Practices for Effective Communication during Requirements Elicitation in Global Software Development

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Abstract — Effective communication play an important role during requirements collection and implementation for any software system. In Global Software Development (GSD), its significance increase more as stakeholders are far away across the globe. In GSD challenges such as language differences and time zone differences exist and thus proper and timely communication become more difficult. There is need of practices for effective communication during proper requirements elicitation and implementation in GSD. This study address possible solutions and practices for effective communication. Through Systematic Literature Review (SLR), 13 practices are identified.

Keywords - Global Software Development; Requirements implementation; Practices; Effective Communication.

I. INTRODUCTION

Requirement Engineering (RE) deals with all aspects of software requirements from requirements collection to requirements implementation in systematic and discipline way [1][2]. RE consist of different phases. In requirement elicitation phase, requirements for software system are collected from clients by applying various elicitation techniques such as background study, interview, questionnaire, apprenticing [3][4]. In GSD, where clients and vendors are far away and there exist geographical distance thus traditional ways of applying elicitation techniques are not possible. There is need of more collaboration and coordination among clients and vendors in GSD. In GSD, use of modern tools and technologies bears more significance. Use of these collaborative modern technologies facilitate effective communication and make elicitation process more and more efficient and successful [5][6]. There are two ways of communication in GSD i.e. synchronous ways of communication such as video chats and asynchronous ways of communication such as fax, emails etc. Through these collaborative tools, both vendors and clients can communicate in both ways [7]. In GSD, vendors and clients possess different cultures and thus difficulties during requirements collection increase more. According to [8], we need practices for effective communication during elicitation phase of RE. With efficient practices, challenges in GSD can be reduced by ensuring effective communication. Effective communication is considered to be the most critical success factor in GSD in many studies [9][10][11]. In our previous research work, SLR was conducted in which success factors for GSD during successful requirements implementation were identified from 92 papers, where effective communication was identified as most critical success factor with frequency of 80% from different studies [12]. The aim of this research work is to identify practices for implementation of effective communication in GSD. In order to achieve our objectives, the following research question is finalized for this study.

II. BACKGROUND STUDY

According to [13], due to barriers such as geographical distance, time zone differences and language differences, effective requirements collection and implementation in GSD become more and more difficult which can affect the quality of software systems. Systematic literature review is conducted by [12], where effective communication is identified as most critical success factor during successful requirements implementation in GSD. With effective communication channels, proper elicitation of requirements in GSD can be assured.

Language is very essential in requirement collection as it disturbs transfer of knowledge and proper communication that depends entirely on appropriate usage of language [14]. In GSD this factor is a big challenge because mostly the clients and vendors face difficulties to fully cope the terminologies of other languages. In GSD, timely communication is another big challenge because there exist difference of time zones between two countries and sometimes this variation in time zones can increases that makes it difficult to communicate synchronously such as video or audio calls etc. Time zone variance is a challenge for both vendors and clients in GSD and thus it requires appropriate solutions and practices [15][16].

Elicitation problems occur due to lack of proper communication and for which model is suggested in one of the studies [17]. The first step in this model is to arranged interviews from several software industries and compare the consequences with outcomes as identified by research group. Theoretical modeling of requirements uncertainty and elicitation dimensions is the next step and the last step is the validation of model from different software organizations.

Communicating knowledge and information's in GSD is challenging and a big challenge in GSD [18]. Poor SRS shows that the knowledge managing was improper.

Proper discussion and negotiation on requirements in GSD is an crucial challenge to be overcome and but due to the stated challenges such as time differences, language barriers and culture differences it is quite difficult to have proper negotiations on requirements [19][20]. Trust should be established in GSD because without trust no team is possible and without team no collaboration is possible and without collaboration and trust a success is achieved only by luck [20].

Different implementation models has been for efficient requirements implementation in the context of GSD. Requirement Implementation Model (RIM)[10], Requirement Elicitation Model (REM) [9] and Requirement Management Model (RMM)[5] are presented in different studies. The proposed models are based on empirical studies that will consist of all possible challenges and success factors with practices and solutions during requirements implementation, elicitation and management in context of GSD.

III. RESEARCH METHOD

SLR is conducted to achieve our goals and objectives. In our previous studies we used the same research method to achieve other goals [21]. In this research study, we are repeating the same steps as we did in our previous research works. The step by step approach of conducting SLR is shown in Figure 1.

a. Research Question Identification

The first step of doing SLR is finalizing research questions. Based on particular research question, data are retrieved from different research studies. We have finalized the following research question (RQ1) for this study.

RQ1: What are possible best practices for effective communication during requirements implementation in GSD?

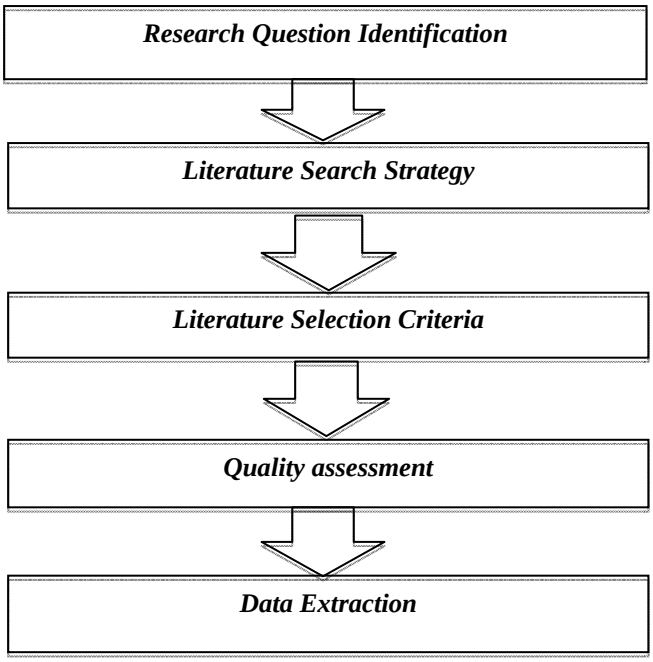

Figure 1. Development Process for the SLR Protocol

b. Literature Search Strategy

Literature Search strategy is made that consist of the following;

- **Range of search (time and space)**

There is no bound on search time and space. Publication related to our defined RQ1 will be included for the next step.

- **Electronic data sources used**

We will used Science Direct, Springer link, ACM portal, IEEE Xplore.

- **Strings for the search**

We have used the following search string for this research work.

((“Requirement Engineering” OR “Requirement Implementation” OR “Requirement Elicitation”) AND (“Global Software development” OR “Distributed Software Development”)).

c. Literature Selection Criteria

During literature selection criteria, not all but some publications that are most relevant to research question is selected for final data retrieval. Studies that are not written in English will be excluded from final list of papers. Inclusion and exclusion criteria for this research study is based on RQ1. Papers that address practices for effective communication in GSD will be only included.

d. Data extraction

This is last phase where practices for effective communication during requirements implementation in context of GSD will be retrieved from final selected list of publications. Based on inclusion and exclusion criteria, Table 1 shows number of primary and final selected papers from different digital resources. Final list of papers are given in appendix section.

Table 1: Final selected papers from different digital resources

Publisher Site	Total Results found	Primary selection	Final Selected Papers (Appendix)
IEEExplore	360	85	14
Science Direct	300	85	4
ACM	280	40	3
Others	430	105	7
SpringerLink	140	20	2
TOTAL	1510	335	30

IV. RESULTS

After conducting SLR, following 13 practices for implementation of effective communication during requirements implementation in GSD as shown in Table 2 are identified.

Table 2: Practices for effective communication

S/No	Practices	% of Practices via SLR (N=30)
1	Use asynchronous way of communication like email or watsapp for communicating the requirements	14
2	Use synchronous way of communication like video chats	10
3	Regular and open communication	5
4	The use of collaboration software and tools	9
5	Informal communication is needed	5
6	Face-to-face relationship building	4
7	Using ontologies as bridges to facilitate communication	4
8	Structure of an organization	2
9	Facilitate communication sessions	1
10	Documentation as way of communication	1
11	Train team members	2
12	Social Network Analysis	1
13	Creating a communication coordinator role	1

V. DISCUSSION

In GSD, when clients and vendors are far away and their exist time zone differences, so asynchronous ways of communication such as email and watsapp become necessary. Through this way of communication or use of any asynchronous tools and technology, clients and vendors can effectively communicate and discuss requirements. As in GSD, language differences exist, so use of such kind of communication become more and more necessary because clients and vendors can get enough time to properly communicate with chat. In GSD, where clients and vendors can't meet face to face directly, use of synchronous tools such as video chats become necessary. Through direct video communication, both clients and vendors effectively discuss requirements. In GSD, communication on regular basis is important to remove conflicts in requirements before implementation. Through regular and open communication, missing requirements or any misunderstandings can be resolved before implementation. As traditional ways of requirements elicitation such as background study is not possible in GSD, so collaborative ways of elicitation and use of collaborative tools and technologies bears more significance. Informal communication is also one of the way to increase collaboration between two parties in GSD. In many studies, authors focused on use of informal communication as way of effective communication. Informal communication remove hesitations from clients. In GSD, building trust in two parties is very important. For increasing trust factor, it is necessary to build face to face relation using modern technologies. Use of infrastructure that facilitate effective communication rich environment for GSD bears much importance.

VI. CONCLUSION AND FUTURE WORK

As a result of SLR, 30 papers were finalized for data extraction. From these papers, 13 practices are identified for effective communication during requirements implementation in GSD. In these factors, 'Use asynchronous way of communication like email or watsapp for communicating the requirements', 'Use synchronous way of communication like video chats' and 'use of collaboration software and tools' are identified as most important and critical practices. In future, we aim to validate these factors with empirical studies from software industries. Some new practices that are not identified and found in literature will be published in future. Future goal is to build requirement implementation model (RIM) that can assist software vendors to better implement all success factors.

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