support and maintenance of the application resources that run the systems that aid in the car production at the Torslanda plant in Gothenburg, Sweden. With staff strength of 350 employees, it provides IT services to not only its plant in Torlslanda but also in Uddevella, Olofström and Gent in Belgium. The area of vulnerability regarding the paucity of knowledge in application maintenance was studied to investigate the organisational factors which could influence the software development professionals to share knowledge at VCIT.

3.2 Research Process

This research was decoupled into seven phases: the first phase was done by reviewing the literature for an understanding of the topic area. The second phase focused mainly on the company presentation. The other phases are further explained in table 1.

3.3 Data Collection

The collected data was qualitative in nature. Semi-structured interviews, literature reviews, a workshop and informal meetings were the techniques used to collect the data. Separate workshops were held for the IT application managers and common application developers. The agenda item in the course of exploring the data was termed "knowledge sharing". The Workshop lasted approximately 1 hour. During the workshop documentary accounts were processed as text. At the workshop, participants produced data as text which were documented anonymously on post-its (Hodson 1999). Participants were asked to identify at least two organisational factors which could influence knowledge sharing at VCIT. The factors which influence knowledge sharing were related to their everyday work life.

3.4 Participants

The participants were active staff at VCIT, and had the following roles: IT manager, application manager, software architect, system tester, common application managers and software designers. We chose participants with the aim of getting diverse perspectives regarding the organisational factors which might influence knowledge sharing.

3.5 Interviews

We conducted six semi-structured interviews in English which lasted for an approximate 1 hour. The interviews were done on a one-to-one personal basis so as to ensure that the response was high whilst at the same time providing an opportunity for social interaction. We noted the significant need of knowledge sharing while interviewing the responsible personnel's. Interviews are seen to be very effective when getting feedback or opinion on the knowledge sharing in the software development processes from diverse perspectives, as well as activities, problems or other issues (Boyce & Neale 2006, p. 3; Hong & Nam 2010, p. 3912). The criteria for choosing the specific interviewees were made based on their roles at VCIT unit. Among the informants were: the IT manager, Common Application Manager, Software Architect, Project Manager, IT Application Manager (ITAM) and Manufacturing & Supply Chain Manager. We mainly asked open ended questions

Research Process	
Phases	**Description**
Phase 1	**Conduct literature review:** The literature review was carried out on knowledge sharing and creation. The problem description provided a backdrop which helped the researcher to narrow down the research question to specific areas which are both relevant and realistic.
Phase 2	**Company presentation:** Four presentations were held at VCIT; three with the IT manager and one with the application maintenance manager. It was during the presentation that we discovered the vital need to focus on the company's problem with knowledge sharing.
Phase 3	**Conduct interview:** Information was gathered from the interviews and informal meetings which were thus recorded and documented accordingly.
Phase 4	**Conduct workshop:** The concept of SECI model of knowledge creation was taught to the team that participated. Also, there was a session of the general brainstorming on the organisational factors which influence knowledge sharing. Participants were asked to identify organisational knowledge sharing influences which were related to their everyday work life. Finally, there was an answer session where participants produced texts that were documented anonymously.
Phase 5	**Study and code the data:** Study the data gathered from interviews and workshops. The data was coded similarly by grouping them accordingly.
Phase 6	**Analyse the data:** The data was analysed using thematic analysis.
Phase 7	**Discuss the data:** The data was discussed with the literature so as to answer our research question.

Table 1. Research Process Phases

during the interviews in order to identify themes in the data. Interviews were recorded and transcribed accordingly.

3.6 Data Analysis

The analysis of the qualitative data collected during interviews and workshops was done using a thematic analysis method. Thematic analysis is a method for identifying, analysing and reporting patterns (themes) within data (Braun & Clark 2006). Thematic analysis seeks to identify insights into the activity from the observational data collected.

The documentary accounts were listed and ordered in groups. Themes were labelled and thereafter concepts emerged. The qualitative data were analysed using meaning condensation: the meanings of the documentary accounts were structured around thematic concepts following identification of relations between concepts (Kvale 1996). The concepts that emerged through condensation represent common characteristics of the documentary accounts within each concept.

At the inception of the analysis, several of the documentary accounts were shown to represent one or more concepts; however condensation was limited to one concept per documentary account. Consequently, some of the concepts may represent a broader perspective than that actually expressed. Furthermore, when similar concepts appeared among the professional groups, they were given the same notation. Finally, we extracted concepts showing clear major patterns by assigning specific names that reflect the messages of the themes.

4. RESULT

In this section, we describe characterisation of the group A and B of the software development professionals' modes of knowledge sharing as well as the concepts and groups relations.

4.1 Characterisation of Group A and B

The five dominating concepts of knowledge sharing are identified, extracted and aligned with the documentary accounts from interviews and workshops. In figure 2 the results are listed in the order of dominance with the most prevailing concept presented first and illustrated as sizes of circle. The documentary accounts are presented in table 2 and 3.

The five dominating concepts of knowledge sharing in figure 2 represent two kinds of attitudes to knowledge sharing which are social orientation and goal orientation. These characteristics are analytical categories associated
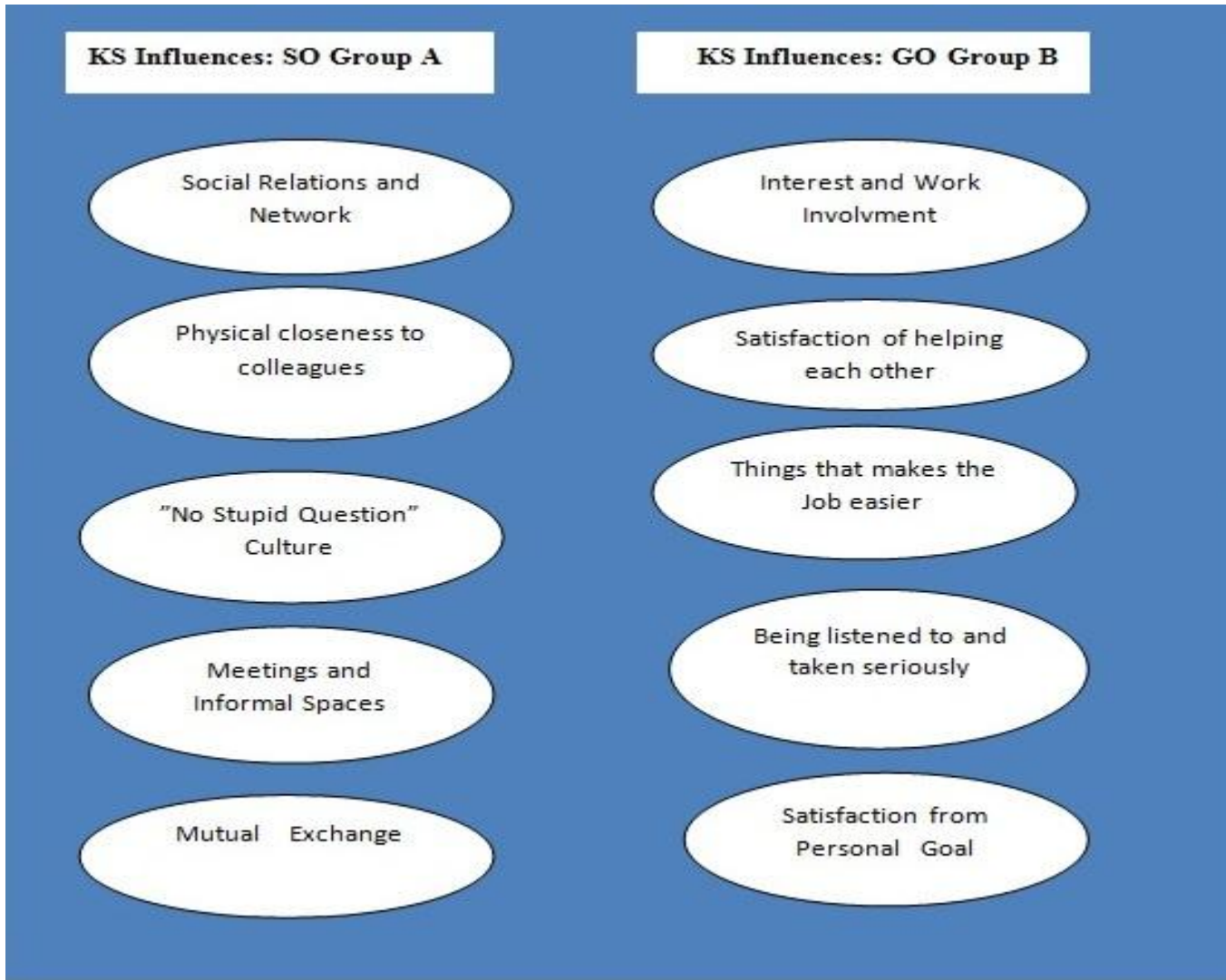
Figure 2. Concepts of Knowledge Sharing Influences. KS: Knowledge Sharing, SO: Socially Oriented, GO: Goal Oriented

with groups of software development professionals regarding their perspectives on knowledge sharing.

4.2 Knowledge Sharing Influences and Concepts

As shown in figure 2, socials relations and network, physical closeness, no "stupid question culture", meetings and informal spaces, and mutual exchange were the most conspicuous concepts which could influence knowledge sharing among the software professionals. The documentary accounts that support each of these concepts are shown in table 2. For example, the concept social relations and network is exemplified by the following: "To know each other. Easier to share/give knowledge to someone you know."

Furthermore, as illustrated in figure 2, the most dominant concepts regarding the factors that influence knowledge sharing among the software professional in the group B at VCIT were: interest and work involvement, things that make the job easier, the satisfaction of helping each other, being listened to and taken seriously, and satisfaction from personal goal. The documentary accounts that lend credence to each of these concepts are shown in table 3. For instance, the concept interest and work involvement is shown by the following: "When I see something interesting, exciting or new in my task I become involved and want to share my knowledge."

Knowledge Sharing Influences for Socially Oriented Group A Software Professionals	
Concept	**Documentary Accounts**
Social Relations and Network	"Good work collaboration/good personal relations"
	"Good sense of belongings"
	"Contact with other people for other aims-
	opportunities to talk and chat about some interesting things"
	"Seminar within VCIT site on specific and non-specific subjects where there are plenty of breaks"
	"Seminar within VCIT site – allow aligning with those with same goal and aspiration as me"
	"Through social networking – resolve any incident case that bothers me"
	"Social arrangements – allow easier contact in future"
	"Knowing each other. Easier to share/pass on knowledge to someone you know"
	"Closer affinity – create an opportunity to pass the knowledge you know"
	"Partnering with my colleagues – easier to know someone that I have not been in touch before in order to share my knowledge"
Physical Closeness to Colleagues	"Sharing office space with more than two people – strengthened social contact facilitates opportunities for sharing experience"
	"Sitting in an open office – makes it more informal to come and ask question"
	"Physical proximity, e.g. shared office"
	"Sitting close together, i.e. along same corridor"
	"Having a work space/desk close to each other"
	"Proximity to co-workers and project group members"
"No Stupid Question" Culture	"Openness – a work environment that stimulates your intentions"
	"Openness – a good attitude that enables a collaborative atmosphere to share knowledge"
	"Openness – a software process is described through my colleagues and that establishes a team spirit in place that help others to share knowledge"
	"When there is no such thing as stupid question due to trust in each other"
	"That is OK to ask questions – to have a knowledge sharing culture"
	"Trusting and believing in my colleagues capability"
	"Common goals that comes through trust"
Meetings and Informal Spaces	"Unplanned meetings, shared facilities/coffee rooms"
	"Informal meetings for personal interaction"
	"Coffee rooms and other informal meeting space"
	"Short face-to-face meetings"
	"People sit close together – knowledge will be shared"
	"Having meetings between one or more persons"
	"Informal meetings – get feedback from my colleagues"
	"Feedback during meetings – feel encouraged to explore other unknown areas that might help my colleagues to innovate at rate that meets our need in order to sustain a competitive advantage"
	"Meetings – create room for evaluation to reflect on important milestones though which i share knowledge"
	"Meetings – converge together to know how to do things"
	"Face-to-face meeting – make it easier to share knowledge in that i communicate very well with my colleagues"
Mutual Exchange	"Sense of responsibility and obligation – I share knowledge because i have received help at some point in the past"
	"Morally right – I share my knowledge when i feel the other person, who is asking for help, is in same situation that I had been before"
	"I want to help whenever I see a helpless colleague"
	"I share knowledge in the expectation of getting something in return"

Table 2. Knowledge Sharing Influences for Group A Software Professionals at VCIT

Knowledge Sharing Influences for Goal Oriented Group B Software Professionals	
Concept	**Documentary Accounts**
Interest and Work Involvement	"I become involved and want to share my knowledge, when i see something fascinating, exciting, stimulating or new in my task" "It is very inspirational to share knowledge, for me as well as the person i am helping. Increased commitment, involvement and motivation" "Being interested in my fellow workers makes me to want to share knowledge" "Eager to share information – willing to share with others the knowledge I have" "I desire to see a larger meaning in my task and to know that what i do will be used by others/to support our common goals. That motivates me to get involved to share my knowledge and experiences with others" "Being interested in resolving the issue of incident case during application maintenance make me willing to share the knowledge that i have" "I share knowledge when i perceive the person who asks the question is serious about the topic"
Satisfaction of helping each other	"Willing to help" "Teaching others – I learn a lot from teaching my colleagues and at the same time we exchange and share knowledge" "Pleased with my colleagues – to please others with my little effort in helping them solve incident cases" "Helping my colleagues to solve issues with supply chain management with our IT counterpart. It is good to see their relief after such a barrier is removed" "Dependency – When i know that others are dependent on my knowledge. I strive to ensure that what I know is shared with others in a way that ensures that innovation is upheld in the company" "If i perceive that a colleague could do things differently or in an easier way. Then i share my knowledge"
Things that makes the Job easier	"Handling a task faster/easier than expected – I find it easy to share my knowledge when a colleague is happy due to the way i handle cases of incident" "Incident case is a way to learn something new. If you deal with it, you improve on what you do" "A clever way to make work easier" "Using the available resources to make work easier and faster" "More people can handle the same task when they are familiar with how i carry out my task" "The more people know about how my apparatus works, the more people will devote themselves in helping out when i am ill or on holiday" "Task assignment – if people have similar knowledge, then it is easier to assign a task. Knowledge is shared"
Being listened to and taken seriously	"Good communication – someone listens to what i have to say" "Getting clearer view of how to do things – talking to someone that you rely on in order to learn from the person" "If you come to a person who has an open mind and a will to answer questions"
Satisfaction from Personal Goal	"Sharing my knowledge makes me more visible and put me in a favourable position for personal gain opportunities, such as job offers" "I validate my knowledge because I share it"

Table 3. Knowledge Sharing Influences for Group B Software Professionals at VCIT

4.3 Concepts and groups Relations

After integrating and relating the findings, it could be possible to show the associations between the concepts and groups in figure 3. As could be seen in figure 3, the concepts of knowledge sharing influences between the groups of professionals at VCIT were not the same, although the concepts in both categories had mutual characteristics. We could see interdependency between the concepts related to settings fostering personal closeness. This was evident among the socially oriented group A of the software development professionals in table 2. However, we could not see any similarity between the concepts for the
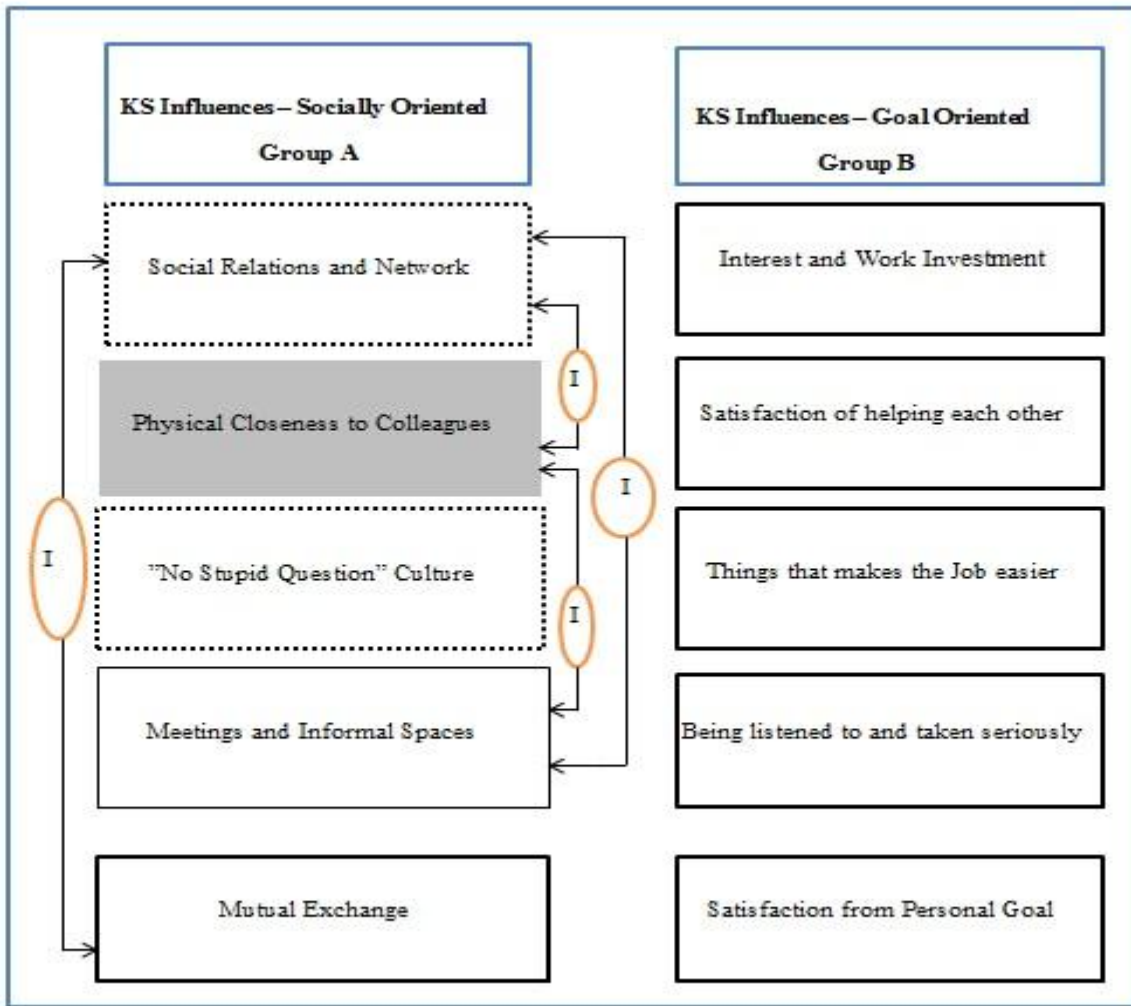
Figure 3. Overview of Knowledge Sharing Influences and their Associations. KS: Knowledge Sharing, I: Interdependency

groups of the goal oriented software development professionals in table 3.

5. DISCUSSION

In this section, we discuss the results of different modes that motivate software professionals to share knowledge and the practical implications of our study.

5.1 Characterisations of Socially Oriented groups in Software Development

As mentioned in section 2, social dimension is an essential factor which influences knowledge sharing in software development organisation. The idea is to strengthen social ties among individuals within social networks setting and to enhance the quality of information received and shared (Cross & Cummings 2004; Hansen 1999; Tsai & Ghoshal 1998). To elaborate slightly, Levin & Cross argued that a strong social tie between the knowledge provider and the recipient lead to the recipient's having a higher level of trust in the competence of the provider (2004). This is the unique characteristics exhibited by the socially oriented groups of the software development professionals at VCIT. The discussion from the results of this study highlights the characteristics inherent in knowledge sharing, which were associated with socially oriented groups, in three ways.

Firstly, in social relations and network, individuals have a strong social dimension through which knowledge sharing work may be practiced in informal settings that assimilate

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social exchanges (Alvesson 2004). Similarly, Uzzi & Lancaster found that individuals were more willing to share knowledge when the relation was embedded in a strong social network (2003). In social gathering at VCIT, common coffee and lunch breaks are settings that facilitate knowledge sharing due to the fostering of personal closeness (Corti & Lo Storto 2000; Marsden, & Hulbert 1986). The team members interviewed in our study used these settings to relate personally with each other, resolve any incident case that bothers them, partner with each other, and to maintain a good rapport with each other. This enabled the software development professionals to share their knowledge due to the strong tie and social cohesion. Therefore, social relations and network is an important organisational factor that was observed in our study.

Secondly, physical closeness to colleagues is said to be another conspicous factor that influences knowledge sharing and creation in software development organisation. As cited in Leenders & Wierenga, physical proximity was stimulated via change in work content which thus enables knowledge sharing and creation (2002). Also, as argued in Cardinal & Hatfield, knowledge sharing is socially embedded and increasing its potential would require settings that stimulated physical proximity (2000). For the software development professionals at VCIT, sharing office space with more than two people, sitting close together, having a work space close to each other and sitting in an open office were all important social core values mentioned by the socially oriented groups in our study. These social core values could strengthen social contacts which faciliate opportunities for knowledge sharing. This was remarkable and evident from our interviews and documentary accounts.

Thirdly, "no stupid question" culture, is noted to be a good practice that ought to be inculated among the socially oriented software development professionals. The "no stupid question" culture in the course of the exchange and share of knowledge is instrumental to building the competency-based trust which reduces feelings of vulnerability (Dewitte & de Cremer 2001: Swart & Harvey 2011). Also, DesShon & Gillespie admonish that, by avoiding situations where individuals risk demonstrating their incompetence or asking stupid question, it could be possible to share and exchange knowledge for the betterment of any organisation (2005). The socially oriented groups in our study related the notion of "no stupid question culture" to openness to new experiences. For example, Cabrera, Collins, & Salgado examined openness to experience and found it to be positively related to

individuals' self-report to knowledge exchange and sharing (2006). They suggest that individuals high in openness to experience tend to have a high level of curiosity resulting in devoting their time to learn from each other without allowing any room to entertain stupid questions. The software professionals interviewed in our study mentioned how they avoided asking stupid question by not only trusting in each, but also working in an environment where openness to new experience is highly valued in their groups. This enabled them to share knowledge that is devoid of rancour,bitterness and envy.

In addition, mutual exchange is known to be another factor that motivates the socially oriented groups in our study to share their knowledge. This is because the socially oriented groups were more willing to mutually share and exchange knowledge in a strong network (Uzzi & Lancaster 2003). As observed in the course of this research, the individuals' willingness to help others stems from the belief that it is only fair to help others if they themselves had received help from the organisation (Wasko & Faraj 2000). Thus, this creates the situation where group members reciprocate to each other directly for help. This was a typical scenario that we observed during the interviews and documentary acoounts of our study. At this juncture, the socially oriented group members saw it as a sense of responsibility and obligation to give back to the organisation the help that was received in the time past.

5.2 Characterisations of Goal Oriented groups in Software Development

In the goal oriented groups of the software development professionals, there are five distinct concepts which comprise: "interest and work involvement", "satisfaction of helping each other", "being listened to and taken seriously", and "satisfaction from personal goal". The employees in this category are more concerned about demonstrating their competence effectively while avoiding risks and negative judgements in knowledge sharing (Dweck & Leggett 1988). This implies that the goal oriented groups are concerned with appearing incompetent resulting in them avoiding knowledge sharing situations where they are uncertain about how others will respond to their knowledge or the probability of successful knowledge transfer.

In "interest and work involvement", team members were committed with a view to seeing a larger meaning in their task knowing that whatsoever contributions made would support the common goal of the software development organisation. This shows another perspective of the general

reciprocity which is related to the personal gain of an individual (Wasko & Faraj 2000). The reciprocity innate in personal goal was observed by some of the interviewees. The documentary accounts from the interviews show that some team members share knowledge in order to make them more favourable for personal gain, such as job offer.

Interest in organisational commitment has been stimulated largely by its demonstrated positive relationship to work behaviours such as job satisfaction, high productivity, and low turnover (Cohen 2003). The linkage between goal-oriented behaviour and commitment produces the psychological process through which people pursue actions which are specific and satisfactory (Lee, Tan & Javalgi 2010, p. 133). The satisfaction that comes from helping others as well as the fulfilment of one's personal goal is salient here. Our study corroborates the personal satisfaction that is realised whenever knowledge is shared or exchanged among the goal oriented software professional groups. Some of the professionals were satisfied whenever a colleague came to them to ask a question and to listen attentively for any constructive feedback.

5.3 Practical Implications

There are several practical implications that can be drawn from the findings of this study. First, managers should take into cognizance the diversity that exists between the socially oriented and goal oriented software development professionals regarding knowledge sharing in their organisation.

Second, a culture emphasising trust and innovation is conducive to knowledge sharing. It appears that the importance of the organisational culture lies in its ability to have a direct effect on employees' knowledge sharing behaviour as well as an indirect effect through influencing managers' attitudes toward knowledge sharing. Thus, human resource practices including fairness in decision-making and open communication are likely to promote an organisational culture that supports knowledge sharing (Cabrera & Cabrera 2005). An important caveat is that a positive culture alone may be insufficient to facilitate knowledge sharing. Research suggests that it is important to design knowledge management initiatives that are aligned with existing working habits and routines that link knowledge sharing to company goals and values (Hickins 1999; McDermott & O'Dell, 2001). Because the implementation of a knowledge management service or a new strategic emphasis on knowledge sharing involves asking managers and employees to adopt new attitudes and behaviours related to

knowledge sharing, a change management strategy needs to be considered. This strategy needs to create a need to change the status quo, and includes activities designed to ensure that employees are satisfied with the change process (e.g., reduce the stress level of company employees during change) (Taylor & Wright, 2004).

Third, Organisations should reward managers for providing the support necessary for encouraging knowledge sharing among employees. Management support for knowledge sharing may be demonstrated by emphasising sharing "lessons learned" instead of "mistakes made" (Teo 2005).

Fourth, Bryant's study suggests that knowledge sharing can be enhanced by increasing employees' self-efficacy through training (2005). It may also be important for organisations to help shape and facilitate employee perceptions of knowledge ownership which have been found to enhance their knowledge sharing because of internal satisfaction that comes from the realisation of personal goal.

6. CONCLUSION

Many IT organisations have employed the use of Nonaka's SECI model to create tacit knowledge in order to facilitate knowledge sharing. However, only a few researchers have conducted empirical research with regard to the influence of organisational factors on knowledge sharing in software development organisation.

This thesis, in its entirety, set out to explore the organisational factors which could influence the VCIT employees to share their knowledge. Subsequent to this, interviews and workshops were held in order to get a first-hand understanding of the organisational factors which will leverage knowledge sharing. This study adds to the understanding of knowledge sharing between different professional groups working at VCIT. The result of our study identified the characterisations of the two kinds of attitudes to knowledge sharing into the socially oriented and goal oriented groups. For the socially oriented groups, "social relations and network", "physical closeness to colleagues", "no stupid question culture", and "mutual exchange" are the organisational factors which influence knowledge sharing at VCIT. The attitude to share knowledge among the socially oriented groups is due to the social ties within the social networks setting which thus enhances the quality of information received and shared (Cross & Cummings 2004; Hansen 1999; Tsai & Ghoshal 1998). On the other hand, the organisational factors that influence the goal oriented groups are; "interest and work

involvement", "satisfaction of helping each other", "being listened to and taken seriously", and "satisfaction from personal goal". The knowledge among the goal oriented groups is mainly based on their general view on reciprocity which is related to the personal gain of an individual (Wasko & Faraj 2000).

However, as what motivates the socially oriented groups to share their knowledge is different from the goal oriented groups; there might be a conflict in satisfying everyone. Based on the practical implications in section 5.3, we reach conclude by proffering the following recommendations to managers and staff:

- make use of human resources management practices that facilitate a variety of co-worker relationship to help employees develop awareness of each other's expertise, a common language, and the trust that facilitates the sharing of knowledge

- uphold a culture that is not only focused on the idea of "no stupid questions" culture but also on the total organisational culture that promotes knowledge sharing

- put in place a recognition system that encourages socially and goal oriented groups to adapt to the different modes in knowledge sharing

- reward those employees who are experienced and knowledgeable at VCIT in order to encourage them to share their knowledge

7. FUTURE WORK

Data collection was limited to VCIT. Therefore, care should be taken in making generalisation from sample. We recommend that further work be done in software development organisation where a multiple-case case study could contribute to the wider generalisation of the findings. Furthermore, more multiple-case case studies on knowledge sharing influences could be carried out in a setting other than the software development organisation.

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