Frequent and Proper Negotiations as Success Factor in Global Software Development

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Abstract - Global software development (GSD) remain a challenging task for software vendors because of challenges such as geographical distance, language barrier, time zone differences and culture variations. Requirements collection and implementation in GSD become so difficult and can affect product quality and project success. In several previous conducted studies in the context of GSD, frequent and effective negotiations and discussion is considered to be critical success factor during successful requirements collection and implementation. This current research study address and investigate importance of frequent and proper negotiation through Systematic Literature Review (SLR). Further, analysis is conducted on basis of software company size, continents, time period and research methodology.

Keywords: Systematic Literature Review, Proper negotiations, Global Software Development.

I. INTRODUCTION

Global Software Development (GSD) is development of software product across the globe where clients and vendors are separated with geographical distance [1][2]. In requirement engineering phase of software development life cycle consists of different phases such as requirement elicitation, requirement analysis, requirement specification and requirement validation [3]. Requirement elicitation phase directly involve clients interaction with vendors due to which collection of requirements become more and more difficult especially when clients and vendors are separated with geographical distance in GSD [4]. In GSD, traditional ways of requirement elicitation such as background study, prototyping are interview are difficult and depends more on collaborative ways of elicitation techniques [5].

In GSD, big challenge is language barrier as people belong to different nations have different languages and ways of talking that makes it difficult to understand each other's [6][7]. Time zone difference is another critical challenge addressed by many authors [8][9]. Sometimes time difference in two countries are too much which makes it difficult to communicate timely e.g. time difference between U.S and Asian countries is nearly twenty hours. Similarly in GSD, culture variation is another big challenge identified in several studies [10][11]. People belong to different countries have different ways of doing and dealing with things and have different opinion on same issue. Due to the stated challenges in GSD, effective communication among clients and vendors is affected which affect proper requirements collection. In several studies [9][12][13][14], importance of frequent meetings with clients and proper discussion in considered to be important so that effect of stated challenges can be significantly reduced.

A lot of research work is published to identify success factors. In order to reduce the effect of these challenges in GSD. One of the critical success factor identified is a need of frequent and proper negotiations. As no SLR has been conducted yet to identify all those related studies on frequent and proper negotiations as success factor, so the purpose of this research is to conduct systematic review to identify all those studies who identified frequent and proper negotiations as success factor and to analyze it based on software company size, time period, research method and sub-continents. Other studies in GSD relevant to their research questions also used same criteria [15]. Purpose of analysis is to know how proper negotiation as success factor vary in different time periods, research method, company sizes and sub-continents. The ultimate goal is to address the need of proper negotiations in GSD so that probability of successful delivery rate of software projects in GSD can be assured.

II. BACKGROUND STUDY

According to [16], there is a need of negotiation's and discussion. The negotiation's leads to compromise from both clients and vendors who create dependencies between them so there is need to focus on significance of proper and effective negotiations. According to [17], more and more discussion and collaboration is needed sot that any conflicts in requirements can be resolved on time. With more and more collaboration among clients and vendors, less will be the effect of culture variation and will be easy to understand each other's. According to [18], collaborative tools design for GSD are more helpful for fruitful discussion. Collaborative tools having facilities of both synchronous and asynchronous enrich communication facilities. With asynchronous ways of communication, both clients and vendors get enough time to properly discuss requirements where there exist huge difference in time zones and languages while with synchronous communication, directly face to face communication become possible. According to [19], informal communication among vendors of the organization and with clients (instant messaging, threaded discussion groups, and physical awareness) gets more helpful while discussing requirements. With such communication, more and more inter-organizational learning is possible and knowledge and be easily transferred among them which helps in reducing the effect of challenges in GSD and increase probability of successful delivery of software projects. According to [20], requirement engineering relies completely on fruitful negotiations among stakeholders and in GSD, its role and need become more necessary. In discussion, soft skills among stakeholders are more helpful which allows parties on both sides to understand each other's opinions easily. According to [21], requirements negotiation is one of the most complex and communication concentrated practice of software engineering, especially in GSD, where organizing meetings are usually unreasonable and thus more and more emphasis is required on proper negotiations. According to [22], this negotiation is more operative when the members in GSD share a joint under-standing, also stated to as common ground in communication. The common ground is the knowledge that participants have in common when communicating and the awareness of it.

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 [23][15][9]. 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 Questions

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 questions for this study.

To conduct the research the following questions are formulated.

RQ1. How proper negotiations in GSD is related to the study strategies used?

RQ2. How negotiations in GSD vary from one time period to another?

RQ3. Is there any relationship between proper negotiations and a software company size?

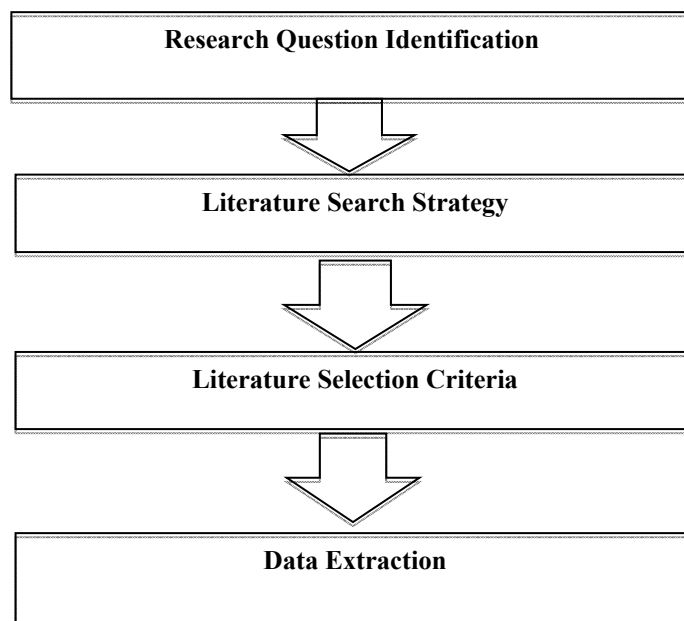RQ4. Do proper negotiations vary from continent to continent?

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 research questions. Papers that address practices for effective negotiations in GSD will be only included for SLR. In first selection of papers, all papers relevant to requirements collection in GSD will be identified as 'total results found' shown in Table 1. In second selection, which is primary selection where all those papers that address success factors in total results found initially will be finalized while in final selected papers as shown in Table 1, only those papers will be selected which address frequent and proper negotiations in GSD as critical success factor.

d. Data extraction

This is last phase where data relevant to research questions will be retrieved from final list of papers. Other studies also used same criteria in GSD relevant to their research questions [15]. Data retrieved include the following;

- Research method applied
- Time period in which paper is published
- Software company size where case study is conducted
- Sub-continent where case study is conducted

IV. RESULTS

Based on inclusion and exclusion criteria, Table 1 shows number of primary and final selected papers from different digital resources. Total number of final selected papers found are 41.

Table 1: Final selected papers from different digital resources

Publisher Site	Total Results found	Primary selection	Final Selected Papers (Appendix)
IEEExplore	360	85	13
Science Direct	300	85	3
ACM	280	40	6
Others	430	105	16
SpringerLink	140	20	3
TOTAL	1510	335	41

4.1. Analysis based on research methods

Table 2 shows research methods used in different studies. List of identified papers in which particular research method used are given in appendix. Five different research methods used are given in Table 2.

Table 2: Research method used in different studies

Research Method	Identified papers (Appendix)
Case Study	1,2,4,7,9,10,11,12,16,17,20,23,24,25,26,27,31,32,38,39,41
Experiments	3,8,18,22,40
Interview	14,28,29,34,35
Survey	13,15,21,30,37
Experience Report	5

Figure 2 shows that case study is method that is used mostly by authors while showing role of frequent and proper negotiations in GSD while collecting user requirements. Case study is method which deeply analyze any factor. Frequency of other research methods used are also shown in Figure 2.
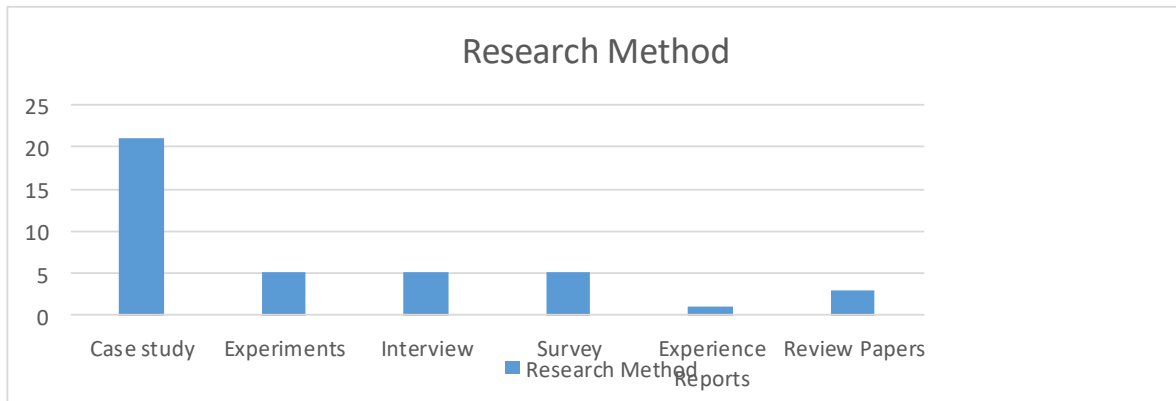

Figure 2: Frequency of various research method used in SLR

4.2. Analysis based on time period

We have divided time period into two categories i.e. below 2007 and after 2007. Table 3 shows period of time with identified papers as shown in appendix.

Table 3: Studies conducted in different period of time

Time period	Identified papers (Appendix)
Below 2007	1,2,3,4,12,14,16,18,21,22,23,25,30,35,37,39
2007 onwards	5,6,7,8,9,10,11,13,15,17,19,20,24,26,27,28,29,31,32,33,34,36,38,40,41

Figure 3 shows frequency of two different time periods from SLR which indicates that numbers of identified papers from SLR in period 2007 onwards are higher than papers identified in period below 2007. Higher number of papers published in recent decade shows importance of proper negotiations and holding frequent meetings with clients is still important which can reduce the effect of challenges in GSD. In recent years more advancement in GSD is shown much as compare to previous decade due to rising of web technologies which forced importance of negotiations in GSD more. Another reason for this is that more software engineering process maturity is seen and more models such as agile are introduced to reduce challenges. In software engineering models such as agile, frequent communication, customer involvement throughout the project and more and more discussion with vendors is mandatory which forced authors to address the need of frequent and proper negotiations while developing software in GSD.
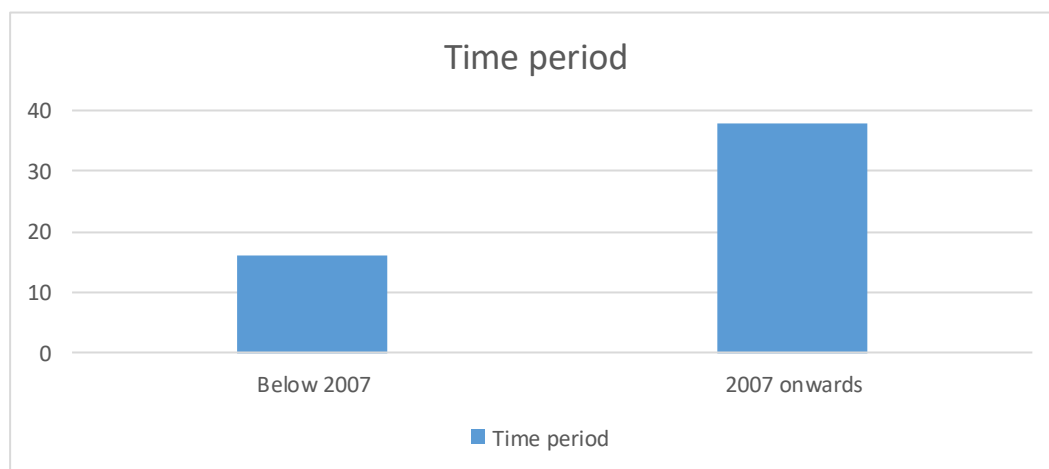

Figure 3: Frequency of two different time periods from SLR

4.3. Analysis based on software company size

We have divided software company sizes into three categories i.e. small, medium and large size. Categories are made in such a way that company with number of employees less than 20 are considered small. Company with number of employees greater than 20 and less than 50 are considered medium size while company with number of employees greater than 50 are large sizes. Other studies also used same strategies to categorized software company sizes into small, medium and large sizes. Table 4 shows software company sizes with identified papers as shown in appendix.

Table 4: Studies conducted in different software company size

Company size	Identified From (Appendix)
Small	4,32,35
Medium	1,2,7,27,31,
Large	3,8,9,10,11,12,16,18,20,22,23,25,26,36,38,41

Figure 4 shows frequency of different company sizes as identified from SLR. It shows that number of large company sizes are higher than medium and small company sizes while small company sizes are lowest in number which indicates that need of proper negotiations as success factor is more addressed in large size companies as compare to medium and small size companies. There could be several reasons but one of the reason could be that as large sizes companies normally follow software engineering standards and models more as compare to small sizes companies. Companies that have large size are running from several years and much based on standards which shows importance of frequent and proper negotiations as success factor in GSD. But it doesn't mean that small size companies don't need proper negotiations while collecting user requirements.
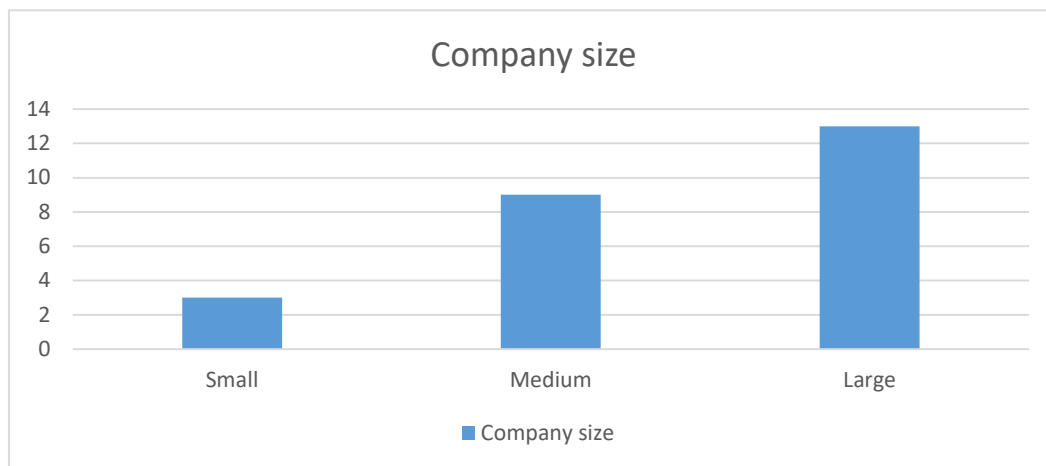

Figure 4: Frequency of three different company sizes from SLR

4.4. Analysis based on sub-continents

We have categorized our study into four continents i.e. Asia, Europe, America and mixed continents. Countries like Canada etc. near to America will come in that category. Mixed country include case study conducted into more than one country. Table 5 shows sub-continents with identified papers as given in appendix.

Table 5: Studies conducted in different sub-continents

Sub-continents	Identified papers (Appendix)
Asia	13,18,19,21,22,29,40,41
Europe	4,5,6,7,8,16,17,20,26,32,37
America	1,2,30,31,35,36,39
Australia	3,9,14,15,
Mixed continents	10,11,12,23,24,25,28,33,38

Figure 5 shows that frequency of studies conducted Europe is more as compare to other countries belong to different sub-continents. Mostly Asian countries such as china, Pakistan and India are vendors as labor cost in these countries are much reduced while clients are mostly belong to Europe and America.
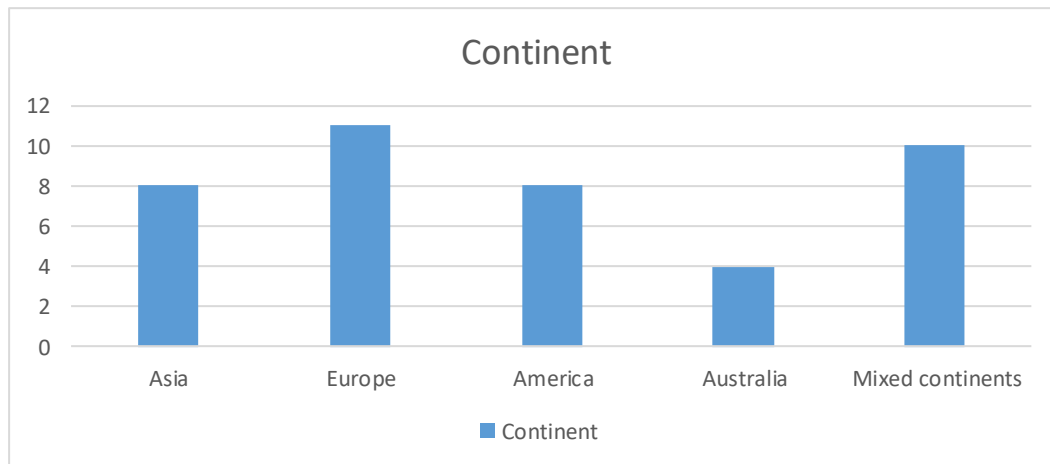
Figure 5: Frequency of different sub-continents from SLR

V.   CONCLUSION AND FUTURE WORK

In order to reduce challenges which GSD faces such as time zone differences, language barrier and culture differences, this study aimed to address importance and need of frequent and effective negotiations among clients and vendors. To do so, SLR was conducted. First step in conducting SLR was design of SLR protocol. On execution of SLR protocol, we had total of 41 final papers that addressed need of frequent and effective negotiations while collecting user requirements. Furthermore, results of SLR were analyzed based on research methods used, time period of decade, software company size and continents in which studies were conducted. In future, we aim to empirically evaluate importance and need of frequent and proper negotiations from real software industries via questionnaire. Analysis from real software industry will be further based on experience of negotiator. The ultimate goal is to arise the need of effective negotiation process and to implement modern tools and technologies and all those processes which favor effective negotiations process.

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