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Master Thesis in Informatics

Exploring knowledge sharing in the
Requirement Engineering phase
of globally distributed
Information Systems development:
Perceived challenges and suggestions for improvement



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Abstract

The Master thesis explores the knowledge sharing that takes place during the requirement engineering phase of globally distributed information systems development. In recent years, due to globalization, information systems development activities have become increasingly distributed across different geographical locations. Requirement engineering is an important and knowledge intensive phase in the development of information systems. Requirement engineering is the process of identifying, analyzing, documenting, validating and managing the requirements of a system. Effective and efficient knowledge sharing during the requirement engineering is vital for the successful development of information systems. However, the global distribution of the stakeholders has affected knowledge sharing during requirement engineering in various ways making it more challenging.

Drawing on the theories of knowledge sharing within the field of information systems, this interpretive research study aims at exploring stakeholders' perceptions about the challenges met during the knowledge sharing in requirement engineering phase of globally distributed information systems development projects. More specifically, this Master thesis explores the perceived challenges and generates a list of suggestions to overcome the challenges by conducting qualitative semi-structured interviews among the key stakeholders, both customers and business analysts.

The findings indicate that the knowledge sharing is influenced by challenges such as cultural differences, language barriers, communication issues, coordination issues arising from multiple stakeholders, time difference and difficulty in sharing tacit knowledge in the globally distributed settings. Participants' suggestions for overcoming these challenges include cultural trainings, kick off meetings, language trainings, use of translator, face-to-face communication and interaction, video conferencing, scheduling important meetings in the common suitable timings, identification of the main stakeholders, having a mediator and making close observations with face-to-face interactions.

Keywords: Information Systems, Information Systems Development, Requirement Engineering, Knowledge Sharing, Global Distribution, Outsourcing

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List of abbreviations:

- BA : Business Analyst
- IS : Information Systems
- ISD : Information Systems Development
- ISDLC : Information system development lifecycle
- RE : Requirement Engineering
- IT : Information Technology

Chapter 1

This chapter introduces the research subject, describes the research problem, gap identification from the previous literature and topic justification. Aims and objectives of the study, research questions, scope and limitations of the study are also presented in this chapter.

1. Introduction

1.1 Introduction and Research setting

Due to globalization, the trend towards information systems development (ISD) has changed (Edwards and Sridhar, 2005) and globally distributed information systems (IS) development has become increasingly common (Carmel, 1999). This enables the organizations to operate in a globally distributed cross-cultural environment. The primary reasons for the companies to outsource and operate in the distributed environment are skill-based needs and cost benefits from the vendors (Macgregor et al., 2005). Globally distributed information systems development projects consist of two or more teams working together to accomplish the goals from different geographical locations (Kotlarsky and Oshri, 2005). The distributed teams communicate and collaborate both within the company and with external partners, subsidiaries and outsourcing service providers. Success of globally distributed projects relies on effective knowledge sharing among these teams (Razzak and Ahmed, 2014).

Requirement engineering (RE) is a crucial phase in the information system development life cycle. Requirements describe what an information system should do (Sommerville, 2011, p.83) and during RE phase, the user requirements are identified, analyzed, documented, validated and managed. Besides the term Requirement Engineering, Requirement Analysis is also used for describing RE phase (Lopez-Lorca et al., 2016; Beynon-Davies, 2013). However, in the Master thesis the researchers adopt the term Requirement Engineering. There is a continuous communication, coordination and collaboration between the stakeholders during requirement engineering. Most of the times knowledge sharing and communication take place in virtual mode in the distributed environment due to geographical boundaries. Hence, RE phase is characterized by communication and knowledge transfer that involves various people who have different backgrounds, skills, knowledge, and experience (Coughlan and Macredie, 2002).

Keil et al. (1998) studied the experience of 41 project managers and found that most of the project risk factors were related to the requirements. RE is information and knowledge-intensive work that involves different stakeholders (Distanont et al., 2014). Since the requirement documents capture the stakeholders' expectations, failure to capture and document the appropriate requirements has an impact on the quality of the outcome (Macaulay, 1999). Poor execution of requirement elicitation will almost result in complete failure of the final project (Hickey and Davis, 2004; Khan et al., 2011). In fact, 70% of the projects fail due to poor requirement elicitation (Khan et al., 2011). The trend towards the global distribution of the ISD projects has been growing rapidly and, regardless of the advantages, there are also many challenges faced in requirement engineering phase because of the global distribution. Huang (2012) also states that globally distributed teams perform more poorly than those that are not geographically distributed. Success or failure of the information system mainly depends upon the quality of the requirements. RE being the critical activity in ISD, any problem in knowledge sharing process will have an impact on the quality of the requirements, which in turn will impact the consecutive stages of the ISD.

Therefore, this research study has two main purposes. One of the purposes is to explore the challenges in the knowledge sharing process in the RE phase of globally distributed IS development. By acquiring knowledge about the existing situation, the other purpose is to generate a list of the key stakeholders' suggestions to overcome these challenges. The participants of this research study are the business analysts and the customers, who represent the key stakeholders in the RE phase of globally distributed ISD projects. Customers express the requirements in their own term to the business analysts (Sommerville and Sawyer, 1997). Business analysts (BA) work closely with the customers/clients to identify, document and manage all business requirements in order to improve the existing information system or to develop a new one. The customers selected for this research study are from the organizations, which have their business units across multiple markets. These organizations outsource their ISD to the specialized IT vendors. The business analysts selected for this research study are from the vendor organizations that are involved in the development of web based information systems and provides IT services to the customer organizations.

1.2 Identification of the gap

Dorairaj et al. (2012) studied how knowledge is generated, codified, transferred and applied in distributed teams. Studies conducted by Tiwana (2003), Layman et al. (2006), Razzak et al. (2013) and Samoilenko and Nahar (2013) also addressed knowledge sharing process in distributed teams. However, these studies explored neither the challenges in knowledge sharing nor participants' suggestions for overcoming these challenges. Li (2010) studied factors that impact employees' online knowledge sharing in a cross-cultural context. Al-Salti and Hackney (2011) studied factors that facilitate or inhibit knowledge transfer success from vendors to clients in information systems (IS) outsourcing from the client perspective. Razzak and Ahmed (2014) studied challenges faced by the practitioners during knowledge sharing in distributed agile projects and suggested mitigation techniques to overcome the challenges. Riege (2007) conducted a study in Australian based multinational company in order to explore the actions to overcome the knowledge transfer challenges in a multinational company. Though these studies have addressed knowledge sharing challenges and provided suggestions for overcoming these challenges, there wasn't any specific study conducted with respect to knowledge sharing in the requirement engineering phase.

Damian and Zowghi (2003) conducted a field study to investigate the RE challenges in the global software development projects and provided recommendations to overcome these challenges. Bhat et al. (2006) conducted a case study from an Indian IT-services firm and provided insights about the root causes of RE phase conflicts in client-vendor offshore-outsourcing relationship. Damian (2007) conducted an empirical case study in an U.S.-based firm to study the challenges with stakeholder's interaction in RE in the distributed projects. This study also provided, practical solutions for those challenges. Karlsson et al. (2007) conducted a qualitative interview study with practitioners in order to identify the challenges in RE in the market driven software development. However, these studies investigated only the general challenges in RE, but not in the context of knowledge sharing.

Distanont et al. (2012) conducted a case study and a literature review to identify the knowledge transfer challenges in the requirement engineering. Following this study, Distanont et al. (2014) conducted another case study and literature review to overcome the challenges, identified by Distanont et al. (2012). However, these studies have not explored knowledge sharing in the RE phase in the context of globally distributed environment.

After a thorough literature review, it is observed that there is a lack of research studies in the IS research area particularly focusing on knowledge sharing in the RE phase in the globally distributed context. In addition to that, most of the previous researches were case studies and field studies that explored only the perspective of customers, which is one side of the knowledge sharing process. As it is essential to get a holistic view, in this research study, the perspective of key stakeholders, both customers and vendors, have been explored by conducting qualitative semi-structured interviews.

1.3 Purpose statement and research questions

This research study has two main purposes:

1. To explore and acquire knowledge about the current situation regarding the challenges met by the key stakeholders in the knowledge sharing in the RE phase in the globally distributed setting of information systems development.
2. To generate the key stakeholders' suggestions for improvements in order to overcome the challenges.

Having the above aim and objectives in mind, an interpretive qualitative research study was conducted. The research questions explored by the research are given below:

RQ1: How do the key stakeholders perceive the challenges met in knowledge sharing process in the requirement engineering (RE) phase of globally distributed IS development?

RQ2: How do the key stakeholders believe that the challenges in knowledge sharing process in the requirement engineering (RE) phase of globally distributed IS development can be addressed?

1.4 Topic justification

1. Why this study?

IS development activities are globally distributed to different countries because of the competitive market and skill-based needs. Hence, the stakeholders in requirement engineering are dispersed across various locations in the globally distributed setting. Knowledge sharing becomes complex, especially when the teams are globally distributed (Cramton, 2001). In order to build a large and complex information system successfully, proper learning and knowledge sharing is required among the team members (Curtis et al., 1988). RE being the primary and crucial phase in the ISD, the consecutive stages of system development such as design, testing and implementation depend completely on RE. Any problem with the requirements will lead to the failure of the system (Hickey and Davis, 2004; Khan et al., 2011). This is also supported by Macaulay (1999), who argues that the improper requirement capture will impact the quality of the outcome. In addition to that, a huge amount of time and money is getting wasted in developing the system with incorrect requirements (Distanont et al., 2014). Requirement errors are the most expensive errors to fix (Graddy, 1999 cited in Distanont et al., 2014). 70% to 85% of the rework cost is due to the errors in the requirements (Leffingwell, 1997 cited in Distanont et al., 2014). Boehm and Papaccio (1988) state that lot of rework effort and cost is needed to compensate for the inappropriately defined requirements. Thus, getting the right user

requirements at the early stage, eliminate a great amount of downstream work (Boehm and Papaccio, 1988).

RE is a knowledge-intensive work that involves different stakeholders (Distanont et al., 2014), and there is always a mutual knowledge sharing between the various stakeholders in RE across geographically distributed stakeholders. Inevitably, the knowledge sharing is a continuous process throughout the RE phase of ISD. Based on these dimensions, the RE environment can be seen as a knowledge sharing environment. As knowledge sharing is very crucial during RE, any challenges in knowledge sharing across globally distributed stakeholders can have a detrimental effect on the quality and the performance of the developed information system. So, it is essential to conduct this research study in order to identify the challenges in the contemporary distributed environment and, consequently, to generate the key stakeholders' suggestions for overcoming these challenges.

2. Why the perspectives of business analysts and customers?

The stakeholders in RE are the end users of the system, managers, business analysts, developers, customers and external bodies such as regulators and authorities (Sommerville and Sawyer, 1997; Kotonya and Sommerville, 1998). Though there are various stakeholders involved in the RE phase, the business analysts (BAs) and the customers are the key stakeholders of it. Hence, they are chosen as the participants of this research study to get a holistic view on knowledge sharing process in the RE phase in the distributed setting. The business analysts ensure that the IT solution meets the business requirements and expectations of the customers. Apart from capturing the requirements, business analysts enable the client to articulate needs (Kotonya and Sommerville, 1998). BAs act as a communication bridge between the client, the IS development teams and other stakeholders (Ambler, 2012). There is a continuous collaboration and mutual knowledge sharing between customers and the business analysts during RE. System customers, who specify the requirements, check the requirements' document to verify if it is an acceptable expression of their needs (Sommerville and Sawyer, 1997). As both the customers and business analysts play a key role in RE process in framing the requirements, it is important to get the viewpoints of both of them about knowledge sharing in the globally distributed environment.

3. To whom it is useful?

This research study benefits the researchers who intend to work on knowledge sharing process in RE that occurs in the globally distributed setting. The results of this Master thesis give insights about the knowledge sharing process in RE to various stakeholders such as business analysts, managers, developers, customers and the end users of the information system. This also benefits, both the customer and the vendor organizations to understand and improve the knowledge sharing practices in the RE phase that occurs among the globally distributed stakeholders.

1.5 Scope and limitations

Our research study approaches the research questions by interviewing the key stakeholders, both business analysts and customers, to explore their perceived challenges in the knowledge sharing in the RE phase that occurs in the globally distributed environment. This research study also provides the key stakeholders' suggestions for improvements in order to overcome these challenges. Only, the perceptions of the business analysts and the customers, who are the key

stakeholders in RE, are explored in this study. The perceptions of other stakeholders are not explored in this research study. In addition to that, the scope of this research is limited to the RE phase of web based information systems development in the globally distributed environment. The participants selected for this study are from multinational organizations with multiple organizational units across the globe. More specifically, both the vendor and the customer organizations has their business units in various countries. So the result of this study is only applicable for the multisite organizations.

1.6 Thesis organization

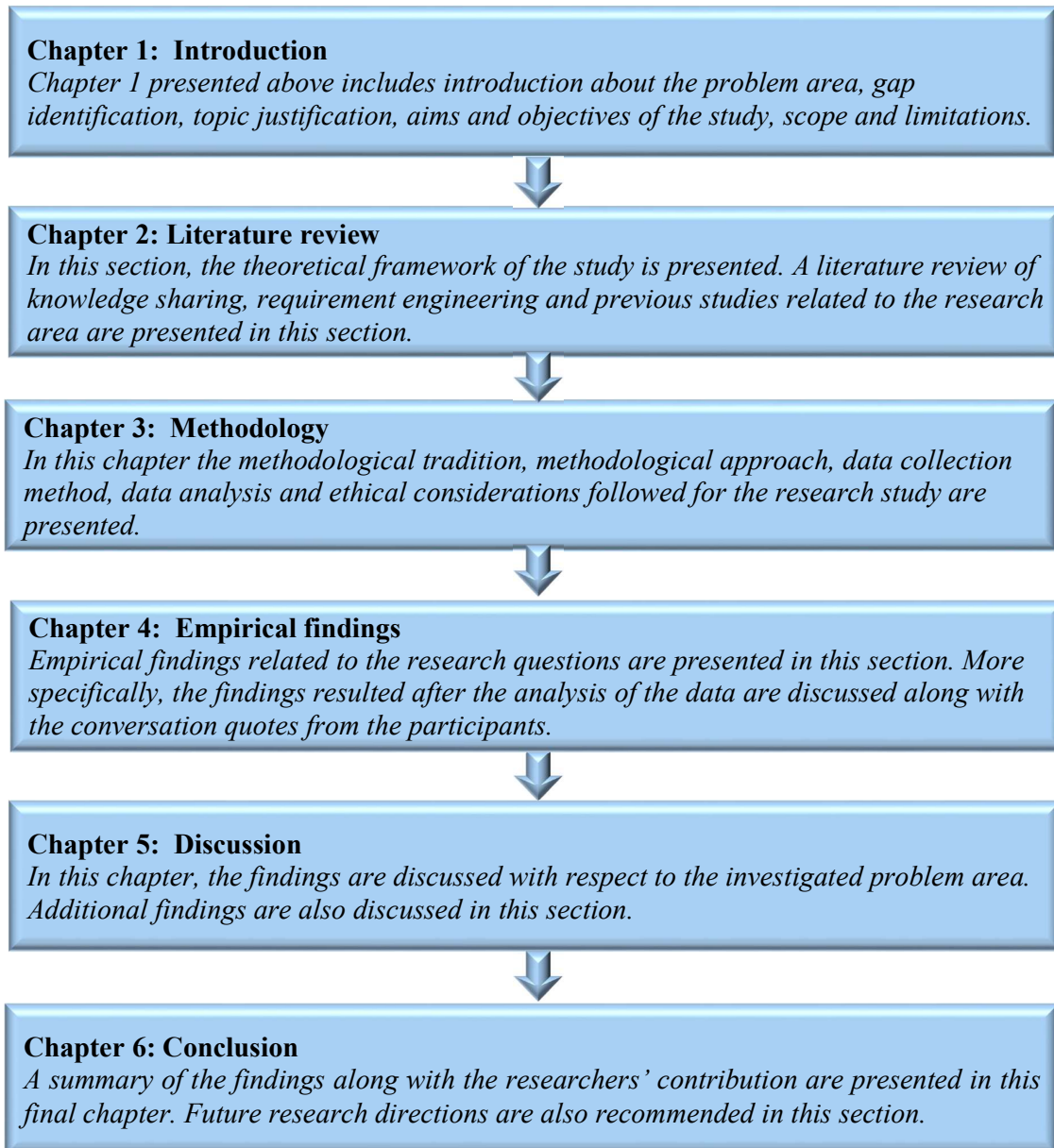


Fig 1. Thesis organization

Chapter 2

In this chapter the theoretical framework of our research study is presented. A literature review on knowledge sharing, requirement engineering and previous studies related to the research area are presented in this section that provides a better understanding on the research topic under study.

2. Literature Review

2.1 Information systems development life-cycle

The first phase of information systems development is the *conception phase*, where the business use case is developed and feasibility study is conducted. Strategic evaluation and risk analysis are carried out during this phase. Following the conception phase, is the *analysis, systems design, construction, testing and implementation phases* (Beynon-Davies, 2013, p.410).

During the *phase of analysis*, requirements are identified and documented. The requirement analysis phase is also described as requirement engineering (RE) by Kotonya and Sommerville (1998) and Sommerville and Sawyer (1997). In the Master thesis, we, as the researchers, adopt the term Requirement Engineering.

Systems design is the process of planning a technical artefact to meet the requirements, which is the blueprint for the construction phase. *Construction* involves programming and testing. This is followed by *testing* and, then, *implementation* that involves the delivery of the system into its context of use. This can be done in an assured manner by immediately moving from the old to the new system. Alternatively, it can also be approached in another way, where the old and new systems run in parallel for a period of time to ensure that there is a fallback position. Maintenance is the feedback process that involves changes to the information system (Beynon-Davies, 2013, p.410).

2.2 Requirements

According to Kotonya and Sommerville (1998, p.6) “*requirements are defined during the early stages of system development as a specification of what should be implemented*”. Sommerville and Sawyer (1997, p.4) define the requirements as “*descriptions of how the system should behave, or of a system property or attribute*”. According to Sommerville and Sawyer (1997, p.4) the requirements might describe a user level facility, a general system property, a specific constraint on the system, or it could be constraint on the development of the system. Sommerville (2011, p.83) states that the requirements are the descriptions of what the system should do, the services it provides and the constraints on its operation. Constraints are conditions that exist because of limitations imposed by internal and external factors, according to Distanont et al. (2014).

Requirement is a generic term and it can be distinguished into user and system requirements. Sommerville (2011, p.83) states that user requirements are the statements in a natural language and high level abstract requirements, whereas the system requirements are more detailed descriptions of the system’s function, services provided by the system and constraints on its operation. System requirements are classified as functional and non-functional. Functional

requirements describe what services the system provides, how it reacts to specific inputs and how it behaves in certain situations (Sommerville, 2011, p.85). Non-functional requirements define the overall qualities or attributes of the resulting system such as performance, reliability, usability etc. and they are not concerned with the functionality of the system (Kotonya and Sommerville, 1998, p.187).

The costs for fixing the errors because of the faulty requirements are greater than fixing errors that arise at the later stages of the system development process (Kotonya and Sommerville, 1998). For fixing the requirement problems, it requires lot of rework effort for system design, development, testing and implementation. Additionally, Kotonya and Sommerville (1998) argues that the cost of fixing a requirements error can be up to hundred times the cost required for fixing a small programming error.

2.3 Requirement Engineering

Requirement Engineering (RE) is the primary and crucial phase in information systems development (ISD). The requirement engineering process consists of requirement elicitation, requirement analysis and negotiation, requirement documentation and requirement validation as described by Kotonya and Sommerville (1998, p.32) and illustrated in figure 2. Requirement engineering involves people with different backgrounds such as business, marketing, design, development, testing and project management. These people are called stakeholders (Maalej and Thurimella, 2013, p.5). Typically, for the development of information systems, requirement engineering is primarily software requirement engineering, according to Kotonya and Sommerville (1998).

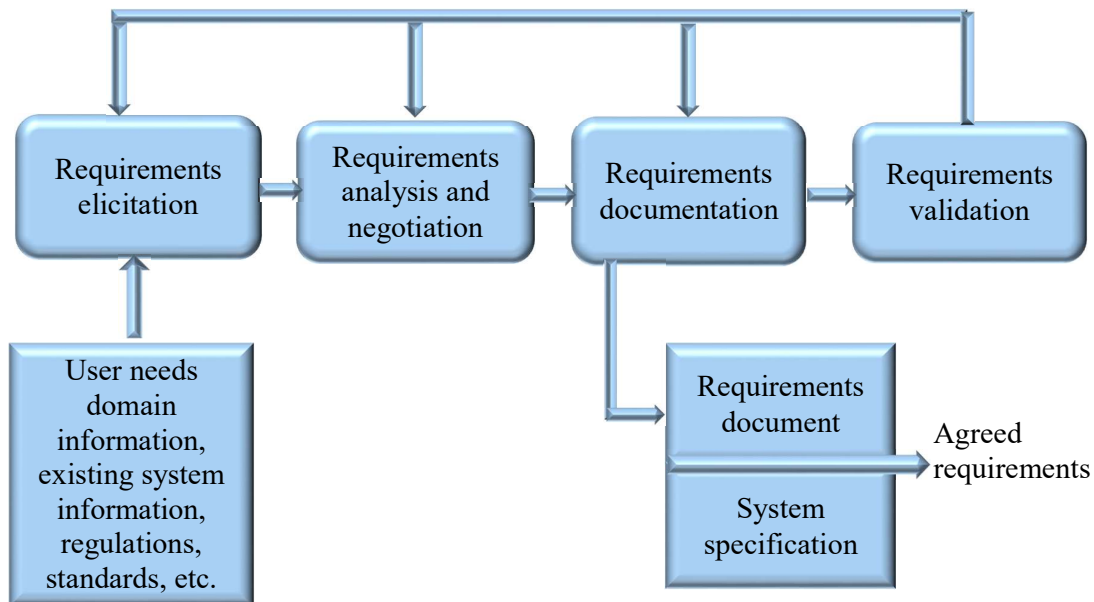


Fig 2. RE processes (Kotonya and Sommerville, 1998, p.32)

The needs of the customers are gathered and identified during the elicitation phase. Sommerville (2011, p.103) states that requirement elicitation is the process where the information about the required and existing system is gathered, and the requirements are

distilled from this information. Various elicitation techniques include interviews, workshops, process groups and surveys (Distanont et al., 2014). The identified requirements during the elicitation phase are analyzed in the analysis phase by identifying the missing and inconsistent requirements. Negotiation is done during this phase in order to decide on the set of agreed requirements. Requirement specification is documenting the requirements in order for the stakeholders to understand the detailed requirements. During validation the documented requirements are verified and a final specification document is the output of this phase (Kotonya and Sommerville, 1998, pp.32-33). Requirements validation involves ensuring whether the requirements reflect the customer needs rather than focusing on the correctness of the documentation (Ramesh et al., 2010). Requirement document represents the official statement of the system requirements for the end-users, customers, developers and other stakeholders Sommerville (2011, p.5). System specification describes the functional and non-functional requirements in more detail (Sommerville, 2011, p.93).

2.4 Knowledge sharing

Knowledge has been defined in various ways in the literature. De Long and Fahey (2000) define knowledge as “*a product of human reflection and experience*”. Nonaka (1994) defines knowledge as “*Justified true belief*”. One of the way to define knowledge is by differentiating data, information, knowledge and wisdom that are key elements of the data-information-knowledge-wisdom (DIKW) Hierarchy. The DIKW Hierarchy is illustrated in figure 3 in which data, information, knowledge and wisdom are arranged in a hierarchical manner with data at the bottom and wisdom at the top.

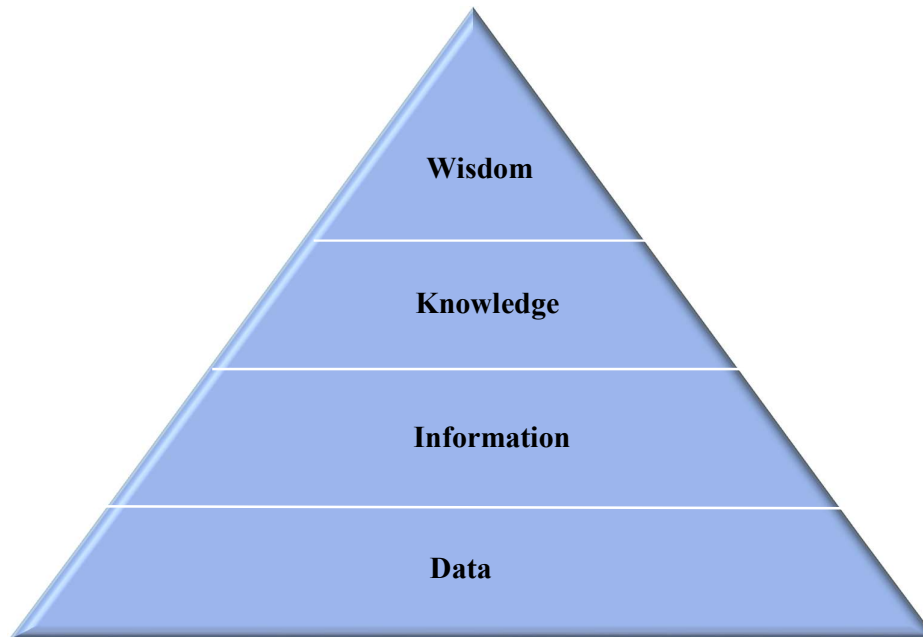


Fig 3. DIKW hierarchy (Adapted by Rowley, 2007)

This model illustrates the conversion of data into wisdom. It is clear from this model that information comes from data and knowledge comes from information. According to Ackoff (1999), data is merely a symbol that represents the objects, events and environment. Information answers to the questions who, what, when and how many. According to Frické (2009), knowledge is know-how, and wisdom is using the knowledge in the appropriate way.

A general process-oriented view of knowledge sharing comprises of three phases as described by Block and Khvatova (2013): 1. Initiating and sending, 2. Social interaction, and 3. Receiving and applying knowledge. This is illustrated in figure 4.

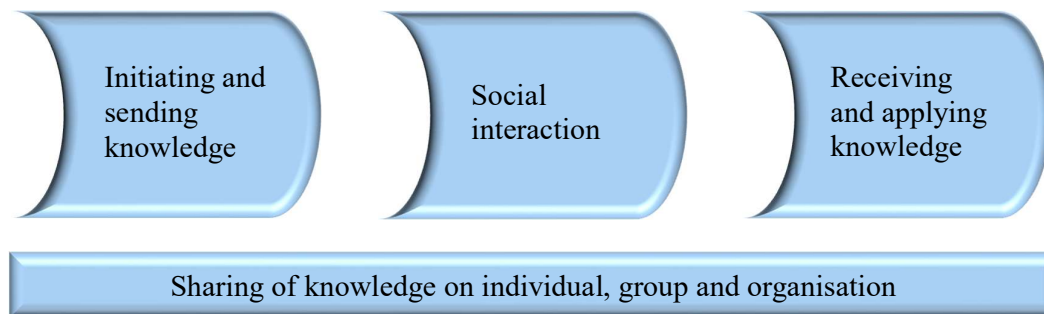


Fig 4. Knowledge sharing process (Adapted from Block and Khvatova, 2013)

Paulin and Sunesson (2012, p.83) define knowledge sharing as “*an exchange of knowledge between two individuals: one who communicates knowledge and one who assimilates it*”. Paulin and Sunesson (2012, p.83) further state that the focus in the knowledge sharing process is on the human capital and the interaction of the individuals. According to Van den Hooff and De Ridder (2004), knowledge sharing is “*the process where the individuals mutually exchange their knowledge and jointly create a new knowledge*”. Block and Khvatova (2013) argues that the quality of knowledge sharing depends upon the human beings involved, and the capability of the actors involved to share and apply the knowledge. Al-Alawi et al. (2007) state that knowledge not only exists in documents and repositories, but it also becomes embedded in people’s minds overtime and eventually it is demonstrated through their actions and behaviors. Knowledge sharing during RE results in the creation of new knowledge in the form of requirement documents or specification documents that assist the information system development activities. This is also supported by Maalej and Thurimella (2013, p.7) who states that the knowledge sharing process in requirement engineering involves “*capturing and transferring*” knowledge.

There are two kinds of knowledge, tacit and explicit. Explicit is the knowledge that can be shared easily whereas, tacit knowledge is hard to communicate and share with because it is deeply engrained in the actions and experience of the individuals (Nonaka and Konno, 1998). Hackney et al. (2008) states that tacit knowledge is more difficult to share and express or sometimes it is impossible to express in verbal and written form. According to Blumenberg et al. (2009), tacit knowledge is valuable in order to achieve a competitive advantage, but it is difficult to articulate it from an individual’s mind. Maalej and Thurimella (2013, p.5) argues requirements knowledge consists of both implicit and explicit information and this implicit knowledge is the hidden knowledge that Nonaka and Konno, (1998) describes as tacit knowledge.

According to Nonaka and Konno (1998), knowledge creation is a spiral process of interaction between tacit and explicit knowledge where the interaction between them results in the creation of new knowledge. Nonaka and Konno (1998) conceptualize four conversion patterns in SECI model as illustrated in figure 5.

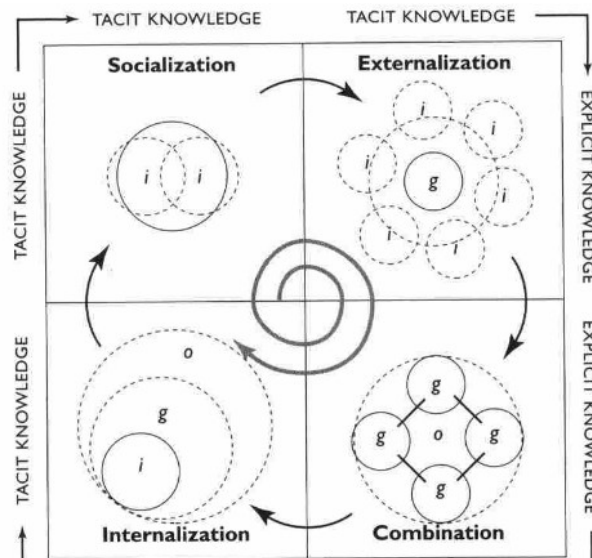


Fig. 5 Spiral Evolution of knowledge conversion process (Nonaka and Konno, 1998).

These are *socialization*, *externalization*, *combination* and *internalization* (SECI). *Socialization* is sharing of knowledge between individuals through joint activities such as spending time together and living in the same environment. Nonaka and Konno (1998) state that socialization involves capturing knowledge through physical proximity, and the process of acquiring knowledge is supported through the interaction between the suppliers and customers. The process of transferring one's ideas to others means to share a personal knowledge and create a common place.

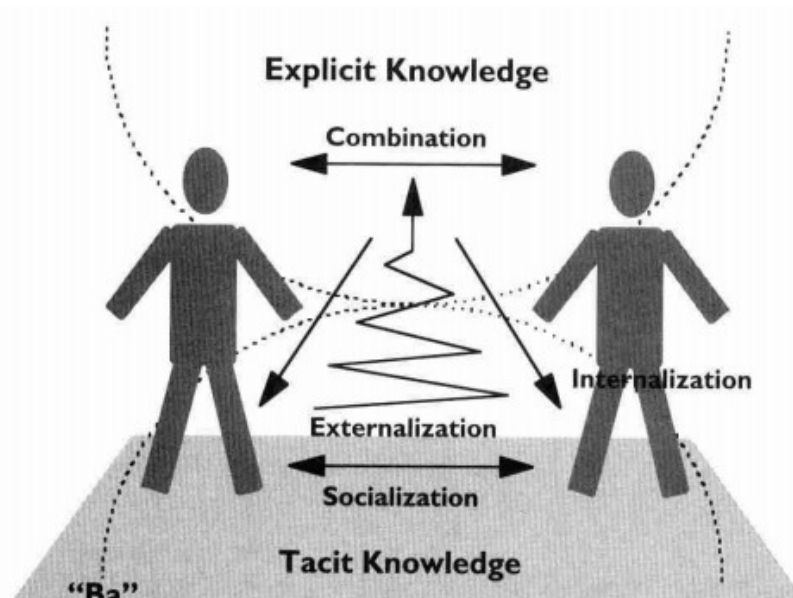


Fig.6 Ba knowledge conversion (Nonaka and Konno, 1998)

Figure 6 illustrates the Ba knowledge conversion process. According to Nonaka and Konno (1998), *ba* can be thought of as a shared space for emerging relationships. Nonaka and Konno, (1998) have adopted this concept for the model of knowledge creation. This space can be

physical, virtual, mental or a combination of these. *Externalization* requires the expression of tacit knowledge and its conversion into an understandable form. During this stage individual become a part of the group and the ideas fuse and integrated with the group's mental world. Nonaka and Konno (1998) describe the *combination* as the conversion of explicit knowledge into more complex sets of explicit knowledge. According to them, a new knowledge is created and spread among the other members of the group. The fourth pattern is the *internalization* in which the newly created explicit knowledge is converted into organization's tacit knowledge. In the SECI model, *ba* offers an integrating conceptual metaphor for the SECI model of dynamic knowledge conversions. Real time knowledge creation is achieved through self-transcendence within *ba* (Nonaka and Konno, 1998).

According to Maalej and Thurimella (2013, p.5) requirements knowledge consists of the implicit or explicit information that is needed or created while engineering, managing, implementing or using requirements. It is also useful for answering requirements-related questions in any phase of the project. Five different types of requirements knowledge are distinguished by Maalej and Thurimella (2013, p.5-6) as explained below:

1. Domain knowledge: It refers to a specialized knowledge in a particular area of discipline.
2. Engineering knowledge: It refers to developing the content of the requirements such as requirements specifications and dependencies between the requirements. It also includes the artefacts such as models, test cases or system architecture needed to understand and implement the requirements.
3. Management knowledge: It includes requirement related issues, decisions, action items, quality measures, templates and properties of requirements such as status, priority and stakeholder preferences.
4. Collaboration knowledge: It includes information about people, discussions, their interactions, argumentation chains and presuppositions.
5. How-to knowledge: It includes information tools, processes, and methods to be used for a particular situation during requirement engineering and management.

So and Bolloju (2005) argue that IS projects are recognized as knowledge-intensive and they often involve interaction of people with different expertise and skills. The two types of knowledge that are transferred in IS projects are technical knowledge and business knowledge (Goles et al., 2008). Tiwana et al. (2003) define technical knowledge as knowledge that is used to translate the business needs into a software-based solution. Transforming business needs into IT-based solution involves knowledge such as programming, operating, configuring and testing (Xu and Ma, 2008). "*Business knowledge is knowledge about the business needs that a system must fulfill*" (Tiwana et al., 2003). This involves knowledge about project management, contract negotiation and risk assessment. Tiwana et al. (2003) state that through the integration of business and technical knowledge, project stakeholders can arrive at mutual agreement about how the functionality and design of a system can support the business objectives of the project. Communication is a tool that facilitates the knowledge sharing process and it is a key for effective knowledge sharing (Al-Alawi et al., 2007). There is a lot of knowledge that resides in the office space, and office space fosters knowledge sharing through knowledge management strategy (Razzak et al., 2013). Trust building and knowledge sharing are

interdependent and nested processes, and building trust plays a pivotal role in requirement analysis success (Luna-Reyes et al., 2008).

To identify the requirements and to share the domain expertise with customers and developers, there is a need for knowledge sharing. Domain knowledge of the experts that perform expert roles in organizational contexts is largely tacit Ryan and O'Connor (2013). Requirements are constructed through a continuous process of sense making and negotiation among stakeholders (Davidson, 2002; Kraut and Streeter, 1995; Levina, 2005; Levina and Vaast, 2005; Sommerville and Sawyer, 1997). Team members share knowledge and learn from each other in the process of completing an assigned task (Bereby-Meyer et al., 2004). In engineering processes, many different sources of knowledge are used; both human sources such as experts, as well as documents and databases (Barnard and Blok, 2003).

2.5 Knowledge sharing in globally distributed environment

The Requirement Engineering process is characterized by communication and knowledge transfer that involves various people who have different backgrounds, skills, knowledge, and experience (Coughlan and Macredie, 2002). Social interaction and conversation are the vital elements of effective knowledge sharing in a distributed project where verbal face-to-face interaction facilitates effective knowledge sharing between the team members (Razzak and Ahmed, 2014). Communication is a tool that facilitates the knowledge sharing process and it is a key for effective knowledge sharing (Al-Alawi et al., 2007). Hansen (2002) states that strong ties enable effective knowledge sharing in multi-organizational units. A recent research's findings indicate that knowledge sharing, communication, and learning in organizations are influenced by cultural values of individual employees (Hofstede et al., 2010; Hutchings and Michailova, 2004). Simonin (1999) examined the effect of knowledge sharing and knowledge management process between international alliance partners and identified that cultural differences impact these processes. Geographical distance is the fundamental characteristic of multinational corporations and a key factor that influences knowledge sharing across units (Mäkelä et al., 2012). Globalized and distributed processes means capabilities, multiple centers of excellence and cross cultural knowledge exchange (Gerybadze, 2004).

Some researchers have studied the key drivers of knowledge sharing process and have proposed recommendations for effective knowledge sharing (Xiang et al., 2013; Ghobadi and Ambra, 2013). Razzak and Ahmed (2014) studied that version control, screen sharing, daily scrums, weekly sprint status, common chat rooms, technical forums, discussion forums, electronic boards and online conferences are some of the techniques used for knowledge transfer in distributed agile projects. Ryan and O'Connor (2013) studied that social interaction is important for sharing the tacit knowledge. This is also confirmed by Razzak et al. (2013) who argued that social interaction is an important issue for the sharing of knowledge in an effective way in distributed development. Luna-Reyes et al. (2008) argue that trust is critical in succeeding collaborative knowledge sharing process in requirement engineering. Rosenkranz et al. (2014) studied boundary interactions and motors of change in requirement elicitation. However, this study is limited to data warehousing domain. In the outsourced software system development there is a challenge in gaining the domain knowledge from the client (Tiwana, 2003). Razzak and Ahmed (2014) studied that language affects the knowledge sharing in distributed projects. Layman et al. (2006) states that there is lack of informal communication, language and cultural differences in global software development teams that result in low levels of trust and awareness of work at remote sites. Kotlarsky and Oshri (2005) state that social ties, such as trust, influences knowledge sharing process. Face-to-face interactions, organizing

frequent distant interactions, and regular teleconferences facilitate the knowledge transfer process (Kotlarsky et al., 2008). Dorairaj et al. (2012) found that transfer of knowledge between distributed team members occurs using suitable tools, during daily Scrum, pair-programming, inception workshops, visits and discussion sessions. They interact with the stakeholders using technologies such as e-mails, instant messaging, video and tele-conferencing, etc. In some cases, they travel to the client location to have face-to-face meetings (Yadav et al., 2009).

Alshawi and Al-Karaghoul (2003) state that the knowledge gap and culture have impact on business requirements identification. A study of IT-supported knowledge sharing in globally distributed complex systems development provides an overview on the various IT tools, methods and strategies that can significantly improve communication, support knowledge usage and exploitation, and speed up knowledge sharing in globally distributed context (Samoilenko and Nahar, 2013). Li (2010) studied that organizational issues, national cultural differences and online communities of factors impact knowledge sharing among globally distributed members. Knowledge sharing depends upon the cognitive ability of the team (Hai, 2002). Newell et al., (2007) argues that trust building is an important factor that affects knowledge sharing in globally distributed work teams. One of the biggest problem is to coordinate communications from various system stakeholders and to be able to develop a common understanding of stakeholders' requirements (Hannola et al., 2010). Adenfelt and Lagerström (2006) argues that ineffective coordination results in low degree of knowledge sharing.

A recent field study at an industrial software company on knowledge sharing found that the conversations, test cases, and written reminders served to help team members share their knowledge and understanding of the requirements (Sim and Gallardo-Valencia, 2013). Lim et al. (2010) state that stakeholder analysis prioritization is a problem in global software projects. In global software development (GSD) there are many challenges in gathering requirements (Khan et al., 2011). Khan et al. (2011) further states that poor requirement elicitation will almost result in complete failure of the final project and 70% of the projects fail because of that. Söderquist and Nellore (2000), Bhat et al. (2006), Riege (2007) and Noll et al. (2010) suggest that organizing face-to-face meetings enables face-to-face communication that facilitates the relationship between the stakeholders. Al-Salti and Hackney (2011), Bhat et al. (2006) and Riege (2007) argue that informal communication helps to improve the collaboration between the stakeholders. A platform for knowledge sharing should be established (Shan et al., 2010). Riege (2007) suggests that direct contact between stakeholders should be encouraged to ensure proper knowledge sharing. Riege (2007) and Noll et al. (2010) recommend that most appropriate transfer channel has to be chosen for efficient knowledge sharing. Riege (2007), Goffin et al. (2010) and Shan et al. (2010) propose that a database has to be created for managing the requirements so that the stored requirements can be accessed by all the stakeholders. Bhat et al. (2006) state that collaborative environment supports knowledge transfer. Sharing in distributed ISD projects is far more challenging than co-located projects (Kotlarsky and Oshri, 2005). According to Liu et al. (2006), knowledge management software can help an organisation to capture knowledge and experience. This software product gets the correct knowledge from the right person at the right time to facilitate timely and effective decision-making. Damian (1999) identified that there is a need for developments in computer-supported collaborative work in distributed requirement engineering.

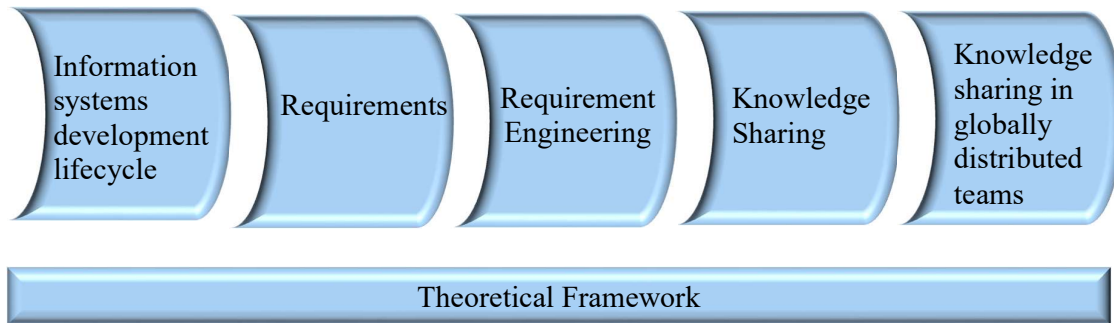


Fig. 7 Theoretical framework

A thorough literature review has been made, concerning the particular research area to gain a good grasp of the topic under study. Figure 7 illustrates the theoretical framework that guided our research study.

To conclude, the literature review shows that the challenges in knowledge sharing in the globally distributed teams are still pervasive and there are breakdowns in knowledge sharing in IS development projects. In addition, the previous research studies also show that the dispersed teams perform more poorly compared to the co-located teams. Indeed, there is a gap that less attention has been given in studying the challenges in knowledge sharing during the RE phase in the globally distributed context. So, this calls for further study of this topic, which is a key activity in ISD.

2.6 A conceptual representation of the research study

The globalization has impacted on almost every industry making organizations to operate in more than one country in the multinational context. Skill-based needs, cost benefits, availability of project resources round the clock and several other factors make organizations to distribute the

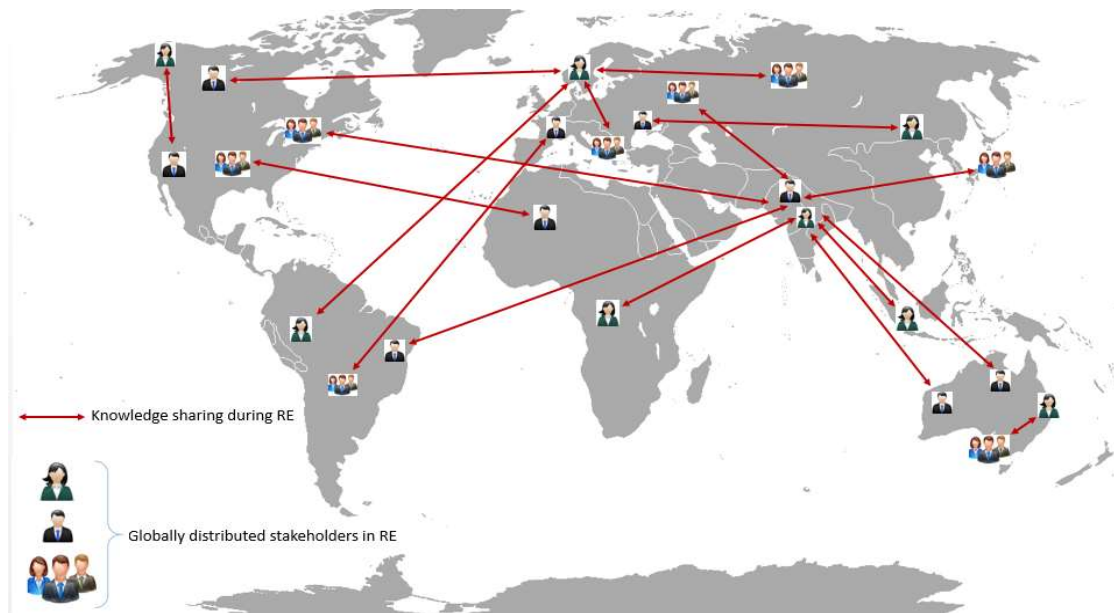


Fig. 8 A conceptual representation

ISD projects to other locations. Hence, the stakeholders in ISD projects from various countries with various backgrounds work together in the globally distributed environment. Requirement Engineering in information systems development is a knowledge intensive phase which needs continuous and close collaboration between the key stakeholders such as business analysts and customers.

Figure 8 depicts our research concept, i.e. knowledge sharing during the RE phase that occurs between globally distributed stakeholders. As illustrated in figure 8, the stakeholders in RE are widely spread across the world and are engaged into continuous mutual knowledge sharing. However, the global distribution impedes the knowledge sharing process in RE which makes it challenging. Hence, it calls for a need to explore the key stakeholders' challenges met in knowledge sharing in the RE phase in the globally distributed environment and to generate their suggestions for improvements to overcome these challenges.

Chapter 3

In this chapter the methodological tradition and methodological approach followed for our research study are discussed. In addition, methods of data collection and data analysis are also discussed. Finally, validity and reliability along with ethical considerations followed for the research study are presented.

3. Research Methodology

3.1 Methodological tradition

Epistemology is theory of knowledge that justifies the knowledge building processes. It also justifies how the knowledge can be obtained by the researchers (Carter and Little, 2007). Orlikowski and Baroudi (1991), followed by Chua (1986) state that there are three main paradigms in IS research based on epistemology which are positivist, interpretive and critical. Myers (1997) states that positivistic researches are carried out by assuming that the reality is objectively given and it can be described by measurable properties. He also states that interpretive researches are carried out assuming that the access to reality is socially constructed. According to Walsham (1993, p.10) “*Interpretivism is an epistemological position, concerned with approaches to the understanding of reality and asserting that all such knowledge is necessarily a social construction and thus subjective*”. Whereas the critical researches are carried out assuming that the social reality is historically created and it is produced and reproduced by people (Myers, 1997).

In this research study, the chosen research paradigm is interpretivism as this study focuses on exploring the perspectives of the participants. Interpretive research paradigm helps the researchers to understand human thought and action in social and organizational context (Walsham 1993, p.10). It focuses on the complexity of human sense making as the situation emerges (Kaplan and Maxwell, 1994). Furthermore, it has the potential to produce deep insights into information systems phenomena and it attempts to understand phenomena through the meanings that people assign to them (Klein and Myers, 1999). Klein and Myers (1999) further states that the knowledge of reality is attained in the interpretive research by social constructions such as language, consciousness, shared meanings and other artefacts.

3.2 Methodological approach

The main research approaches in the field of information systems are qualitative and quantitative methods. Quantitative research was originally developed in the natural sciences in order to study natural phenomena (Myers, 1997). Survey methods, laboratory experiments, formal and numerical methods such as mathematical modeling are some of the examples of the quantitative approach (Myers, 1997). While, the qualitative approach is helpful “*to understand how people think or feel about something and why they think that way... to understand and explore what a technology or practice means to people*” (Kaplan and Maxwell, 1994).

For this research study the qualitative approach has been adopted. The motivation behind the selection of the qualitative approach is to collect the data from the participants in the real environment, and to share their real time experiences that will be helpful to yield realistic results. The goal of qualitative research is understanding issues or particular situations by

investigating the perspectives and behavior of the people in these situations and the context within which they act. It investigates the influence of social, organizational, and cultural context on the area of study (Kaplan and Maxwell, 1994).

3.3 Methods/Techniques for data collection

The interview technique was the chosen method for the collection of our data. There are three kinds of interview techniques namely structured, unstructured and semi- structured interviews. Semi-structured interviews were selected as means of data collection for our Master thesis as it is well suited for the exploration of the perceptions and opinions of the respondents regarding the research area (Barriball and While, 1994). Semi-structured interviews also assisted us to further probe more questions based upon the responses of the participants and ask for more clarifications. The interview framework was prepared prior to the interviews (Appendix A).

The participants were selected using purposive sampling because purposeful sampling assists in selecting information-rich data. Studying information-rich data yield insights and in-depth understanding rather than empirical generalizations (Patton 2002, p.230). Therefore, the selection of the interviewees was based upon the kind of the company they work at, their experience in requirement engineering in the distributed projects, and their role in the organization. Age and gender factors were not considered in sample selection as we believe that it would not have any impact on the quality of the data. More specifically, the participants of this research were customers and business analysts from the vendor teams involved in distributed projects located across different countries such as Sweden, USA, Singapore and India with different ethnic backgrounds. It was appropriate to conduct the interviews with participants working in this kind of setting in order to collect rich data for our Master thesis. Considering the probabilities of withdrawal, 11 participants are chosen for this research study. Out of 11 participants, 2 of them have withdrawn from the interview. However, the sample size of 9 was sufficient enough to gather rich data for the research study. The details of the participants are given in the table below.

Participants	Role in RE	Location	Years of experience
Participant 1	Business analyst	India	7
Participant 2	Business analyst	USA	5
Participant 3	Business analyst	USA	11
Participant 4	Business analyst	USA	6
Participant 5	Business analyst	Sweden	4
Participant 6	Customer	Singapore	5
Participant 7	Customer	Sweden	2
Participant 8	Customer	Singapore	4
Participant 9	Customer	USA	5

Table 1: Participants details

As the participants of the research were globally distributed, the interviews were conducted using telephone and face-to-face depending upon the distance between the participants and the researchers. Among 9 interviews, 7 interviews were conducted using telephone and 2 face-to-

face interviews were conducted. The time and day of each interview was decided according to the flexibility of the participants. The interviewees were informed about the purpose of the research study prior to the interview. Each interview lasted for minimum 30 minutes to maximum 60 minutes. The researchers started each interview with the introductory questions and then moved onto the questions of the specific area under study. Eight of the interviews were conducted in English, which is a common language between the researchers and the participants. This made the transcription of the interviews simpler, as this thesis is written in the English language. One of the interviews was conducted in the common native language between the researchers and the participant. The interview was translated into English and then transcribed in order for the data to be analyzed. Follow up interviews were conducted in needed cases. The interviews were audio recorded with the consent of the participants. Audio recording frees the researchers to concentrate on engaging with the interviewee (Walsham, 2006). Additionally, with audio recording, it was possible to return later to the transcriptions for alternative forms of analysis, and it was useful for picking out direct quotes when writing up. The transcriptions of the semi-structured interviews were documented as a report. The interview report of each participant was sent to the interviewee in order to verify whether it was correctly transcribed. The collected data such as audio recordings and scanned copy of the interview notes were stored as electronic sources. To avoid the data loss, due to unexpected hardware/software errors, data backup was taken proactively.

3.4 Data Analysis

The data collected from the interviews were analyzed using thematic analysis in order to translate the raw data to meaningful concepts. This is called the three Cs of analysis: from coding to categorizing, and then to concepts according to Lichtman (2013).

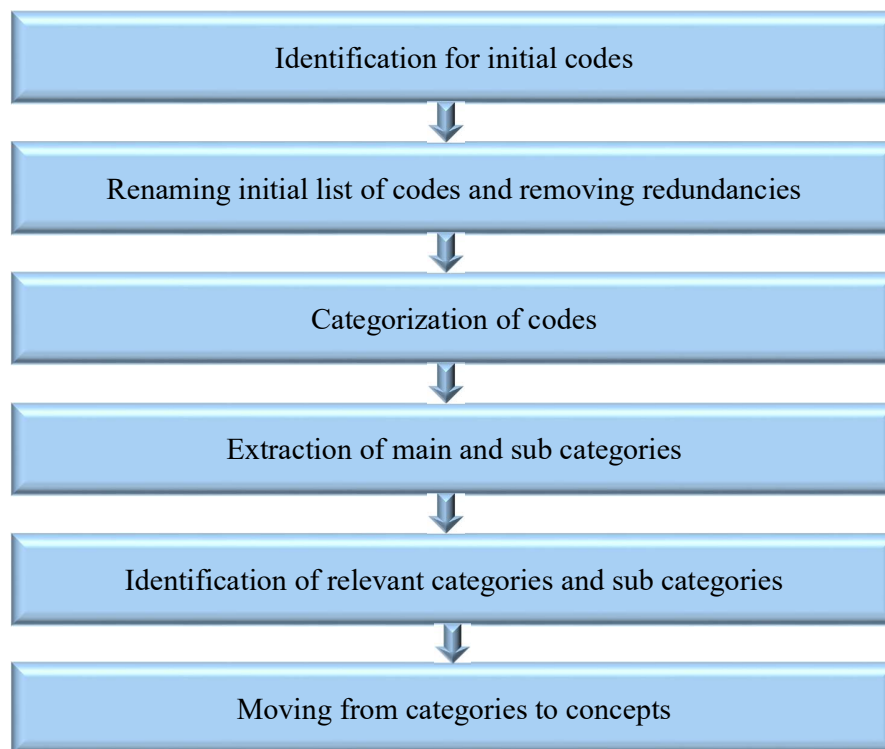


Fig. 09 Thematic analysis process

The data analysis consisted of the following steps as illustrated in figure 09: initial coding, revisiting initial coding, developing an initial list of categories, modifying initial list based on additional re-reading, revisiting the categories and subcategories and moving from categories to concepts.

Therefore, the researchers have gone through the text of the interview transcriptions and made an initial coding of words and phrases of the participants as suggested by Lichtman (2013). Initially, a large number of codes were developed from the interview text. It was checked for redundancies and some of the recurring codes were excluded. Then, some of the codes that were synonyms were also renamed. After removing the redundancies and renaming the synonyms, the researchers managed to reduce the number of identified codes from the initial list of codes. After that, the codes were organized into categories. Some of the codes became the main topic of the category, while others became the subsets within these categories. The researchers repeated the same process and eliminated unimportant categories until the most important and relevant categories of the study were identified. Finally, meaningful concepts were made out of the categories. There were six main concepts identified after the thematic analysis and, these are: cultural differences, language barriers, communication issues, time difference, coordination issues with multiple stakeholders and tacit knowledge. The empirical findings of these concepts are discussed in detail in chapter 4.

3.5 Validity, reliability and reflexivity

Validity and reliability are the two important aspects with respect to any kind of research. Validity in research is concerned with the accuracy, and reliability is concerned with the replicability of the scientific findings (Le-Compte and Goetz, 1982, p.32). According to Campbell et al. (1963), there are two types of validity namely internal and external validity in qualitative research. According to Denzin (1970 cited in Brink, 1993), internal validity is the extent to which research findings are a true reflection and representation of reality rather than being the effects of extraneous variables. External validity addresses the degree to which such representations of reality are validly applicable to fulfill the outcome of the research (Denzin, 1970 cited in Brink, 1993).

The below mentioned points ensure reliability and validity of the research findings:

1. In order to get rich data, semi structured interviews were conducted with large number of interviewees, i.e. 9 participants.
2. Participants with at least two years of experience as stakeholders in the RE working in the globally distributed environment were selected for the interview.
3. Follow up interviews were conducted in some cases in order to gather accurate data.
4. The data collected from the participants were transcribed and confirmed with them in order to achieve high accuracy.
5. The results were derived by categorizing more frequently occurring codes from the collected data.
6. Making presumptions are avoided in order to eliminate research bias.

Apart from reliability and validity, reflexivity is also one of the additional aspect of qualitative research that *“relates to the degree of influence that the researcher exerts, either intentionally or unintentionally, on the findings”* according to Jootun et al. (2009). Jootun et al. (2009) argue that researchers’ own identities and roles could affect the data collected and the analysis of the

findings. Though the researchers could not completely detach themselves from their previous knowledge and experience, data interpretation and analysis were made cautiously. Klein and Myers (1999) also states that preconception is a source of bias and a barrier to true knowledge. So in order to be neutral with the data interpretations and analysis, making any pre-assumptions about the research study were avoided.

3.6 Ethical considerations

There are many ethical issues involved in the research study as it deals with humans. The names and details of the participants were kept confidential and the participants were informed about that. An agreement with the research participants was made with the informed consent (Appendix B). It was also crucial to try to reassure the participants at the start about the purpose and about confidentiality (Walsham, 2006). The participants were informed about the nature and purpose of the research, anonymity, confidentiality, and the duration of participation prior to the interview. The participants were also informed that they can withdraw from the research at any point of time, if they are not interested to participate anymore. Audio recordings of the interviews were taken only with the consent of the participants (Appendix B).

Additionally, participants were informed that the gathered information is used only for academic purposes. During the interview, it was made sure that the conversation was within the research topic and the participants were not asked any questions outside the research topic. The participants were also informed about the risks and benefits of being involved in the research study. The interview report was shared with the interview participants in order to ensure the correctness of transcriptions and to assure transparency.

Chapter 4

In this section the findings from the semi-structured interviews are presented. The summary of the findings with specific quotations from the interview conversations related to the research questions are presented in this section. The transcribed interview findings that were extracted from data analysis and categorized into concepts by using thematic analysis are presented here in order to give a clear picture of the findings.

4. Empirical findings

There are seven concepts that were found through the thematic analysis of the transcriptions of the gathered data:

1. Cultural differences
2. Language barriers
3. Communication issues
4. Time difference
5. Coordination issues with multiple stakeholders
6. Tacit knowledge

4.1 Empirical findings for RQ1

Concept 1: Cultural differences

The majority of participants expressed that cultural difference is one of the main challenges in the knowledge sharing during RE in the globally distributed setting. The three main codes that emerged during the analysis with respect to the key concept of cultural differences are: the way of expression, behavior and way of understanding things. It is the social aspect and is how the people react to, understand and behave in a particular situation.

Participant 7 said that the challenges with the cultural differences leads to misunderstandings. He said:

“Cultural aspect is important. Some of them are straightforward and some of them are not. How we express ourselves creates a lot of misunderstanding”.

Another participant, participant 1 has a similar view about culture and he said that the way of expression and style of writing differs for people from different countries. He said:

“The way of expression and style of writing differs for different countries. We will have one way of writing which is slightly convoluted. Their way of writing is direct straight to the point of context... When we write the sentences, it is not readily understandable by the readers”.

Similarly, participant 2 has also got a similar view about culture and he said:

“Other kind of challenges are generally working with teams from different parts of the world... different people with different culture”.

Participant 9 said:

“I interact with people from different cultural background and sometimes it is really a challenge...I expect the business analysts to be straightforward and ask for clarifications, when I share the requirements. It is crucial...”

Cultural values are embedded differently among different group of persons as the people are from different cultural background. Most of the participants perceived culture as a challenge in knowledge sharing during RE in the distributed setting.

Concept 2: Language barriers

The second key concept that emerged during the analysis is the language barriers. Most of the participants expressed that language is certainly a challenge when working in distributed teams. The three main codes that have emerged under the concept of language are: accent, different language and the right use of words.

One of the participants, participant 6 conveyed that the language is a barrier and he said:

“When I talk to people from certain countries, the way of speaking is sometimes difficult to understand”.

Similarly, participant 5 expressed that language is important in RE and it is essential to use the right words for expressing the requirements. She said:

“...But just in terms of requirements we have to be really to the point. Have to use the right word to get the right nuances of saying... Swedish English is different from Indian English...other Swedish understand exactly what I mean and somebody, from other part of the world, may not have the same understanding”.

Participant 8 also has a similar view about the usage of right words and she said:

“Since I am from functional department, if the business analyst is too technical in his words, then it will be a challenge.... The language should be in layman terms but not in technical terms”.

In addition, participant 2 said that some of the users share the requirements in their native language.

“We were having users in Japan and Japan users speak their language, and they did not give us the requirements in terms of English”.

Participant 9 has also responded in a similar manner:

“The other barrier is the accent. Sometimes we misinterpret the questions raised by them and give clarifications in some other context and later we realize it, when someone interrupts. When the business analysts, provides the solution we need to get the point in the right context. It is essential to make the right decisions”.

Though English is the common language of communication with the members working in the distributed setting, accent and the way of speaking considerably varies from country to country. When people have different accent and the documents are in a different language, it leads to misinterpretation of requirements, as most of the participants said. Additionally, the right usage of words is also an important aspect to get the right meaning of the requirements during the knowledge sharing process in RE.

Concept 3: Communication issues

The third key concept is the communication issues. The three main codes emerged with the concept of communication issues are: lack of face-to-face interaction, non-verbal communication and understanding issues.

One of the participants, participant 7 said that face-to-face interaction is important during knowledge sharing. He added that body language is also essential for communication during knowledge sharing. He said:

“I do not see any possibility to capture all the needs without face-to-face... without face-to-face, it is difficult to see the body language... it is important for the communication”.

Participant 5 also has a similar view and she responded that it is a challenge when people are not in the same room. She said:

“It is really hard when we are not typically in a room...we cannot read peoples' faces”.

Other participants, participant 1 and participant 2 have responded that there are some understanding problems as there is a lack of face - face interaction. Participant 1 said:

“there would be many people over the call...during conversation I will not understand to whom they are talking...sometimes I answer thinking that they are questioning me, but it would be a question to someone else... somebody will be interrupting and say that it is an internal question....”.

As the participants responded, lack of face-to-face interaction is a challenge in the distributed setting that leads to misinterpretation during knowledge sharing. Non- verbal communication such as body language and face reactions are also acknowledged as important aspects in knowledge sharing during RE in the distributed setting. The participants have also mentioned about understanding issues that lead to communication problems during knowledge sharing in the globally distributed setting.

Concept 4: Time difference

The fourth concept is the Time difference. The participants said that sometimes some of the stakeholders skip the meetings and there are delayed response for the emails due to the time difference. They also added that sometimes the working hours have to be compromised because of the difference in time- zones.

Participant 1 said that sometimes he skips the meetings because of the time difference:

“The day in U.S. is night in India and I skip some of the meetings that are scheduled late”.

Participant 2 also responded that the time difference is a challenge for knowledge sharing:

“We had difficulties with Time zones...we had three different time zones. Japan timing, Indian timing as well as California timing. Somehow we used to work, and sometimes some users have to compromise on their working hours”.

Participant 4 said that it is difficult to make all the stakeholders to attend the meetings. He said:

“Everyone should be onboard on the same time in conference calls...In a way information may be lost, if all the stakeholders are not appearing...We have to have everyone onboard at the same time. It is a challenge to bring the people in different time zones into a common forum”.

Participant 6 said that there are difficulties in getting immediate email response because of the difference in time zones. As observed from the responses of the participants, the difference in time zones across various locations, causes difficulties in collaboration with the remote stakeholders during knowledge sharing.

Concept 5: Coordination issues with multiple stakeholders

The fifth concept that emerged is the Coordination issues among multiple stakeholders. The three main codes under this concept are: stakeholders with different point of view, absence of stakeholders for meetings, and identification of right stakeholders.

Participant 5 said that different stakeholders have different opinions about the same requirement and it is a problem during knowledge sharing. She said:

“Different business people have different opinion...requirements might be contradictory from different stakeholders... this is a problem, and also the stakeholders are missing sometimes”.

Participant 1 has also responded in a similar manner and he said:

“We have issues in having multiple stakeholders with conflicting point of view about the requirements”.

Participant 8 also said that there is a challenge to make all the stakeholders to attend the meeting sessions. He said:

“When there are multiple users, everyone should be present for the meeting...but this is a challenge”.

Participant 2 said that it is a challenge to get to know, who knows what from the multiple stakeholder group. She said:

“Sometimes it is difficult to get the right people at the right time. It is difficult to get to know about who is the right person to decide on certain business rules”.

The participants said that multiple stakeholders dispersed across various locations is a challenge during knowledge sharing. There are issues in identifying the right point of contact and to know whom to approach for getting informed about particular matters from the group of multiple stakeholders. Furthermore, the participants have also conveyed that stakeholders are not appearing for the meeting sometimes and stakeholders from the customer group have different points of view. Hence, the lack of proper coordination among the stakeholders is a challenge during knowledge sharing in RE in the distributed setting, which needs to be addressed.

Concept 6: Tacit knowledge

The sixth concept is the tacit knowledge. The participants said that there are difficulties in sharing tacit knowledge during RE in the distributed setting. They responded that sometimes they have difficulties in explaining the requirements explicitly.

One of the participant, Participant 6 said:

“Sometimes, we are not good in explaining the process... but good at showing, by using an existing system”.

Another participant, participant 2 has a similar viewpoint, and she said:

“When it comes to tacit requirements, it is difficult to get it from the business users... they never know that there is a requirement to say explicitly that this is my requirement. Unless otherwise we closely follow them and work with them, it is difficult to identify those requirements.”

Participant 2 has also added:

“When we are gathering requirements, it is difficult to share those kind of tacit knowledge...”

When participant 9 was asked, whether he was able to share the knowledge as planned, he replied:

“Sometimes we realize that there is a gap... but it is not that easy to share everything verbally, whatever we know”

The participants answered that there are challenges in sharing the tacit knowledge related to the requirements in the distributed setting. Without sharing the entire knowledge about the requirements, the requirements will not attain a complete form.

The above findings describe the challenges met by the key stakeholders in knowledge sharing in the RE phase of globally distributed IS development. These findings answer our first research question,

RQ1: How do the key stakeholders perceive the challenges met in knowledge sharing process in the requirement engineering (RE) phase of globally distributed IS development?

KEY STAKEHOLDERS' PERCEIVED CHALLENGES IN KNOWLEDGE SHARING PROCESS IN RE PHASE OF GLOBALLY DISTRIBUTED IS DEVELOPMENT
Cultural differences
Language barriers
Communication issues
Time difference
Coordination issues with multiple stakeholders
Tacit knowledge

Table 2: Key Stakeholders' Perceived Challenges

4.2 Empirical findings for RQ2

RQ2: How do the key stakeholders believe that the challenges in knowledge sharing process in requirement engineering (RE) phase of globally distributed IS development can be addressed?

Below are the findings for the second research question that provides the key stakeholders' suggestions for overcoming the identified challenges.

KEY STAKEHOLDERS' SUGGESTIONS FOR IMPROVING THE KNOWLEDGE SHARING PROCESS IN RE PHASE OF GLOBALLY DISTRIBUTED IS DEVELOPMENT
Cultural trainings
Kick off meetings in the beginning of the project
Language trainings
Use of translator/interpreter
Face-to-face communication, video conferencing
Scheduling important meetings in the common suitable timings
Identification of main stakeholders responsible for decision-making in the project
Having a mediator (in order to have a better coordination and to create a common base of understanding)
Enabling close observations

Table 3: Key Stakeholders' Suggestions for improvements

Concept 1: Cultural differences

The participants suggested that to overcome the challenges in knowledge sharing due to cultural differences, cultural trainings would be beneficial. They also added that having a kick off meeting at the beginning of the project, would help them to learn and understand the cultural values of each other.

Participant 1 and participant 9 suggested that cultural trainings would be beneficial to overcome the cultural challenges. Participant 1 said:

“It will be useful, if cultural trainings are provided by the organization to overcome the cultural challenges”.

Participant 5 and participant 7 said that kick off meetings at the beginning of the project help to learn the cultural values. Participant 7 has replied in the following manner:

“In the beginning we have kick off. We learn about our culture and values...to get to know each other and understand”.

Concept 2: Language barriers

The interviewees stated that language trainings and use of interpreter/translator improve the knowledge sharing process in RE in the distributed context.

Participant 1 said:

“Language trainings will be useful to overcome the language problems...”

Another participant, participant 5 has responded in a similar manner:

“Normal mode of communication is English. Sometimes, email communication happens via their language. We translate it and understand. When we reply, they translate it and understand... this is a challenge. But we always had a common person, who can communicate between us”.

Participant 4 said:

“The language is certainly a challenge. We may need to have a translator If it is completely a different language”.

Participant 2 also experienced a similar situation of working with some of the non-English speaking user groups. She said that they had a business user who acted as a translator to translate the requirements from the Japanese users in terms of English and vice versa, during the telephonic conference meetings.

Concept 3: Communication issues

Most of the participants suggested that face-to-face interaction is the best way for effective knowledge sharing during RE. As the stakeholders are distributed across various geographical

locations, video conferencing is a best option to overcome the communication issues during knowledge sharing.

Participant 1 and participant 2 suggested that face-to-face communication is effective for communication during knowledge sharing:

“Face-to-face communication is better than other forms of communication which facilitates proper decision making”.

Participant 7 suggested that:

“Video conference and face-to-face interaction is good for communication. Body language is important as well to communicate. I think the best one is always face-to-face... this is crucial...”

Participant 7 also added that when they are in face-to-face, certainly they are able to understand the process better. Participant 4 has also got a similar view and he responded that video conferencing enables face-to-face interaction in the distributed environment.

Concept 4: Time difference

Participants conveyed that finding a common suitable time and planning the meetings at comfortable time zone for all the stakeholders will help to overcome the problems that arises due to time difference in the globally distributed environment.

When participant 4 was asked, how he could overcome the challenges for knowledge sharing with the time difference, he responded:

“Finding time that suits all the stakeholders. We have to make some adjustments. Without any adjustment it won't work”.

Participant 2 also has a similar view and she replied:

“Generally, we organize and block the calendars for the meetings... Just to make sure that everyone is in comfortable time zones, everything is planned well ahead”.

Participant 6 and participant 9 have also responded in a similar manner and they conveyed that they schedule important meetings in a common timing suitable for everyone. In this way, gaps in knowledge sharing due to different time zones can be overcome.

Concept 5: Coordination issues with multiple stakeholders

The participants have responded that identifying main stakeholders and having a single point of contact/mediator to decide on certain things will help in overcoming the challenges during knowledge sharing which arise due to multiple stakeholders dispersed across different locations.

One of the participant, participant 1 responded:

“Clearly identifying main stakeholders from multiple stakeholders for the requirement meetings will help to overcome the problems due the multiple stakeholders”.

Participant 2 also has responded in a similar way and he said:

“Identifying the stakeholders for the business rules and having single point of contact for getting clarification would help to overcome the coordination issues with multiple stakeholder group”.

Participant 3 and participant 4 have also got a similar view and responded that identifying one or two main stakeholders who can act as mediators during RE will ensure proper coordination.

Concept 6: Tacit knowledge

Sharing the tacit knowledge is a challenge during the requirement phase, as observed from the empirical findings. The participants expressed that this kind of knowledge is transferable only when the business analysts observe and work closely with the other users.

Participant 4 said:

“They were used to that but they never come up with this kind of requirements. By closely observing them, we came to know the requirements which they have not expressed earlier”.

Participant 2 has also responded in a similar manner. She said:

“We closely follow them and work with them like shadowing. We were working with some of our workshops, where we were working with the business users like shadowing their role, so that we understand what exactly was happening”.

Similarly, participant 6 also said that they find it easy to demonstrate with the help of an existing system than explaining verbally. He responded that closely observing these demonstrations and frequent interactions will help in overcoming these challenges. He said:

“Sometimes, we are not good in explaining the process... but good at showing, by using an existing system”.

The challenges in knowledge sharing hinder the knowledge flow between the stakeholders in RE. The above discussed reflections from the participants provides suggestions to overcome the challenges of knowledge sharing in RE in the globally distributed environment.

Chapter 5

In this chapter, the findings with respect to the research questions are discussed. In addition to that, the additional outcomes of the study are also discussed in this section.

5. Discussion

5.1 Discussion of RQ1.

Our findings for RQ1 describe the challenges in the knowledge sharing process in the RE phase of globally distributed IS development. It is identified that cultural differences, language barriers, communication issues, issues with working in different time zones, coordination issues arising due to multiple stakeholders and tacit knowledge are the major challenges in the knowledge sharing process during RE in the globally distributed environment.

The first and the main challenge in the knowledge sharing process is the cultural diversity as mentioned by the majority of the interview participants. Hofstede et al. (2010, pp.6) define culture as the collective programming of the mind that differentiates the members of one group of people from others. According to Hofstede et al. (2010 pp.4), “*every person carries him or herself patterns of thinking, feeling and potential acting that were learned throughout person’s lifetime*”. Carmel (1999, pp.61) states that each individual is a member of multiple cultures that may include one or more national/ethnic culture, one or more professional cultures, functional culture, corporate culture and team culture. The empirical findings reflect the aspects of national culture. Due to globalization and competitive environment, the business teams of customers are diversified across various countries that bring in different national cultures. This is in line with Carmel (1999), who argues that globally distributed teams face cultural differences that include, but are not limited to, different national traditions, values and norms of behavior. Different ways of expressing, different styles of writing and speaking, different ways of understanding and difference in behavior are the cultural challenges faced by the stakeholders during knowledge sharing in RE. Li (2010) has also discussed about this issue of cultural difference in his recent study. The study result of Layman et al. (2006) reveal that cultural difference result in low level of trust between the distributed team members. Alshawi and Al-Karaghoul (2003) also found that culture has an impact on capturing the business requirements. As the requirement engineering phase involves different national and corporate cultures, the complexities due to cultural difference is more pronounced during knowledge sharing in RE. Creation of knowledge gap is the consequence of this challenge that can negatively impact the requirement engineering process.

The second most important challenge during knowledge sharing in RE is the language barrier. The findings reveal that difference in the accent, communicating in a different language, and inappropriate use of words are the main language barriers during knowledge sharing. As one of the interview participant said, the right usage of words is important in RE, to properly design the requirements. English is the common language of communication in the globally distributed projects, which is a non-native language for most of the stakeholders. The business analysts stated that different stakeholders across various countries communicate in a different language which has to be interpreted with the help of a translator. Language is the greatest mediator that allows people to relate and understand each other (Imberti, 2007). In their researches, Razzak and Ahmed (2014) and Layman et al. (2006) also found that language affects the knowledge sharing in distributed projects. Language is a vital aspect that influences the knowledge sharing

in RE. Through the data analysis, the authors found that the stakeholders find it difficult to get the required information and knowledge about the requirements, because of the language barriers. Wrongly documenting the requirements by misinterpretations could seriously impact the quality of the information system, as the information system is built based upon the requirements.

The third challenge, as revealed from the empirical findings, is problems in communication. Lack of face-to-face interaction, lack of non-verbal communication and understanding problems are the key communication issues for knowledge sharing during RE identified from the empirical study. These issues result in loss of information and misunderstandings during RE. This is also in line with the study findings from Damian and Zowghi (2003), Khan et al. (2011), and Carmel (1999). Requirement negotiation is also much associated with communication where the stakeholders need to arrive at the agreed set of requirements (Sommerville, 2011). During RE, knowledge sharing is done by interviews, workshops, process groups and surveys (Distanont et al., 2014) which involve extensive communication. Requirements are built through a continuous process of sense making and negotiation among stakeholders (Davidson, 2002; Kraut and Streeter, 1995). In their recent study, Ghobadi and Mathiassen (2016) also studied that communication issues affect the effectiveness of knowledge sharing. Sahay et al. (2003) argue that “*complexities of knowledge transfer are centrally associated with issues of communication*”. As So and Bolloju (2005) argue IS projects are recognized as knowledge-intensive and they often involve communication between people with various expertise and skills. The communication issues are specifically experienced during requirement gathering in RE as it requires massive amount of communication between the customers and the business analysts. Poorly eliciting the requirements because of understanding problems and loss of information will eventually lead to the erroneous development of information system.

The fourth challenge in the knowledge sharing process in the RE phase of distributed IS development is the difference in the time zones of stakeholder’s locations. This eventually leads to loss of information during RE. The empirical findings reveals that the time zone differences across various sites makes it difficult for the required stakeholders to participate in the meetings regularly. The interviewees expressed that they skip some of the meetings that are scheduled at inconvenient hours. Another problem is that the stakeholders could not get an immediate response for the emails and there is a delay. In his study, Razzak and Ahmed (2014) also investigated that the difference in time zones is a challenge for knowledge sharing. The time zone difference minimizes frequent interactions for knowledge sharing. The day time in one country is night time in another country. Hence, it is harder for some of the stakeholders to get together at a specific time, for the conference meetings.

The fifth challenge identified from the empirical findings is the coordination issues arising due to multiple stakeholders involved in RE phase. The three main issues identified in empirical findings with respect to coordination during knowledge sharing are stakeholders with different point of view, absence of stakeholders for meetings and difficulties in identifying right stakeholders that eventually affect the RE. This finding is in line with Hannola et al. (2010) and Khan et al. (2011). Hannola et al. (2010) state that one of the problem in the requirement engineering is to coordinate communication from various stakeholders and to be able to develop a common understanding of stakeholders’ requirements. Coordination during knowledge sharing in RE is about how the stakeholders synchronize among them. It is also the process of planning and scheduling activities to ensure that the right people are allocated to the tasks in RE. Khan et al. (2011) studied that stakeholder priority to situation urgency is a risk

factor in the requirement engineering process. Lim et al. (2010) state that stakeholder analysis prioritization is a problem in the global software projects. These difficulties of knowing which stakeholder to contact about what and challenges in initiating contact across various sites, leads to coordination problems during knowledge sharing in RE.

The sixth challenge identified through the empirical findings is the difficulty in sharing tacit knowledge. Explicit knowledge is documented and shared during RE but it is difficult for the stakeholders to explain the tacit requirements, as found from the empirical data. As Maalej and Thurimella (2013, p.5) states, the knowledge corresponding to the requirements can be implicit or explicit. This implicit knowledge is the tacit knowledge which is difficult to articulate from an individual's mind. This is also discussed by Hackney et al. (2008) and Blumenberg et al. (2009), who argues that tacit knowledge is hard to express either verbally or in a written form. As analyzed from the data, it is the customers feel that it is harder to explain the knowledge and the business analysts find it harder to identify the tacit requirements. Ryan and O'Connor (2013) states that domain knowledge of the experts that perform expert roles in organizational contexts is largely tacit. In RE, this domain knowledge is the knowledge in the particular area of expertise (Maalej and Thurimella, 2013, p.5). This domain knowledge is closely associated with the business knowledge which is the "*knowledge about the business needs that a system must fulfill*" (Tiwana et al., 2003). The tacitness of this domain knowledge may result in poor quality requirements because of the knowledge gap created by this challenge.

5.2 Discussion of RQ2

The empirical findings suggest that the organizations can provide some trainings to learn about other cultures in order to overcome the cultural challenges. This is in line with the findings from Riege (2007), Razzak and Ahmed (2014) who investigated that through cross cultural trainings and cultural exchange programs the challenge of cultural differences can be overcome. Another suggestion for improvement from empirical finding is that planning kick off meetings at the beginning of the project, where the stakeholders get an opportunity to meet the stakeholders from other part of the world. In the globally distributed environment, the stakeholders in RE are from different cultures and they interact with the stakeholders from diversified cultural backgrounds. Sahay et al. (2003, pp.41) states that the culture refers to group or community that share some common experiences that shapes the way of people's understanding of the world. Cultural training programs and project kick off meetings at the beginning of the projects will enable the stakeholders of RE, to get to know each other's cultures that can eventually help them in getting to know them as individuals. Training programs and kick off meetings will facilitate the stakeholders to understand the way of working with persons belonging to different cultures, which in turn can enable proper knowledge sharing during RE.

To overcome the language barriers, the participants suggested that the use of translator/interpreter, as well as language trainings can be useful. Riege (2007) also suggests that language trainings can help in overcoming the language challenges. With the increased number of nationalities in the distributed IS development, the stakeholders of RE speak different languages, have different English proficiency levels and English accent differs from person to person. In the distributed environment, the stakeholders do not share a common native language and English is the general mode of communication across distributed teams. In certain cases, where the stakeholders speak a different language, use of a translator is suggested by the participants. Using a translator and language trainings can help the stakeholders to overcome the challenges with the language to some extent. However,

increasing the proficiency in a language and learning to understand the accent would not be an easy job that can be accomplished in a shorter span of time. RE phase being an early phase during ISD, that describes what an information system should do (Sommerville, 2011, p.83), arranging language trainings for a longer period may not be feasible for the project management, considering the time and cost constraints involved in ISD.

Continuing, the empirical findings revealed that face-to-face interaction and visual meetings via video conferencing are the better ways to overcome communication issues during knowledge sharing. Khan et al. (2011) also suggests that video conferencing enhance proper communication during knowledge sharing in RE. Riege (2007) suggests using facilitator teams, use of effective tools, methods and techniques that can ensure proper communication flow. Knowledge sharing with face-to-face interaction enable *Socialization* (Nonaka and Konno (1998), which is sharing of knowledge between individuals through spending time together in the same environment. As observed from the empirical findings, most of the business analysts work from one of the customer's place. However, it is not possible for the stakeholders of RE to meet all the other stakeholders because of the greater travelling distance between various locations of the stakeholders.

Additionally, the empirical findings reveal that identifying the main stakeholders in RE and having a single point of contact who act as a mediator, will help in overcoming the coordination issues that arise due to multiple stakeholders from the customer group. Mediator is termed as brokers by Brown and Duguid (1998). Brokering refers to the activities by which the individuals involved in facilitating and sharing of knowledge between communities of practice across knowledge boundaries (Fleming and Waguespack, 2007). Knowledge brokers or mediators involves in the processes of translation, coordination, and alignment between perspectives (Wenger, 1998, p. 109). Effective coordination is required for high degree of knowledge sharing in RE, as it involves several stakeholders. Use of a mediator will improve the knowledge sharing across diversified locations by improving the coordination among the stakeholders.

Furthermore, the empirical findings suggest that identifying some common timing suitable for all the stakeholders and planning the important meetings in those timings may help to overcome the issues with the time difference. Some of the participants expressed that there are some compromises and adjustments in timings, when it comes to the time difference. Razzak and Ahmed (2014) also suggest that rotations and overlapping hours would help in overcoming this issue. However, when there are diversified teams across the world, only the important meetings can be scheduled at the overlapping time that suits all the stakeholders. So properly planning and scheduling the meetings at a common time that is suitable for all the stakeholders can prevent the RE stakeholders from skipping the meetings. However, still there would be challenges with getting immediate response for the emails, as there is a larger time difference between various countries.

Also, the participants recommended that closely working together and allowing the business analysts to make close observations will aid to overcome the challenges in sharing the tacit knowledge. With the data analysis, it was found that the customers find it harder to express the requirements verbally but can demonstrate with the help of an existing system. Razzak and Ahmed (2014) also discuss that challenges with the tacit knowledge can be overcome by demonstration. Nonaka and Konno (1998) term this process as *externalization* during which the expression of tacit knowledge and its conversion into an understandable form occurs. Externalization is the process when individuals become a part of the group and the ideas fuse

and integrated with the group's mental world, according to Nonaka and Konno (1998). Hence, for the extraction of tacit knowledge occurs when there is a *socialization* (Nonaka and Konno, 1998) by which the business analysts can extract the knowledge by closely working with the customers.

The identified mitigation suggestions of the key stakeholders could foster the knowledge sharing process in the RE phase in the globally distributed environment by enhancing better communication, collaboration and coordination.

5.3 Discussion of additional outcomes

In addition to the findings corresponding to our research questions, some of the additional outcomes which are not related to the RQ have been discussed in this section. The additional concepts found from the empirical data are '*necessity of domain knowledge*', '*necessity of technical knowledge*', '*creating prototypes*', '*reverse knowledge sharing*', and '*recorded sessions*'.

Empirical data reveals that a good domain knowledge and experience is required for RE to capture the business requirements. One of the participant from the customer group stated that they could not realize that there is an understanding problem exists during the initial stage of RE phase. The customers could only figure it out only at the later stages. They believe that good domain knowledge and experience is required to understand the customer needs and translate them to requirements. Knowledge in the particular area of expertise (Maalej and Thurimella, 2013, p.5) is very much essential to understand the business and to come up with the proper requirements for developing information systems.

From the data analysis, it is observed that technical knowledge is also important in RE to some degree to come up with the system requirements. One of the participant said "*BAs should have knowledge about the IT system and a very sharp business analysis is needed*". Tiwana et al. (2003) states that only through the integration of business and technical knowledge, a system that meets the business objectives can be designed. However, the technical knowledge mentioned by Tiwana et al. (2003), corresponds to the knowledge in programming, operating, configuring and testing (Xu and Ma, 2008). On the contrary, empirical findings revealed that a basic level of technical knowledge about IT system is needed to develop the system requirements that meets the customer's business needs. Hence, both the functional and non-functional requirements of a system can be derived more effectively with the combination of domain knowledge and technical knowledge.

Creating prototype of information system is also practiced during RE, as analyzed from the data. One of the participant said "*We came up with mock up system. We wanted to show to the customers about how the system is going to be like*". By creating such prototype models the vendors can ensure that their understanding about the system requirements are aligned with customer expectations. As one of the participant said, this prototype is not the complete information system but it is a workable model, similar to the actual information system to be developed. Getting the confirmation from the customers with these kind of prototypes, can largely avoid the project failures because of the requirement errors. In addition, it can also save large amount of time and effort getting wasted in designing an incorrect system by the misunderstanding of the requirements.

Additionally, it was also found from the empirical data that reverse knowledge sharing and recording of the sessions are also practiced during RE, in certain organizations to avoid misunderstanding of the knowledge shared from the customers. During reverse knowledge sharing sessions, the BAs present their understanding from the previous knowledge sharing sessions from the customers. With these reverse knowledge sharing sessions, the customers can make sure that the knowledge shared by them is correctly captured by the business analysts. One of the participant said “*We record the sessions so that the whole conversation can be used later on during RE*”. By recording the knowledge sharing sessions the information loss arising due to communication problems and misunderstandings can largely be avoided.

Kotonya and Sommerville, (1998) states that it takes a lot of effort for fixing requirement problems and the cost for fixing a requirements error are up to hundred times the cost required for fixing a small programming error. Creating prototypes, reverse knowledge sharing sessions and recording the knowledge sharing sessions can largely avoid the above mentioned requirement related problems and can ensure proper knowledge sharing during RE. In addition to that, proper domain knowledge in the particular business area coupled with technical knowledge will facilitate the experts from the vendor team to meet the needs of the customers.

5.4 Reflections

Based on the empirical findings of this research study, it is evident that the knowledge sharing process during the RE phase of distributed ISD is mediated both by social and technical factors. According to Pan and Scarbrough (1998), socio-technical system underlines the complex interactions which take place between the subjective perceptions of employees and the objective characteristics of work processes. Culture, language, communication and coordination are the social aspects in knowledge sharing in the distributed teams. The empirical findings revealed that knowledge sharing happens via technologies such as teleconferencing, videoconferencing and e-mails which represent the technical aspects. So, this knowledge sharing environment in RE can be seen as a socio-technical environment as it is interconnected with both social and technical factors. However, the identified challenges are closely connected to the social factors and are human related rather than technical challenges.

Furthermore, cultural challenges, language challenges, communication problems and challenges in sharing tacit knowledge are widely experienced by customers as well as the business analysts. However, the coordination issues are merely the reflections from the business analysts, as they are interacting with multiple stakeholders in the customer group. Most of the business analysts’ interviewed for this research study are located in one of the customer’s organizational unit. However, the organizations have their business units located globally due to globalization. Hence, the business analysts have a need to communicate with various stakeholders across various countries to gather the requirements, which poses a great challenge for the business analysts. Various stakeholders from the customer group has conflicting points of view for the same requirement and the business analysts have difficulties in prioritizing the requirements from these stakeholders.

5.5 Summary of challenges and suggestions for improvement

Table 4 presents the answers to our research questions, where the summary of identified challenges with suggestions for improvement are listed.

RQ1: How do the key stakeholders perceive the challenges met in knowledge sharing process in the requirement engineering (RE) phase of globally distributed IS development?

RQ2: How do the key stakeholders believe that the challenges in knowledge sharing process in the requirement engineering (RE) phase of globally distributed IS development can be addressed?

Key stakeholders' Perceived Challenges	Key stakeholders' Suggestions for Improvement
Cultural difference	Cultural trainings Kick off meetings in the beginning of the project
Language barriers	Language trainings Use of translator/ interpreter
Communication issues	Face-to-face communication Video conference
Time difference	Scheduling important meetings in the common suitable timings
Coordination issues with multiple stakeholders	Identification of main stakeholders responsible for decision-making in the project Having a mediator (in order to have a better coordination and to create a common base of understanding)
Tacit knowledge	Enabling close observations via face-to-face Interaction.

Table 4: Key Stakeholders' Perceived Challenges and Suggestions for improvement

Chapter 6

6. Conclusions

In this chapter, we are concluding by answering our research questions. Further, researchers' contribution is also presented here. Lastly, future research directions are also recommended in this section.

6.1 Conclusion

In this research study, the researchers have explored the challenges of knowledge sharing in the requirement engineering phase of information systems development met by the key stakeholders in the globally distributed setting, and generated their suggestions for improvements to overcome these challenges. The six main challenges identified through this research study were cultural differences, language barriers, communication problems, problems with time difference, coordination issues with multiple stakeholders, and challenges in sharing tacit knowledge.

It is evident from the foregoing discussion that non-technical issues are of greater significance than technical issues. The geographical distribution of the stakeholders of RE introduces human related social issues during knowledge sharing in the globally distributed teams. As the success of information systems development largely depend on RE, any gap in knowledge sharing practices during this phase has a great impact on the successful IS development. Hence, based on the identified challenges from the empirical findings, suggestions by the key stakeholders were also generated to overcome these challenges. It was found that knowledge sharing process in the RE phase in the distributed setting can be improved by cultural trainings, kick off meetings at the beginning of the project, use of translator/interpreter, by the identification of the main stakeholders who are responsible for decision making, use of mediator to have a single point of contact, video conferencing for face-to-face interactions, finding a common suitable time to work in the overlapping hours, and enabling close observations via face-to-face interaction for tacit knowledge sharing. These suggestions provided by the key stakeholders can enhance interactive and effective ways of knowledge sharing during RE in the globally distributed IS development. In addition, the requirement errors can largely be avoided by improved knowledge sharing practices in the globally distributed context, thereby reducing the project failures.

Additional concepts from the empirical findings that are not related to the RQ are also discussed as part of the thesis which include necessity of domain knowledge, necessity of technical knowledge, creating prototypes, reverse knowledge sharing, and recorded sessions. Creating prototypes, reverse knowledge sharing sessions and recording the knowledge sharing sessions can largely avoid requirement related errors caused during information system development, thereby saving lot of time and effort being wasted in fixing these errors. In addition to that, proper domain knowledge combined with technical knowledge can assist the business analysts in developing the requirements according to the customer needs.

6.2 Contribution

This research study mainly contributes to the field of information systems development, knowledge sharing and requirement engineering in the globally distributed context. In addition,

the presented research results enhance the previous study findings with the perspectives of both customers and business analysts, who are the key stakeholders in RE. Also, the research results benefit academic researchers, practitioners and the organizations by providing insights towards the knowledge sharing challenges in requirement engineering in the globally distributed setting. Above all, the companies may use the proposed list of key stakeholders' suggestions as actions to overcome the knowledge sharing challenges during requirement engineering in the globally distributed context. The results obtained from the current research study contribute both to theory and practice.

6.3 Author's contribution

There are two authors for this Master thesis, Ms. Sasikala Adappan Ramu and Mr. Venkatesh Narasingam Kuppusamy. The authors have equally divided all the work and closely worked together, throughout the Master thesis. Narasingam Kuppusamy has focused more on writing the introduction section and Adappan Ramu has focused on the Literature review and Methodology section. It is difficult to define a clear margin between the efforts spent by the two authors in writing the thesis, as both the authors are equally responsible for the thesis. However, both the authors have discussed and reviewed each other's work in these sections. In the same way, both the researchers were involved in data collection and analysis of the empirical data as well. Similarly, both the authors were involved in building the remaining sections of the thesis, right from the section 4.

6.4 Future research

In the future, this research study can be further explored by including all the core stakeholders of requirement engineering to get additional insights on the phenomenon under study. Besides that, multiple case studies can also be conducted by exploring the perspectives of stakeholders in RE in the globally distributed environment, which would complement the findings revealed in this research study. In addition, more empirical research is required to assess the impact of the knowledge sharing challenges in RE in the globally distributed projects. Furthermore, though this Master thesis generated the key stakeholders' suggestions for improvement to overcome the challenges, future studies can also focus more on finding permanent solutions as well as standardized best practices to ensure effective knowledge sharing across globally distributed teams.

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Appendices

Appendix A: Script for the semi-structured interview

Table 1: Script for semi-structured interview

(Adapted from Galletta, A., 2012. *Mastering The Semi-Structured Interview And Beyond: From Research Design To Analysis And Publication*)

<p>Researchers: Sasikala Adappan Ramu and Venkatesh Narasingam Kuppusamy.</p> <p>We are two students named Sasikala Adappan Ramu and Venkatesh Narasingam Kuppusamy from the department of Informatics at Linnaeus university in Växjö, Sweden. We are studying our Master in Information Systems and we are conducting this research study for our Master thesis.</p> <p>Hello, we would like to thank you for accepting our invitation to take part in this interview. We request your written permission (along with your first name only) for the audio-recording of the interview. So, please sign the consent form and send it to the email address provided to you.</p> <p>The primary purpose of our research is to explore the challenges met by the key stakeholders in knowledge sharing in the requirement engineering (RE) phase of globally distributed IS development and to generate the key stakeholders' suggestions for improvements in order to overcome these challenges. The provided information during the interview will only be shared with our Master thesis supervisor, examiner and ourselves. The findings will only be used for the research purposes.</p> <p>You are selected for this study since you are one of the key stakeholders in the requirement engineering phase within the field of information systems. Your contribution will help us to get rich source of information regarding the knowledge sharing process in RE in the distributed setting.</p>
<p>Introductory questions</p> <p>What is your current role in the organization?</p> <p>What are your responsibilities in the organization?</p> <p>How long have you been working in requirement engineering (RE) related activities?</p>

<p>Main questions</p> <p>What are your viewpoints about knowledge sharing process in RE in this distributed setting?</p>

Do you come across any challenges in knowledge sharing during requirement engineering? If so, could you recall any of the incidents from the past?

What is your opinion about knowledge sharing with multiple stakeholders during requirement engineering?

Are you able to share the knowledge completely as you planned?

What kind of techniques/methods do you use for knowledge sharing during requirement engineering?

Do you think that the knowledge has been shared to you effectively from the other stakeholders in order to accomplish the requirement related tasks?

Have you faced any other challenges in the knowledge sharing process in RE? Could you recall any of the incidents?

Which mode of communication do you prefer for knowledge sharing during RE? Why?

Have you tried to overcome the challenges that you mentioned earlier? If so, how did you overcome them?

Do you have any suggestions to overcome the challenges in the current knowledge sharing process in RE? If so, could you explain briefly about that?

Appendix B: Informed Consent Form for Master Thesis

(Adapted from: Uppsala University, 2016. *Informed Consent*. [Online] Available at: <<http://www.codex.vr.se/en/manniska2.shtml>>)

Title/Topic: Exploring knowledge sharing in the RE phase of globally distributed IS development: perceived challenges and suggestions for improvement

Date: April 2016.

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Research purpose and objective: The purpose of this research is to explore the key stakeholders' challenges in knowledge sharing in the requirement engineering (RE) phase of globally distributed IS development in order to generate the key stakeholders' suggestions for improvements to overcome these challenges. To explore the phenomenon, you are interviewed to get your perceptions on the above mentioned challenges and your suggestions for improvement which will be the primary source in the data collection process of this research. This research study will benefit the researchers who intend to work in knowledge sharing process in the RE in the distributed setting. The research results will give insights about the knowledge sharing process to the stakeholders of the RE process. This would also benefit the organizations to understand and improve the knowledge sharing process in RE in the distributed IS development.

Description of the research study procedure: A list of questions and the interview date and time will be communicated to you a week before the interview. The interview will be conducted either through Skype or mobile phone conversation or face-to-face. The interview will not be more than 60 minutes. Based on your experience in the RE, you are requested to share your perceptions on the challenges in the knowledge sharing process and your suggestions for improvement to overcome these challenges. Based on your willingness, the interview conversation will be audio recorded as part of the data collection process. The recorded interview will be used for the data analysis process in order to conclude to the research findings.

Risks and Discomforts: There aren't any foreseeable risks from your participation in this research study.

Benefits of being in the study: As the researchers, we will gain knowledge about your current challenges in the knowledge sharing process in RE in the globally distributed setting, and also we will generate your suggestions for improvement to overcome these challenges. As a participant, you will be benefitted by knowing the perceptions of other research participants. In addition to that, in order to overcome the challenges at your work place, you could use the suggestions for improvement identified through this research study.

Confidentiality and Data Security: This research study is anonymous, which means that neither your identity nor your company's identity will be revealed to anyone. Moreover, the participants' names will be changed to "Participant 1, Participant 2, etc." and therefore your original names will not appear in our Master thesis. Your or your company's identity will not be documented or mentioned in any of our documents or audio recordings. The recorded audio file will be kept in an external hard disk and the interview notes will be documented in a notebook. Only Sasikala and Venkatesh (researchers), our supervisor and our examiner can have access to the collected data. The audio recordings will be used solely for the purpose of the research. The audio material serves only for analytical purposes. Also, you will be given the opportunity to review and approve the transcriptions of your interview.

Right to Refuse or Withdraw: Your participation in this research study is entirely up to you, i.e. conducted voluntarily. At any time, you can refuse to take part in the research study and can quit the interview at any point without giving any explanation. Your decision not to take part in the interview will not affect your relationship with the researchers or Linnaeus University. Also, you have the right not to answer specific questions in case you do not feel comfortable. In case, you completely withdraw from the research study, all collected interview documents will be deleted immediately. However, if you wish to withdraw from the research study, we request you to inform us in advance in order for us to make alternate arrangements.

Questions about the research: If you have any questions about the research or about your role in the research study, please do not hesitate to contact Sasikala Adappan Ramu and Venkatesh Narasingam Kuppusamy, Master Program in Information Systems, Linnaeus University, and Växjö, Sweden either by email or by mobile phone. (Email: sa223dw@student.lnu.se and vn222ce@student.lnu.se ; Mobile: +46(0)769625078 and +46(0)769625077)

Consent: Your signature below indicates that you are willing to volunteer as a research participant in this research study, and that you have read and understood the information provided above. You will be given a signed and dated copy of this form for your reference.

Signatures: I consent to participate in the research study "Exploring knowledge sharing in the RE phase of globally distributed IS development: perceived challenges and suggestions for improvement" conducted by Sasikala Adappan Ramu and Venkatesh Narasingam Kuppusamy. I have read the above information and I understand that this research study is voluntary and I may stop at any time. I consent to participate in the study and allow the recording of the skype or telephonic discussion. My signature below indicates my consent.

Signature:

Participant:

Date:

Signatures:

Researchers: Sasikala Adappan Ramu and Venkatesh Narasingam Kuppusamy

Date: