A First Step in Improving the Requirements Engineering Process by Using the Knowledge Management Perspective

Case Study from French Public Institute

Malika Grim-Yefsah
INSERM (Institut National de la Santé Et la Recherche Médicale) DSI – INSERM,
13 rue Watt – BIOPARK- Bat B, 1er étage, 75013 Paris, France

Keywords: Requirements Engineering, Knowledge Management, Knowledge Transfer, Information System Development, Case Study.

Abstract: This paper argues that requirements engineering (RE) process is vital and key of success of an Information Systems Development (ISD). In French public institute, ISD project is produced by service provider and internal team. During this project, relevant context aspects are neglected. One aspect is incorrect and incomplete requirements specification. So the challenge is how to effectively transfer knowledge-related requirements from internal team to service provider. In this paper, first, we describe the state of practice of RE in a French public institute. Second, we describe who we address the requirements engineering from the perspective of knowledge management (KM). Finally, we discuss challenges knowledge transfer in RE process.

1 INTRODUCTION

This study aims to enhance the understanding of knowledge management in requirements engineering in the context of information system development. In a French public institute, an ISD project implicates three participants. Two internal participants: IT Department and the Business Department, and an external participant which is software and computing services Company also called service provider. The ISD is a hard task for which it is inevitable to define requirements clearly and accurately at the outset. It has been recognized for many years that poor requirements definition remains a root cause of project failure and waste. As in (Rodrigues, 2001) several problems that torpedo the timely delivery of software projects: (1) Unstable, constantly changing requirements (66%). (2) Poor requirements specification (55%). (3) Client behaviour, such as approval delays, requirements changes and poor communication (42%).

In French Public Institute, existing processes for establishing requirements are often ad-hoc and inefficient, leading to miscommunication and insufficiently defined requirements. Then, the significant challenge of IT Department is how to effectively transfer knowledge-related requirements from internal to service provider. The IT department's aim is to become streamlined and efficient: (a) ensure that information system development projects break free from traditional bottlenecks and delays, (b) meet the real needs of their users, (c) have accurate requirements.

Improving the quality of IT department's activities can be achieved in two ways:

• By improving ongoing management which means that organizations save time and money in the design phase, during development and throughout the testing and quality assurance processes.

• By improving the requirements engineering process so that errors are not introduced into the specification.

The paper is structured as follows. Section 2 presents briefly the research method and captures the state of the practice of requirements engineering in our company. Section 3 summarizes the theoretical foundation of this study. It's on two areas: Requirements Engineering (RE) and Knowledge Management (KM). Section 4 presents how we introduce the RE process combined with KM activities in ISD project. In section 5, we discuss our finding and our challenges. The section 6 highlights

Grim-Yefsah M..
A First Step in Improving the Requirements Engineering Process by Using the Knowledge Management Perspective - Case Study from French Public Institute.
DOI: 10.5220/0005133602800288
In *Proceedings of the International Conference on Knowledge Management and Information Sharing* (KMIS-2014), pages 280-288
ISBN: 978-989-758-050-5

works done by others that somehow ties in with our own work. The section 7 draws conclusions.

2 RESEARCH METHOD

The research was carried out as a case study, a method of studying contemporary phenomenon in a real life context (Yin 2009). We collect data by interviewing two projects teams conducted by Information Technology Department (ITD) of a French Public Institute. Less than 1% of staff works in this ITD. The interviews were semi-structured. The questions' themes were: RE concepts, RE process, documentation, and practices. We have noted all answers and summarized them. Finally, we sent them to interviewees for review and correction. We have also collected data by interviewing stakeholders about three domains (biomedical research, financial and human resource) involved in these projects. In summary, the RE's state is drawing in Figure n°1.

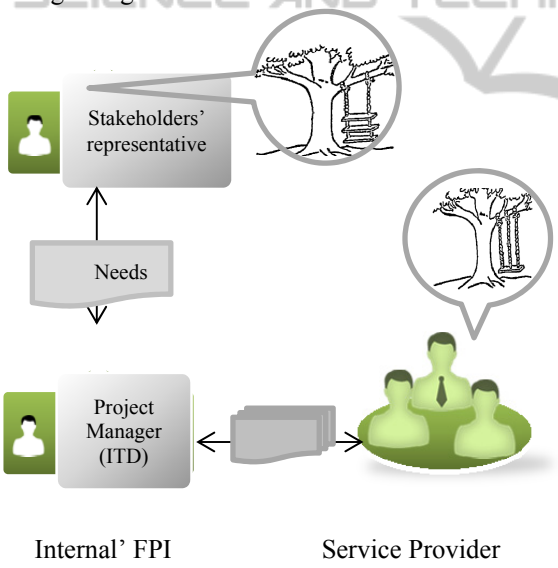

Figure 1: Representation of ISD in FPI.

The IT Department produces a statement of the scope of the system which was envisaged by stakeholders, and summaries those needs. It puts out an invitation to tender. Contractors submit proposals that set out their experience in building such systems. The ITD's committee draws up detailed comparison of the bids. It selects a company which appears to have the post experience in developing similar systems, and the cheapest. The selected company meets with the ITD to initiate the contract. Company developers meet with the project manager, who was chosen by ITD, throughout the development to review any changes, and to discuss how those would impact the cost and schedule. The selected company delivers the system; it is tested by users selected by ITD. Throughout tests, users ask for additional functions to be added to the delivered system: each function must be paid.

The stakeholders' representative shows that the system is significantly different from the target users identified; however, they want to start using them immediately and he asked for additional functions. The system proved to be rather inflexible. First, the project manager explains that specification turns out to be poorly written by the service provider.

The selected company (service provider) assured that customer requirements were pretty incomplete, ambiguous or even contradictory sometimes. Their engineers, analysts and developers have built what they think is request and they have written test cases using the same assumptions.

Finally, the project manager concludes that requirements were inadequate and that no requirements engineering process was identified before.

Throughout this study, we explain that: "*Requirements or knowledge to be communicated and transferred are difficult to express explicitly to others because they are mostly tacit and intangible*" (Medeni et al. 2011).

The summary of the results was presented in a workshop and report was send from CIO.

3 THEORETICAL FOUNDATIONS

This study bases its theoretical foundation on two areas: knowledge Management (KM) and requirements engineering (RE).

3.1 Requirements Engineering Process

Requirements engineering (RE) is a systematic and iterative process to understand, capture and document what require from a product or a system into written form requirements and specifications (Asghar and Umar 2010; Kauppinen et al. 2004; Kotonya and Sommerville 1998; Wiegers 2003). The purpose of RE is to serve all stakeholders' needs in a product or a system and create understandable, complete, and consistent requirements and specifications that can be accepted by all stakeholders in order to use those as an input in

producing a product or a system (Asghar and Umar 2010; Pohl 2010).

Pohl K. describes the requirements engineering framework by three dimensions: specification, agreement, representation and by four core activities: documentation, elicitation, negotiation, validation (Pohl, 1994). These three dimensions of RE can be characterized as follows:

-Specification dimension deals with the understanding of the system requirements attained.

-Agreement dimension deals with the level of agreement achieved between the relevant stakeholders about the known requirements.

-Representation dimension deals with documenting and specifying the system requirements using different documentation formats.

From the three dimensions of RE, the four core activities of RE can be derived as follows:

(1)Elicitation activity makes knowledge (requirements) about the system explicit and thus leads to a better understanding of the problem (system).

(2)Negotiation makes existing conflicts, argumentations and rationales explicit and assures that the "right" decisions are made; establishes an agreement between the various stakeholders.

(3)Documentation activity deals with the representation of the existing viewpoints in different representation formats; assures consistency and cross-references between the various representation; establishes a (partially) formal requirements specification.

(4)Validation assures that the right problem is being tackled at any time in the process; checks the internal consistency of the specification; controls if the specified requirement are consistent with the user/customer intentions.

The RE process is a communication activity not technical activity (Wiegers 2003). During this process, stakeholders need to express and to transfer their needs, wants, information or knowledge for creating complete and accurate requirements.

3.2 Knowledge Management

Knowledge Management (KM) is all practices of an organization to create, store, transfer, use and share knowledge. A comprehensive survey does by (Kalpic and Bernus 2006; Anand and Singh 2011) of the KM literature shows the various KM frameworks and KM activities. Those activities are: (1) Knowledge Acquisition, (2) Knowledge retention, (3) Knowledge Transfer and (4) Knowledge Utilization. Knowledge acquisition includes those activities associated with the entry (creation) of new knowledge into the system. A system can be human or tool. Knowledge retention includes the activities that preserve knowledge and allow it to remain in the system once introduced. Knowledge transfer refers to the activities with the flow of knowledge from one party to another. Knowledge utilization includes the activities connected with the application of knowledge to business process.

3.2.1 Knowledge

Knowledge is defined as being justified true belief (Nonaka, and Takeuchi, 1995). Knowledge is often distinguished between tacit (or implicit) knowledge and explicit one (Polanyi, 1967). Explicit knowledge can be codified (e.g. writing or drawing) and articulated since it can be expressed formally and systematically. Tacit knowledge corresponds to skills, senses, intuition, physical experiences, "job secrets", environmental knowledge concerning clients or technologies. We can differentiate two kinds of tacit knowledge: the individual and the collective one (Nonaka, 1994). The collective knowledge is created and possessed collectively by a group composed of more than one individual. Note that group tacit knowledge is more than the aggregation of each member's individual tacit knowledge (see (Erden, et al. 2008) for details).

3.2.2 Knowledge Creation

(Nonaka and Takeuchi, 1995) developed the model of knowledge creation, which consists of four phases, as illustrated by Figure n°2: Socialization (tacit to tacit knowledge), Externalization (tacit to explicit knowledge), Combination (explicit to explicit knowledge) and Internalization (explicit to tacit knowledge). This model was called SECI.

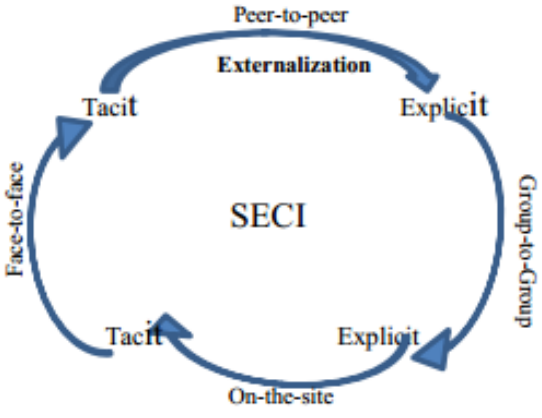

Figure 2: SECI Model.

With this model, knowledge has to flow by being acquired, shared, or exchanged to generate new knowledge. The idea behind this being that the process is dynamic, and should not be thought of necessarily in discrete stages, but as a spiral of information transfer.

Knowledge can be acquired not only through structured media, such as documents, but also through informal and/or formal interpersonal interactions (Davenport and Prusak, 1998).

(Nonaka and Konno 1998; Nonaka and Von Krogh, 2009) indicated that Physical, face-to-face experiences are the key to creation, conversion and transfer of tacit knowledge.

3.2.3 Knowledge Transfer

Knowledge transfer is an important part of knowledge Management (Davenport and Prusak, 2000). It refers to ensuring that knowledge is transferred throughout the company or between organisations from the sender to the receiver who needs that knowledge. (Davenport and Prusak, 1998) proposed this definition:

Transfer= Transmission + Absorption (and Use)

Please, note here the important distinction between Transmission and Transfer. This equation indicates that transmitting knowledge by sending or presenting explicit knowledge is not sufficient for transferring it. The term 'transfer' seems to imply that all the knowledge is passed from one person to another. Knowledge transfer must take place between (at least) two parties. It implies the giving and taking of knowledge within a context by the participants. There are many mechanisms that exist for transferring knowledge from one firm to another for example, documents, project reports, face-to-face meetings, telephone calls, e-mails, video conferences or personal transfer. The important aspect for transferring knowledge is to choose a suitable method of knowledge transfer for the different types of knowledge being transferred (Martin and Antonio 2010). Explicit knowledge can be transferred through, for example books, documents, databases and meetings. On the other hand, tacit knowledge can be transferred through personal interactions, meetings, training and learning by doing. Social interaction ties have positive effects for resource exchanges between organisations (Mirani 2006; Grim-Yefsah 2012).

4 OUR EXPERIMENTATION: APPROACH BASED KM-RE ACTIVITIES

This section describes practices of requirements engineering process which we introduce in the IT department of French Public Institute.

The IT department's problem is: Requirements which to be communicated and transferred from internal to service provider are difficult to express explicitly, because they are mostly tacit and intangible. (Rolland, 2006) argues that "*a number of studies show that systems fail due to inadequate or insufficient understanding of the requirements they seek to address…*". When knowledge transfer is not effective between internal and service provider, all relevant information and knowledge of the product requirements are sent to the service provider incompletely (Grim-Yefsah et al 2011; Grim-Yefsah 2012). Therefore, transferring information, knowledge between the stakeholders and developers is crucial. Our research question is: How can knowledge transfer improve the requirements engineering process, during an Information System Development project?

In our case study, we consider

- Internal: Businesses process representative, customers, engineers, project manager and users are stakeholders. They participate in requirements and they should cooperate with each other.
- Service provider: requirements analysts, designers, developers. They participate in requirements and they should cooperate with the internal team. (Fox, 1982) argues that "*The designers know how to design a product but do not know the tools and techniques required to create and maintain a product or system. The developers understand how to create a product or system and know the technologies or tools for using in producing. The requirements analyst is the person who documents the requirements. The requirements analyst needs to write a requirement that is understandable, unambiguous, consistent, and complete to the developer*."
- The requirements are created mainly based on needs and wants of customers and Businesses process representative.
- Based on the results of our doctoral research (Grim-Yefsah 2012): Knowledge Management is a discipline we use in our organization to identify, create, represent, distribute and enable the adoption and leveraging of good practices embedded in collaborative settings of work of employees.

Effective knowledge management boost the collective expertise of employees in organisation and partners (e.g. the service provider). Then we propose some good practices for this study:

(1) Throughout the project, the information is transferred and shared through many channels, such as meetings, teleconferences, documents and face-to-face discussions with trust and openness;

(2) Be careful to nature of knowledge to be transferred. We could think that explicit knowledge is more easily transferable as it is teachable and articulate. However, we have observed in reality, that even explicit knowledge is hard to learn and transfer due to limitations of explanation capacity (documents) and codification ability (Grim-Yefsah 2012);

(3) Managing communication between partners (internal and service provider);

(4) Articulating the needs and requirements of potential stakeholders.

We propose an approach where RE's activities and KM's activities are combined and those good practices are used. Our approach consists of three steps (Figure n°3).

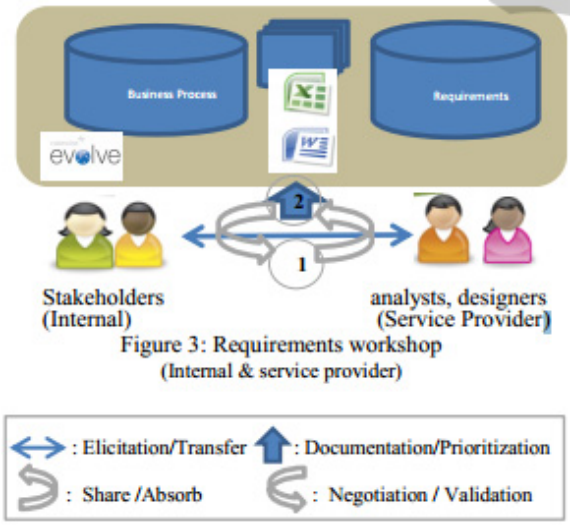

Figure 3: Requirements workshop
(Internal & service provider)

Step1- at this first step, it is important to provide interaction between the internal and service provider. We propose the use brainstorming, meeting to align the perspectives of a wide variety of stakeholders: it is consists of sharing knowledge in face-to-face, natural, and typically social interactions. Stakeholders are the initial holder of some requirements knowledge.

There is tacit knowledge about requirements in stakeholder's mind within a specific context and explicit knowledge. Then, we help stakeholders to communicate their requirements knowledge to analysts. As indicated above, this can be viewed as a knowledge transfer via communicative.

The requirements are elicited from stakeholders by analysts (Figure n°3). Analysts belong to supplier's team (service provider).

On the first hand, stakeholders describe their requirements and business process in natural language, 'French'. A major set of requirements arises from the legislation, decrees, regulations and notes of French Public Institute.

We observe that this description is very sound in natural language but it is very hard to give: Businesses process representative, customers and users have poor understanding of computer capabilities and limitations; analysts have poor knowledge of problem domain and business process. We observe also that users know how to do something but are unable to articulate how they do it. Then requirements workshop, face-to-face and uses cases overcome those problems.

On the second hand, requirements and business processes are collaboratively drawn between internal and service provider by using a BPM Tool (evolve of Casewise). This tool is not dedicated for requirement elicitation but it allowed us to manage relationships, hierarchies, and traceability which are hard to manage by hand and in natural language.

Thus, stakeholders and analysts work collaboratively to "effectively" exchange potential information and knowledge for the requirement and business process. We make six workshops. This step is expensive although the transfer of requirements knowledge have be improved and requirements description have be furthered effectively.

Step2- the previous step focuses on the eliciting users' needs and collecting all requirements. The opinions of the stakeholders are conflict with one another. Internal project manager and supplier's project manager detect those conflicts and they try to make them unambiguous and prioritize them. Therefore, they propose some technical methods; Decision trees, activity diagrams and they used the prioritization technique that gives stakeholders the confidence level and give the necessary information to the development team; "**M**o**SC**o**W**" (**M**ust, **S**hould, **C**ould, and **W**on't Have). The peculiarity is that stakeholders accustom to being asked "what they want" but not "what they do not want"; find some answers to this question gives them a different perspective of their problems and helps them to define requirements much more targeted list. They apply this technique for all requirements on

whatever level of detail, but without any reference to a time scale. The finality of this step is to bring the stakeholders' groups to meet together, to discuss the requirements and to agree on priorities. Therefore, the process of establishing a final set of requirement involves stakeholders negotiating compromises between conflicting requirements is occurred. Thus, the business process and the requirements will be formulated clearly and accurately.

Step3- At this step, all information and knowledge explicated and collected during the previous two steps are formalized in specification document. A synthesis is done in the form of review report, a trend analysis also. Thus, to drive a shared understanding among business managers and others stakeholders, then this documentation is presented to them. Hence, the shared understanding provides better decisions and new requirements have recombined into a form that better lends itself to transmission to designers, business analysts, and the stakeholders. We make available a wiki for stakeholders to enable them to submit their ideas and comments about specification document. Thus, we ensure traceability of business requirements to solution requirements. In this step, the stakeholders detect defects in the requirements and these have been corrected: we have iterated the framework again.

Table 1: Relevant characteristics of our approach.

Approach' properties		
Individual characteristics	**Interaction characteristics**	**Success**
Individual feedback	acquiring knowledge	create a common understanding
In space for sharing, individuals share ideas, questions, answers, wishes, emotions, etc.	➢ socializing with others ➢ seeking for Knowledge	➢ capture decisions made in a project ➢ implement the basic functionality to fulfill the requirements
Individuals elicit, communicate, document his or her expertise	collaborative level	correlation between **RE** and **KM**
Individuals articulate tacit knowledge into explicit concepts	expertise level / reliability	changes in organisations

Based on our doctoral results (Grim-Yefsah 2012) we noted that documents are a poor substitute for interpersonal communication. This we attribute to the inherent restrictions of the available notations and tacit knowledge about requirements in the stakeholder's mind. So we have appreciated the role of meetings such as design reviews in clarifying ambiguities and resolving conflicts in the specification documents. At the end of this step, the requirements have validated (content, documentation, agreement with stakeholders).

This approach has allowed the project team (Internal and Service Provider) to carry out the requirements engineering process. All relevant requirements are explicitly known and understood by stakeholders involved. All requirements are documented and specified.

We summarize particular findings of the case study in table1.

5 DISCUSSION

The results obtained contribute to a better understanding and greater efficiency of the process of knowledge transfer during an Information System Development project, especially in the RE phase, taking into consideration the particular characteristics of the IT Department of French Public Institute. The results show that the transferred knowledge must be directed at the operational needs felt in ISD project. It must be avoided that the service provider's team believes the transferred knowledge is imposed by stakeholders, in order for it to be used as an asset in the production of new products, and consider also requirements of the legislative, decrees, regulations and notes of French Public Institute.

Actually, we note that:

(1) The service provider's team cannot understand the knowledge transferred due to a lack of sufficient prior related knowledge to assess the value of stakeholder's knowledge, the transfer fails as well;

(2) The internal team cannot assess the knowledge transfer gain and it fears the loss of their knowledge.

Based on the literature analysis in § 3.2 about knowledge transfer and our results of illustrated's approach in §4, there are three basic elements of a transfer (Figure n°4): Resource, Process and Context.

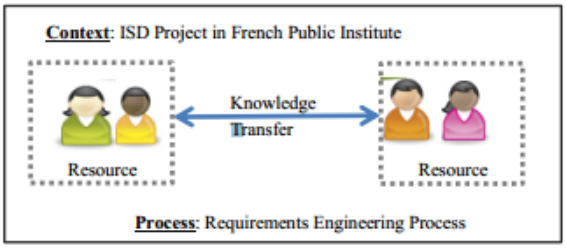

Figure 3: Basic elements in Knowledge Transfer during RE Process.

The element 'resource' consists of:
- Transmitters and receivers (people: internal and service provider in our case);
- The media and channel use in knowledge transfer process (brainstorming, workshop, Visio conference, wiki, email in our case);
- Types of knowledge, regarding tacit knowledge, direct communication between transmitters and receivers ensure that the transfer is conducted effectively.

The element 'context' is about the environment which has an impact on the transfer.

The process considered in our case study is requirement engineering process. Knowledge transfer in the requirement engineering process is studied in a French Public Institute. Our company offers good telecommunication solutions, including tools (BPM) and others services. This process is produced in cooperation with internal team and the service provider. The common understanding between people is the critical challenge in the requirements engineering process. This challenge may cause from, for example the ability/ skill of people and trust between people.

The case study method does not allow the results to be generalized, but it permits the investigation of a combination of problems of the phenomenon thus contributing to its better understanding.

6 RELATED WORK

In this section, we highlight works done by others that somehow ties in with our own work. The challenges of knowledge transfer in the requirements engineering process are summarised from various previous studies (Distanont, 2012; Kotonya and Sommerville 1998; Wiegers 2003). The most important work is the doctoral dissertation of Dr. Distanont. The purpose of her research is to enhance understanding of Knowledge transfer in requirements engineering in the context of collaborative product development. The major domain is industrial engineering. The results of this work indicate that collaboration in product development is very important and acts as a means of obtaining external resources, especially knowledge. In order to increase the effectiveness of knowledge transfer over enterprise interfaces, each knowledge type needs to be transferred through the suitable transfer channel at the right time. The results also indicate that the individual relationships among buyers and suppliers are an essential element for long-term collaboration and common platforms or tools need to be developed to support collaborative product development over enterprise interfaces. We believe that our approach brings a complementary vision by focusing only on an outsourced information system project.

7 CONCLUSIONS

In order to meet the objective of this paper, the following research question is formed: How can knowledge transfer improve the requirements engineering process?

We focus on requirements engineering process due to its significance for ISD success and its complexity. We investigated what is the impact of knowledge management (specifically Knowledge Transfer), on this requirements engineering process and, in turn, on ISD performance.

Our empirical study tests hypotheses by utilizing data from projects of Information System Development, especially in the RE phase, taking into consideration the particular characteristics of the IT Department of French Public Institute, that enables us to estimate the influence of the knowledge transfer on the requirements engineering process.

In this paper we showed how the requirements engineering process can be approached in an organisation through the knowledge management perspective. This is an initial step towards understanding the problem of requirements engineering process in practice.

Different elements directly impact transfer performance during requirements to be created: people, types of knowledge, transfer channels, and context or environment. To overcome the challenge of knowledge transfer, it is necessarily to use a potential solution to manage people, the process and the context as a key challenge of transferring knowledge in the requirement engineering process.

So we find that the proposed approach has an influence on the knowledge transfer during the

requirements engineering process performance, thereby, further improving our understanding of RE process.

We contribute to a better understanding of the importance of knowledge management related to managing explicit and tacit dimensions on the requirements engineering process.

The results of this research have direct applications and utility in our company. However generalizability to other domains remains to be assessed. Moreover, means knowledge transfer practices and others solutions for improve requirement engineering process and for overcoming problems, should be studied.

REFERENCES

Anand, A., and Singh, M.D. (2011). Understanding Knowledge Management: a literature review. International Journal of Engineering Science and Technology (IJEST 2011) vol3 (2), pp926-939.

Asghar, S., and Umar, M. (2010) Requirement Engineering Challenges in Development of Software Applications and Selection of Customer-off-the-Shelf (COTS) Components. International Journal of Software Engineering 1(1), pp32–50.

Blumenberg, S., Wagner, H.T., and Beimborn, D. (2009). Knowledge transfer processes in IT outsourcing relationships and their impact on shared knowledge and outsourcing performance. International Journal of Information Management 29(5), pp342–352.

Davenport, T.H., and Prusak, L. (1998), Working knowledge: How organizations manage what they know. Boston, MA, Harvard Business School Press.

Davenport, T.H., and Prusak, L. (2000). Working Knowledge – How Organizations Manage What They Know. Boston, Massachusetts, Harvard Business School Press.

Distanont, A. (2012). Knowledge Transfer in requirements engineering in collaborative product development. Copyright © 2012. University of Oulu, Finland.

Erden, Z., von Krogh, G., and Nonaka, I. (2008). The quality of group tacit knowledge. J. Strateg. Inf. Syst. 17, vol. 1, pp.4-18.

Fox, JM. (1982). Software and its development. Englewood Cliffs, NJ, Prentice-Hall.

Grim-Yefsah, M. (2012). Knowledge Management and Outsourcing. Doctoral thesis, Computer science, University of Paris-Dauphine, France.

Grim-Yefsah, M., Rosenthal-Sabroux, C., and Thion-Goasdoué, V., (2011). Changing Provider in an Outsourced Information System Project: Good Practices for Knowledge Transfer Proceedings of the IC3K - KMIS 2011.

Kalpic, B., and Bernus, P. (2006). Business process modeling through the knowledge management perspective. Journal of Knowledge Management, 10(3), pp40–56.

Kauppinen, M., Vartiainen, M., Kontio, J., Kujala, S., and Sulonen, R. (2004). Implementing requirements engineering processes throughout organization: success factors and challenges. Information and Software Technology 46(14), pp937–953.

Kotonya, G., and Sommerville, I. (1998). Requirements Engineering: Processes and Techniques. Chichester, England, John Wiley & Sons.

Martin, J., and Antonio, N. (2010) Knowledge transfer to the subsidiaries operating in overseas. Industrial Management and Data Systems 110(4), pp516–531.

Mirani, R. (2006) Client-vendor relationships in offshore applications development: An evolutionary framework. Information Resources Management Journal 19(4), pp72–86.

Medeni, T., Ünsal, S., Ayas, M., and Medeni, I.T. (2011). Tacit knowledge extraction for software requirement specification (SRS): a proposal of research methodology design and execution for knowledge visualization. Proceedings of the 55th Annual Meeting of the ISSS-2011, Hull, UK - journals.isss.org.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. Organization Science, 5(1), pp14–37.

Nonaka, I. and Takeuchi H. (1995). The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford University Press.

Nonaka, I. and Konno N. (1998). The concept of "Ba': Building foundation for Knowledge Creation. California Management Review Vol 40, No.3 Spring.

Nonaka, I., and Von Krogh G. 2009. Tacit Knowledge and Knowledge Conversion: controversy and advancement in organizational knowledge creation theory. Organization science 20(3), pp635-652.

Pohl, K. (2010). Requirements Engineering - Fundamentals, Principles, and Techniques. New York, Springer.

Pohl, K., (1994). The Three Dimensions of Requirements Engineering: A Framework and its Applications, Information Systems, Vol. 19, No. 3, pp.243-258.

Polanyi, M. (1967). The tacit dimension. Garden City, NY: Doubleday & Co.

Rodrigues, A. (2001), "Project Goals, Business Performance, and Risk." Cutter Consortium Project Management Advisory Service Executive Update 2(7).

Rolland, C. 2006. From Conceptual Modelling to Requirements Engineering". D.W. Embley, A. Olivé, and S. Ram (Eds.). ER2006, LNCS 4215, pp5-11.

Sommerville, I. (2006). Software Engineering. 8th ed. Harlow, UK. Addison Wesley.

Watanuki, K., and Kojima, K. (2007). Knowledge acquisition and job training for advanced technical skills using immersive virtual environment. Journal of Advanced Medical Design, Systems and Manufacturing 1(1), 48–57.

Wiegers, K. (2003). Software Requirements. 2nd ed. Redmond, Microsoft Press.

Yin, R.K. (2009). Case Study Research, 4rd ed. Sage.

Yu, E. 1995. Modeling Strategic Relationships for Process Reengineering. A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy Graduate Department of Computer Science University of Toronto.

Yu, Y., Sampaio do Prado Leiteet, J.C., Lapouchnian, A., and Mylopoulos, J. (2008). Configuring Features with Stakeholder Goals. SAC'2008 Proceeding, pp. 16-20.