Knowledge Management Practices in GSD
A Systematic Literature Review Update

Romulo de Aguiar Beninca[1], Elisa Hatsue Moriya Huzita[1], Edwin Vladimir Cardoza Galdamez[2], Gislaine Camila Lapasini Leal[2], Renato Balancieri[1] andYoji Massago[1]
[1]*Computer Department, State University of Maringá, Maringá, Brazil*
[2]*Production Engineering Department, State University of Maringá, Maringá, Brazil*

Keywords: Knowledge Management, Knowledge Management Practices, GSD, GSD Challenges.

Abstract: Software development is an activity that makes intensive use of knowledge. The reduction of face-to-face communication in Global Software Development Environments (GSD), make exponentially important to use Knowledge Management in these environments, which is performed by Practices of Knowledge Management. This study presents an update of a systematic review of Practices of Knowledge Management in GSD. The main contribution of this study relates to the identification of other practices, including sharing of the "social conscience", which gives for people the ability to identify themselves within the work context, improving the interaction, the performance of activities and also trust between individuals.

1 INTRODUCTION

The Global Software Development (GSD) is an approach that allows achieving competitive advantages such as cost reduction with teams in other countries (offshore), with the outsourcing of labor (outsourcing), greater proximity to customers, in addition to possibility of maintaining an ongoing project 24 hours per day (follow-the-sun). However, the different levels of dispersion (cultural, geographic, temporal) that characterize the GSD, brings with them difficulties in communication, team coordination, trust among developers and reduce social consciousness about these work environments (Herbsleb et al. 2000).

Software development is an activity that makes intensive use of knowledge. The reduction of face-to-face communication and the suppression of contextual information resulting from different levels of dispersion in GSD environments make important the use of Knowledge Management in these environments (Desouza et al. 2006; Zahedi and Babar 2014; Madsen et al. 2014).

To accomplish the Knowledge Management (KM), it is necessary the use of Knowledge Management Practices (KMP), which are activities performed regularly with the aim of supporting the development of products and services generating results, using this knowledge (Dalkir, 2011). Despite of the importance of KMP to deal with challenges of GSD, it was identified in the current literature, only one study (Arshad et al. 2012). It presents a systematic review on finding solutions to the challenges of GSD arising from lack of KM and KMP. The authors found that KMPs can be used for mitigating some of GSD challenges such as: trust, lack of common understanding and communication. However, this research does not describe how to implement KMPs identified and neither later works were found, of those authors, that dealt the implementation of these KMPs.

This paper aims to update the initial search results found in Arshad et al. (2012). The framework of practices and challenges should serve as support for the specification of a support structure to deal with the challenges of GSD with KM.

For this, it was carried out a search in the literature in order to identify KMPs used in GSD by a systematic literature review (SLR). The search was based on the primary study performed by Arshad et al. (2012), where was identified 27 papers relating to KM practices in GSD, between the period considering from 2002 to 2012 years. This study extended the studies on this subject, considering from 2012 to 2014 year and also including 11 new studies found in current literature. From performed

de Aguiar Beninca R., Hatsue Moriya Huzita E., Vladimir Cardoza Galdamez E., Camila Lapasini Leal G., Balancieri R. and Massago Y..
Knowledge Management Practices in GSD - A Systematic Literature Review Update.
DOI: 10.5220/0005380103650373
In *Proceedings of the 17th International Conference on Enterprise Information Systems* (ICEIS-2015), pages 365-373
ISBN: 978-989-758-097-0

analysis on these studies the practice sharing of "social conscience" was identified.

This paper is organized as follows: Section 2 describes the methodology used to SLR. Section 3 presents the results of the studies and extracted data. Section 4 presents a discussion on the challenges and practices of KM. Section 5 describes the conclusion.

2 METHODOLOGY

This research was conducted using systematic literature review (SLR). SLR is a way to synthesize results correlated with a specific problem of a research. It is important for the practice of evidence-based science. The benefits provided by this type of approach allows reflection and creation of new knowledge relevant to the scientific community (Kitchenham et al. 2009).

To achieve results with a high scientific value, a systematic review should follow a strict research protocol, where the search engines to be used are identified, the search string and rigid rules of inclusion and exclusion for performing a classification of retrieved studies are also defined. This study follows the approach of Kitchenham and Charters (2007), to perform the SLR and it is divided into three steps 1) Definition of the search protocol; 2) Selection of the work; 3) Synthesis and evaluation of results

Therefore, this study aims to identify and provide a description of a set of KM practices that enables mitigate the challenges posed by the lack of KM in GSD.

So, three relevant research questions for this study were identified:

RQ1: What GSD issues occur due to lack of knowledge management (KM)?

RQ2: What KMPs are used in GSD projects?

RQ3: What GSD issues are addressed by existing knowledge management practices (KMPs)?

A literature review was structured in three phases outlined in the protocol described by the (Kitchenham and Charters 2007):

- Search Strategy;
- Selection of works;
- Evaluation of the quality of the selected studies.

2.1 Definition of the Search Strategy and Conducting the Searches

The definition phase of the search strategy was divided into three sub-phases 1) Definition of the search string, 2) Definition of the search engines, and 3) Conduct of searches.

Aiming to define the search pilot studies were performed to identify synonyms used for the KM and GSD terms. It was done, in order to minimize the possibility of no recovery works related to the subject. The search string was the same used by Arshad et al. (2012), which allowed the updating of the work, plus the work recovered considering the period 2012 to 2014. The search string used is presented in Table 1 below:

Table 1: *String* of search.

GSD : (“Global Software development” OR “distributed software development” OR “multi-site software development” OR “global software engineering” OR “global requirements engineering” OR “distributed software engineering” OR “distributed requirements engineering” OR “multisite software development” OR GSD OR GSE OR “offshore software development” OR GRE)
KM: (**“**knowledge management**”** OR “knowledge sharing” OR “knowledge acquisition” OR “knowledge transfer” OR “knowledge creation” OR “knowledge capture” OR “tacit knowledge” OR “explicit knowledge” OR “knowledge retention” OR “knowledge valuation” OR “knowledge use” OR “knowledge application” OR “knowledge discovery” OR “knowledge integration” OR “knowledge theory” OR “organization knowledge” OR “knowledge engineering” OR “information management” OR “information sharing” OR “information transfer” OR “information reuse” OR “common understanding” OR “shared understanding”

After defining the search string, shown in Table 1, search engines to be used in SLR were chosen:

- Inspec, IET;
- IEEE Explore;
- ACM Digital Library;
- Science Direct;
- Springerlink;
- EICompendex.

To implement the search string minor adjustments to suit the syntax and constraints imposed by different search engines were needed.

The volume of papers retrieved from the searches in this study and the primary studies (Arshad et al. 2012), are presented on Table 2 below.

Table 2: Search results for engines.

	2002 to 2012	2012 to 2014
Inspec, IET, IEEE	38	35
ACM Digital Library	85	28
Science Direct	149	88
Springerlink	215	46
EiCompendex	107	17
Total	**594**	**214**

The primary study performed by Arshad et al. (2012) recovered 594 works in 120 months. The secondary study, concerned at 32 months (January 2012 to August 2014), 214 works were recovered. It shows an average increase of 35% in searches involving KM and GSD. This increase had also been noticed by some authors of recent papers retrieved (Kwan and Damian 2011; Arshad et al. 2012). After the "recovery work" on the search engines the analysis phase and the selection of relevant research topic work was initiated.

2.2 Selection of Works

For selection of the papers the following criteria were adopted:

1)Inclusion Criteria: the inclusion criteria defined in the protocol of this systematic review, aim to set strict rules and well defined to ensure the quality of related work. They are:

- Studies that directly address GSD and KM issues, and;
- Works that respond directly one of the research questions RQ1, RQ2, RQ3.

2) Exclusion Criteria: they were defined and used to filter the retrieved studies, in order to remove those studies that do not contribute to the research. Studies were excluded by the following criteria:

- Are not directly related to KM in the GSD context;
- Studies describing GSD problems not related to KM, and;
- Duplicated or repetitive papers.

After defining the criteria for inclusion and exclusion, the work passed through a primary and secondary selection in order to ensure the scientific quality of the selected papers.

2.3 Primary and Secondary Selection

The primary selection of study was performed by application of inclusion and exclusion criteria, as early described, on the titles and keywords of retrieved papers. After the initial selection, 27 studies that underwent a secondary assessment where chosen, on which were again applied the inclusion and exclusion criteria, throughout the text of the studies. At the end of secondary selection 16 papers remained, which were then assessed for their quality.

The work resulting from the secondary assessment were also evaluated for the quality and clarity of content using seven criteria, following the guidelines described by Kitchenham and Charters (2007) *(not shown here due to space limitations)*. After the evaluation of quality 11 studies were selected, since they show a clear description of context. They were used for data extraction. On Table II, all selected papers from the primary study are presented in Arshad et al. (2012), with S1 to S27 index. The works selected from this study are presented in the Appendix and are identified S28 to S38. Selected papers in this study were used for data extraction and assembly of the construction KMP used in GSD.

For data extraction, each one of the eleven selected papers was read, looking for data on how the lack of KM impacts on the challenges of GSD. KM practices used and / or that could be used to mitigate these challenges were also identified. The data extraction was performed by one of the authors, and submitted for assessment of other authors, in order to ensure the quality of the extracted data.

2.4 Data Synthesis

The extracted data allowed to identify the main challenges of GSD that teams are exposed due to the absence of KM. This motivated the search for KMP that could be used to mitigate these challenges. These data sets were merged with the results of Arshad et al. (2012) and are presented in Section 3.

3 RESULTS

The results of this study were divided into: 1) Challenges of GSD; 2) KMP's; 3) KMP's used to mitigate the GSD challenges that are presented in the following sub topics.

The results were merged with the results of the primary study (Arshad et al. 2012). Table 3 presents the challenges identified in the selected papers.

The challenges related to software engineering for GSD were mainly mentioned in the requirements, analysis and software development phases, in selected works. However, due to its nature, the ER has activities that are characterized as

Table 3: Challenges of the GSD by the lack of KM.

	Challenges
1	*Shared understanding*
2	*Knowledge sharing*
3	*Communication*
4	*Trust*
5	*Relationship building or team cohesion*
6	*Find the right people*
7	*Awareness*
8	*Software engineering in GSD*
9	*Context*

having major difficulty for explicit knowledge. This can be seen by the greater frequency with which they have been dealt by the selected studies.

Desouza et al. (2006) argue that due to the reduction in face-to-face communication between members of a development team, in GSD context, the use of KM becomes exponentially important. Table 4 below shows the KMPs observed in the context of GSD.

Table 4: KMP used in GSD.

	KMP used in GSD	Referencies
1	*Collaborative technology*	*S28,S29,S32,S33,S34, S35,S36,S37,S38*
2	*Knowledge sharing*	*S28,S31,S32,S33,S34, S35*
3	*Transactive memory*	*S32,S33,S34,S35,S36, S38*
4	*Asking the developers/boundary spanners/colleague*	*S29,S32,S33,S36,S38*
5	*Shared social context*	*S29,S32,S34,S36,S37*
6	*Finding the right people*	*S29,S31,S32,S33,S35*
7	*Documentation*	*S34,S35,S36*
8	*Direct communication*	*S31,S38,38*
9	*Standard tools and methods*	*S31,S34,38*
10	*Information update*	*S32,S35*
11	*Meetings or visits*	*S31,S35*
12	*Transferring the competence*	*S31*
13	*Guidelines/training program*	*S31*
14	*Discussion board*	*S32*

Figure 1 show a bar graph displaying the frequency in which KMPS were observed in the analyzed studies.

Some of the practices found in the primary study

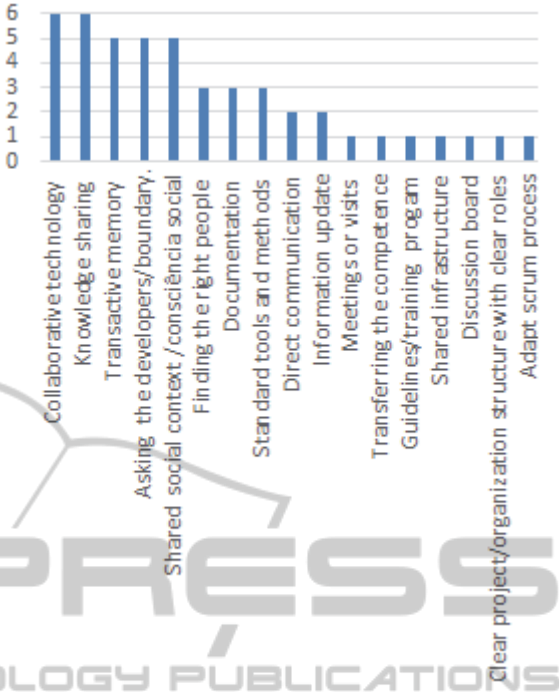

Figure 1: Frequency with which KMP are used in GSD.

were recurrent in this study, including the practices Asking the Developers, Finding the Right People and Transactive Memory. They were also found more frequently in recent studies. Another KMP which was detected only in this SLR was Shared Social Context. The activities related to share of social consciousness has been mentioned frequently in recent studies (Jabar and Sidi 2012; Calefato and Lanubile 2012.). In four of the eleven selected studies from this SLR is suggested to use Collaborative Technologies to support the practice for Sharing Social Awareness. These technologies can be used to store and retrieve contextual information at the time in that they are useful for the developer (Calefato et al. 2012; Basoglu et al. 2012). The use of collaborative technology reduces the social distance and makes one person aware of the others presence. It can help to build the team spirit and enhancing the association of contextual information of the interactions between developers (Basoglu et al. 2012).

Collaborative Technology practice was the most mentioned in both SLR. So, it was selected as an important practice. This is due to the fact that it supports other practices in GSD environments such as: Knowledge Sharing, Transactive Memory, Asking the Developers, and Shared Social Context as aforementioned.

The primary study suggested that Collaborative

Technologies do not allow overcoming challenges related to temporal distance. Another limitation cited by the Arshad et al. (2012) is the inability to mitigate challenges related to lack of informal communication using collaborative technologies. This finding was supported in the study case presented in Zahedi and Babar (2014), where an attempt to simulate the informal conversations via video cameras and screens installed in the resting environment with coffee machines and water coolers, were performed. However, this solution did not show significant improvements in communication and informal relationships among developers.

This can be achieved through technological approaches, not by trying to imitate informal communication occurring in co-located environments, but provide adequate support for holding of informal conversations and sharing of social consciousness. The sharing of contextual information is available on social networks, as well as on the physical characteristics of individuals present in chats and embedded IDE.

With this, the share of social awareness for the identification of individuals more communicative can be performed by analyzing contextual information (Basoglu et al. 2012; Calefato et al. 2012; Licorish and MacDonell 2014).

Therefore, these studies suggest that collaborative technologies can improve the quality of interactions and promoting the sharing of the social consciousness of individuals. However, new approaches that not only try to imitate informal interactions with technology use, but provide greater informal interaction through contextual and social information sharing are necessary.

Another practice detected in the selected works is Knowledge Sharing, that according to Serban and Luan (2002), are activities that enable the exchange of knowledge between people through interaction among individuals. This practice is also mentioned in the KM literature as a way for knowledge conversion known as "socialization" (Nonaka and Takeuchi 1997).

Knowledge sharing enables people to identify where knowledge is. It is known as Transactive Memory. It can be implemented by using knowledge maps (Freitas, 2012). The S29 and S38 studies present the use of the Transactive Memory as a practice for other KMP's like: Developers Asking, Shared Social Context (Madsen et al. 2014; Basoglu et al. 2012).

Other KMPs cited by selected papers used to mitigate the challenges of GSD were Documentation Direct, Standard Tools and Methods. However, they were cited with less frequency, less than 5, therefore, are not presented in Table 4.

Table 5 shows the results of the GSD challenges and practices that can be used to mitigate them. The frequencies with which these practices were observed in the primary and secondary studies are also identified. Among the practices stands as a contribution of this work to identify the social conscience to mitigate challenges such as: Knowledge sharing, Communication, Knowledge transfer, Team cohesion, Trust and Awareness.

Table 5: Challenges and Practices in GSD.

GSD Issues due to lack of KM		KMPs used to address GSD issues due to lack of KM	(Arshad et al. 2012)	Author	All
Shared understanding	1	*Collaborative technology*	3	3	6
	2	*Meetings*	3	1	4
	3	*Documentation*	3	1	4
	4	*Standard tools and methods*	2	2	4
	5	*Transactive memory*	2	1	3
	6	*Asking the colleague Guidelines/training program*	1	1	2
	7	*Reverse Presentation method (RPM)*	1	0	1
Knowledge sharing	1	*Collaborative technology*	4	2	6
	2	*Meetings*	2	1	4
	3	*Surviving the Babel tower*	1	0	1
	4	*Process Knowledge Tracer Cross continental mini teams*	1	0	1
	5	*Direct communication*	1	1	4
	6	*Division of work*	1	0	1
	7	*Shared infrastructure*	1	0	1
	8	*Discussion board*	1	0	1
	9	*Transactive memory*	1	1	2
		Shared social context	0	1	1

Table 5: Challenges and Practices in GSD (cont.).

GSD Issues due to lack of KM		KMPs used to address GSD issues due to lack of KM	(Arshad et al. 2012)	Author	All
Communication	1	*Meetings/Visits*	3	1	5
	2	*Asking the colleague*	3	2	5
	3	*Collaborative technology*	2	2	2
	4	*Clear project and organization structure with clear roles and responsibilities*	2	1	4
	5	*Transactive memory*	1		1
	6	*Information update*	1	1	3
	7	*Adapt scrum process*	1	0	3
	8	*Reverse Presentation method (RPM*	1	0	1
	9	*Knowledge centric product life cycle management*	1	1	2
	10	*Documentation*	1	0	1
	11	***Shared social context***	0	1	1
Knowledge transfer	1	*Collaborative technology*	2	2	4
	2	*Meetings*	2	1	3
	3	*Asking the colleague*	2	1	3
	4	*Documentation*	2	1	4
	5	*Division of work*	1	0	1
	6	*Transactive memory*	1	3	4
	7	*Standard tools and methods*	1	0	1
	8	*Surviving the Babel tower*	1	0	1
	9	***Shared social context***	0	1	1
Team cohesion	1	*Visits/meetings*	4	1	5
	2	*Mutual adjustment*	1	0	1
	2	***Shared social context***	1	0	1

Table 5: Challenges and Practices in GSD (cont.).

GSD Issues due to lack of KM		KMPs used to address GSD issues due to lack of KM	(Arshad et al. 2012)	Author	All
Trust	1	*Meetings/Visits*	3	3	6
	2	*Collaborative technology*	2	1	3
	3	*Transactive memory* ***Shared social context /consciênci***	1	2	3
Finding the right people	1	*Transactive memory*	3	1	4
	2	*Collaborative technology*	1	2	3
	3	*Meetings or Visits*	1	2	3
	4	*Asking the colleague*	1	1	2
	5	*Standard tools and methods*	1	2	3
Awareness	1	*Collaborative technology*	0	3	3
	2	***Shared social context***	0	3	3
	3	*Meetings*	0	1	1
Software Engineering in GSD	1	*Collaborative technology*	0	2	2
	2	*Knowledge Sharing*	0	2	2

4 DISCUSSION

The "lack of common understanding" is the challenge most mentioned among the studies analyzed, being cited in 16 of the 38 selected papers. Among the reasons of the lack of common understanding are: cultural diversity and the differences in standards in outsourcing environments. According to Damian and Zowghi (2007), “collaborative technologies” presented by Peng and Lai (2012) can be used to provide a common understanding in these environments.

The mediated communication can also be used to make better the comprehension of design aspects. Team leader who may define the more adequate way to establish the communication among developers can accomplish this.

However, this approach can also reduce the autonomy of the team and the informal contact

among team members, which, according to Damian and Zowghi (2003), impacts on trust between individuals.

Some studies indicate the sharing of knowledge as a critical success factor in outsourcing environments as well as in offshore environments (Espinosa et al. 2007; Kumar et al. 2012; Kroll et al. 2014). According to Calefato et al. (2012), knowledge sharing can be facilitated with the use of collaborative technologies using personal and contextual information to improve the quality and the chances of successful interactions, allowing the sharing of social consciousness.

Another challenge often cited in the literature is communication. One of the difficulties related to communication is the lack of informal face-to-face meeting, which reduces the sharing of contextual information about other developers and project activities impacting on trust between them. This impact, reported initially by Damian and Zowghi (2003) was recovered in four of the mentioned works (Calefato et al. 2007; Zahedi and Babar 2014b; Paasivaara and Lassenius 2014; Basoglu et al. 2012).

The lack of trust between developers reduces the "knowledge sharing" and also reduces social awareness about the project members and activities, interfering on performed activities and perceptions about the relationship between tasks. Studies performed by Calefato and Lanubile (2012) and Basoglu et al. (2012) propose the sharing of context information as a way to share social awareness and increase the chances of recalling developers, contacts, challenges such as reducing communication and trust.

5 CONCLUSION

The study identified a 35% increase in volume related to KM practices in GSD if compared to the primary study (Arshad et al. 2012). Possibly, this increase is due to the consensus both from researchers as well as professionals of the computing area related to the idea that the challenges of GSD are arising from lack of KM.

It was also observed that the practices "common understanding" and "knowledge sharing" are even more frequent in the work of the past 12 years.

Among the contributions of this work are the identification of KMP Shared social context, and the remark about the need and the importance to use new approaches to improve informal communication among developers, and not just use solutions that simulate informal interactions.

The KMP Shared Social Context enables individuals to have a better understanding of the activities and the work environment, enabling these to have a better performance on activities developed. Another possible improvement is trust among developers and the ability to remember to more details of the interactions at work (Basoglu et al. 2012; Calefato et al. 2007.).

The need to use new approaches supported by collaborative technologies to enhance the informal communication is an important advance in the current state of the art, because they can deal with challenges and they enable Trust, Knowledge Sharing and Awareness.

The identification of the set of knowledge management practices used to mitigate the challenges of GSD, serves as a base for developing future work to identify and describe the necessary elements for implementation of these practices, such as wikis, repositories or case tools. Identification and description of these elements also allow the construction of structures that provide adequate support for GSD, mitigating the challenges with the use of KM.

6 LIMITATIONS AND THREATS TO VALIDATION

Even with the effort to reduce potential threats to validity of the SLR, the research were not able to mitigate the following limitations:

Searches were conducted from the State University of Maringa, which allows access to hundreds of databases of scientific papers, but could not access all of the documents identified in the search network.

ACKNOWLEDGEMENTS

Thank Capes and Araucaria Foundation for funding the research project.

REFERENCES

Arshad, S., Usman, M., Ikram, N., 2012. Knowledge Management Practices in GSD : A Systematic Literature Review. In *ICSEA 2012, The Seventh International Conference on Software Engineering Advances*. p. 516–523.

Basoglu, K. A., Fuller, M. A., Valacich, J. S., 2012. Enhancement of recall within technology-mediated teams through the use of online visual artifacts. *ACM Transactions on Management Information Systems*, v.3, n.1, p.1–22.

Calefato, F., Damian, D., Lanubile, F., 2012. Computer-mediated communication to support distributed requirements elicitations and negotiations tasks. *Empirical Software Engineering*, v.17, n.6, p.640–674.

Calefato, F., Damian, D., Lanubile, F. 2007. An empirical investigation on text-based communication in distributed requirements workshops. In *Global Software Engineering, ICGSE 2007*. p. 3-11.

Calefato, F., Lanubile, F., 2012. Augmenting Social Awareness in a Collaborative Development Environment. *5th International Workshop on Co-operative and Human Aspects of Software Engineering (CHASE)*. p.12–14.

Kwan, I., Damian, D., 2011. The Hidden Experts in Software-Engineering Communication (NIER Track). *ICSE'11 Proceedings of the 33rd International Conference on Software Engineering*, p.800–803.

Dalkir, K., 2011. *Knowledge management in theory and practice.* Routledge, Elsevier.

Damian, D. E., Zowghi, D., 2003. Requirements Engineering challenges in multi-site software development organizations. *Requirements Engineering Journal*, v.8, p. 149–160.

Damian, D. E., Zowghi, D., 2007. The impact of stakeholders geographical distribution on managing requirements in a multi-site organization. *International Conference on Requirements Engineering (RE'02)*, (July 2001), p.1–10.

Desouza, K. C., Awazu, Y., Baloh, P., 2006. Managing Knowledge in Global Software Development Efforts: Issues and Practices. *IEEE Software*, v.23, p.30–37.

Espinosa, J. et al., 2007. Team Knowledge and Coordination in Geographically Distributed Software Development. *Journal of Management Information Systems*, 24 , p.135–169.

Freitas, L. R. M. M., 2012. *Knowledge Management Practices: Proposal for reference*. Master's Thesis submitted to the University Portucalense (in Portuguese).

Herbsleb, J. D. et al., 2000. Distance , Dependencies , and Delay in a Global Collaboration. *In Proceedings of the 2000 ACM conference on Computer supported cooperative work (CSCW '00)*, p.319–328.

Jabar, M. A., Sidi, F., 2012. The effect of Organizational Justice and Social Interdependence on knowledge sharing. *2012 International Conference on Information Retrieval & Knowledge Management*, p.64–68.

Kitchenham, B. et al., 2009. Systematic literature reviews in software engineering:a systematic literature review. *Information and Software Technology*, 51, p.7–15.

Kitchenham, B., Charters, S., 2007. *Guidelines for performing Systematic Literature Reviews in Software Engineering.* Technical Report EBSE-2007-01, School of Computer Science and Mathematics, Keele University.

Kroll, J. et al., 2014. Handoffs Management in Follow-the-Sun Software Projects: A Case Study. *2014 47th Hawaii International Conference on System Sciences*, p.331–339.

Kumar, S. et al. 2012. An Approach to Effectively Transfer Knowledge and Accelerate the Movement of Software Services Offshore. *2012 IEEE Seventh International Conference on Global Software Engineering*, p.212–216.

Licorish, S. A., MacDonell, S. G., 2014. Understanding the attitudes, knowledge sharing behaviors and task performance of core developers: A longitudinal study. *Information and Software Technology*, v.56, n.12, p.1578–1596.

Madsen, S., Bødker, K., Tøth, T., 2014. Knowledge transfer planning and execution in offshore outsourcing: An applied approach. *Information Systems Frontiers*. v.17, n.1, p.67-77. Published online: 9 July 2014.

Nonaka, I., Takeuchi, H., 1997. Knowledge Creation In Company 20th ed., Elsevier Brasil (in Portuguese).

Paasivaara, M., Lassenius, C., 2014. Communities of practice in a large distributed agile software development organization – Case Ericsson. *Information and Software Technology*, v.56, n.12, p.1556–1577.

Peng, R., Lai, H., 2012. DRE-specific Wikis for Distributed Requirements Engineering: A Review. *2012 19th Asia-Pacific Software Engineering Conference*, p.116–126.

Serban, A. M., Luan, J., 2002. Overview of Knowledge Management. *New Directions for Institutional Research. v.2002, n.113,* p.5–16.

Zahedi, M., Babar, M. A., 2014a. Knowledge sharing for common understanding of technical specifications through artifactual culture. *Proceedings of the 18th International Conference on Evaluation and Assessment in Software Engineering*, p.1–10.

Zahedi, M., Babar, M. A., 2014b. Towards an understanding of enabling process knowing in global software development: a case study. *Proceedings of the 2014 International Conference on Software and System Process - ICSSP 2014*, p.30–39.

APPENDIX

S28) Basoglu, K. A., Fuller, M. A., Valacich, J. S., 2012. *Description in the references.*

S29) Calefato, F., Lanubile, F., 2012. *Description in the references.*

S30) Kumar, S. et al. 2012. *Description in the references.*

S31) Lindvall, M., Muthig, D., Dagnino, A., Wallin, C., Stupperich, M., Kiefer, D., May, J., Kahkonen, T., 2004. Agile software development in large organizations. *Computer, IEEE.* v.37, n.12, p.26-34.

S32) Calefato, F., Damian, D., Lanubile, F., 2012. *Description in the references.*

S33) Madsen, S., Bødker, K., Tøth, T., 2014. *Description in the references.*

S34) Paasivaara, M., Lassenius, C., 2014. *Description in the references.*
S35) Solis, C., 2012. An overview of a spatial hypertext wiki and its applications. *ACM SIGWEB Newsletter*, (Winter), 6.
S36) Zahedi, M.; Babar, M. A., 2014a. *Description in the references.*
S37) Zahedi, M.; Babar, M. A., 2014b. *Description in the references.*
S38) Zimmermann, S., Katzmarzik, A., Kundisch, D., 2012. It Sourcing Portfolio Management for IT Services Providers – An Approach for using Modern Portfolio Theory to allocate Software Development Projects to Available Sites. *The Data Base for Advances in Information Systems.* v. 43, n. 1, p. 24-45.