Validation of 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 validation of possible solutions and practices for effective communication from our previous study.

Keywords
Practices, Effective communication, Practices, Global Software Development, Systematic Literature Review.

1. INTRODUCTION
Requirement Engineering (RE) deals with all aspects of software requirements from requirements collection to requirements implementation in systematic and discipline way [1][2][3]. 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 [4][5][6][7]. In GSD, where clients and vendors are far away and there exist geographical distance thus traditional ways of applying elicitation techniques are not possible [8][9]. There is need of more collaboration and coordination among clients and vendors in GSD [7][10]. 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 [11][12]. 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 [13]. In GSD, vendors and clients possess different cultures and thus difficulties during requirements collection increase more. According to [14], 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 [15][16][17]. 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 [18]. In our research work [19], practices for implementing effective communication in GSD were identified through SLR as shown in Table 1. The aim of this research work is to validate practices for implementation of effective communication in GSD through empirical study.

Table 1: Practices for effective communication in global software development

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

2. RELATED STUDY

According to [20], 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 [18], 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 [21]. 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 [22][23].

Elicitation problems occur due to lack of proper communication and for which model is suggested in one of the studies [24]. 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 [25]. 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 [26][27]. 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 [27].

Different implementation models has been for efficient requirements implementation in the context of GSD. Requirement Implementation Model (RIM)[16], Requirement Elicitation Model (REM) [15] and Requirement Management Model (RMM)[11] 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.

3. RESEARCH METHOD

3.1.Survey Design

Survey is empirical study that is conducted to validate our outcomes from results of SLR that was formerly conducted [18]. When maximum responses in short time are to be collected, questionnaire survey is best choice. In this research work, online survey is led with software engineering experts. Structured questionnaire method is adopted for gathering data from the experts working in GSD projects.

The questionnaire consists of success factors that were identified through SLR. Five point scale was used to state the importance of the identified intercultural challenges. The respondents were requested to choose one of the seven options i.e. strongly agree, agree, slightly agree, not sure, disagree.

3.2.Data Sources

Only those software organization were selected that work on GSD projects. Different organizations were finalized for this purpose and questionnaire were distributed amongst them.

3.3.Data Analysis

A total of 35 participants responded to the survey belong to different software houses as shown in Table 2. Among them 5 responses were rejected because of our quality criteria. The experts are selected on the basis of their experience. Final list of responses contain 30 experts. Percentages of strongly agreed, agreed, slightly agreed, not sure and disagreed responses will be calculated for every success factor. This calculation is necessary to analyze these factors and to identify factors that are more critical. Critical factors are those that bears more importance as compare to rest of the factors. Finalized questions in questionnaire form are given in Table 3.

Table 2: List of software houses selected for questionnaire

S/No	Software Company Name	Address
1	Datumsquare IT Service	STP -3, Block A, Ground Floor, Plot # 155, Service Road North, Sector I-9/3, Islamabad
2	Seven Software Development (Private) Limited	3rd floor, software technology park, Service Road North, Sector I-9/3, Islamabad
3	Developer Desk Technologies	House No 258, Street 90, I-8/4, Islamabad
4	DiscreteLogix	Software technology park, Service Road North, Sector I-9/3, Islamabad
5	Techaccess Private Limited	F-8/2, Islamabad
6	StepNex Services (Pvt) ltd	Deans Trade Center, FF-51, Peshawar
7	Trend micro logics	Deans Trade Center, FF, Peshawar
8	Grey Beard Solutions	F-6, Islamabad
9	Vizteck Solutions	Software Technology Park, Plot 156, Sector I-9/3, Islamabad
10	xFlow Research	Software Technology Park, Sector I-9/3,Islamabad

Table 3: Form for questionnaire

Questions	Strongly Agree	Agree	Slightly Agree	Neither	Dissatisfied
Use asynchronous way of communication like email or watsapp for communicating the requirements	☐	☐	☐	☐	☐
Use synchronous way of communication like video chats	☐	☐	☐	☐	☐
Regular and open communication	☐	☐	☐	☐	☐
Use of collaboration software and tools	☐	☐	☐	☐	☐
Informal communication is needed	☐	☐	☐	☐	☐
Using ontologies as bridges to facilitate communication	☐	☐	☐	☐	☐
structure of an organization	☐	☐	☐	☐	☐
Facilitate communication sessions	☐	☐	☐	☐	☐
Documentation as way of communication	☐	☐	☐	☐	☐
Train team members	☐	☐	☐	☐	☐
Social Network Analysis	☐	☐	☐	☐	☐

4. RESULTS

Results after conducting questionnaire survey are given in Table 4 below. It shows that factors 'Use asynchronous way of communication like email or watsapp for communicating the requirements' is most strongly agreed by industry. Factors that frequency of strongly agreed is greater than 50% is more critical which shows that implementation of these factors will

reduce challenges during proper requirements collection in GSD. Other factors whose frequency is low are also important. Figure 1 shows percentages of all practices that are strongly agreed by experts. From the survey it was found that practice 'Use asynchronous way of communication like email or watsapp for communicating the requirements' is most critical with 80% experts strongly agreed while few are only agreed and none of expert is disagreed. Practices, 'Use synchronous way of communication like video chats' and 'social network analysis' are identified from the results of survey with 66% experts strongly agreed. With social network analysis, several people can informally combined and share their opinions about successful implementation of requirements. 'Train team members' is identified from survey as important practices with 56% strongly agreed experts. Training prior to start of the project and during project implementation is necessary. Giving skills to all team members on how to collect and implement software requirements successfully.

Table 4: Practices validation for effective communication in GSD

Effective Communication Practices	Strongly agree	Agree	slightly agree	Not sure	Disagree
Use asynchronous way of communication like email or watsapp for communicating the requirements	24	8	0	0	0
Use synchronous way of communication like video chats	21	9	0	0	0
Regular and open communication	2	15	10	3	0
Use of collaboration software and tools	5	8	7	5	0
Informal communication is needed	2	3	10	0	15
Using ontologies as bridges to facilitate communication	0	2	5	16	7
structure of an organization	5	12	10	0	3
Facilitate communication sessions	9	20	1	0	0
Documentation as way of communication	3	10	10	7	0
Train team members	17	10	3	0	0
Social Network Analysis	20	10	0	0	0
Creating a communication coordinator role	4	13	8	4	1

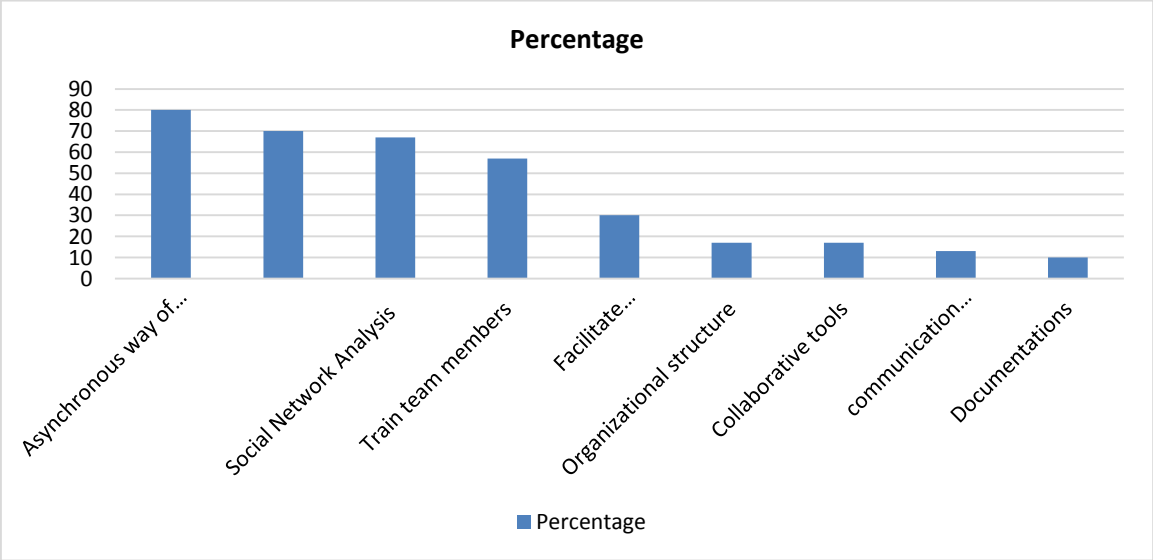

Figure 1: Critical Practices in descending order of percentages of strongly agreed

Figure 2 shows percentages of all practices with positive responses. Positive responses can be either strongly agreed, agreed or slightly agreed while negative response is that either not agreed or not sure. Figure 2 shows that for all practices instead few practices such as informal communications and using ontologies are either not agreed or not sure by experts. Reason could be that using modern technologies such as software web ontologies is new field and can take time so that people can aware of using it. Practices are that agreed by experts are important but this does not mean that other practices are not important.

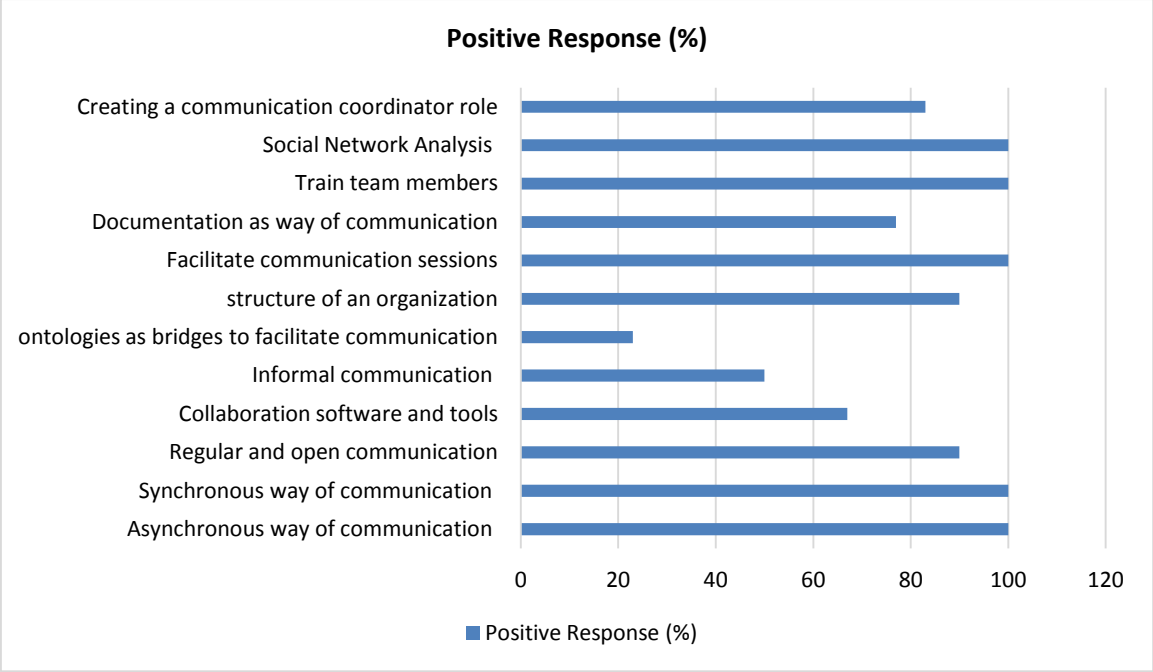

Figure 2: Percentages of positive responses of expert

5. CONCUSION

All identified possible best practices from our previous study for implementing effective communication are validated from software industry. From validation it is concluded that all factors are important but some factors such as 'Use asynchronous way of communication like email or watsapp for communicating the requirements', 'Use synchronous way of communication like video chats', 'Train team members', 'Social Network Analysis' are more important and critical. Thus we need to implement these factors so that effective communication can be assured during requirements implementation in GSD.

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