

Identification of Practices for Proper Implementation of Requirements in Global Software Development: A Systematic Literature Review Protocol

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ABSTRACT

Effective requirement implementation leads to successful delivery of software. The requirement engineering (RE) is very difficult when implemented locally but the case is worst in global software development (GSD). There exist challenges such as 'Lack of effective communication', 'Organizational change', 'Lack of coordination and collaboration', 'Lack of knowledge-sharing and awareness' in GSD and to minimize the effect of these challenges success factors such as 'Support of collaborative tools', 'Global project management', 'Requirement Engineering modelling', and 'Proper negotiation and discussion' are suggested by many authors. To decrease the effect of challenges and to successfully implement success factors, practices and solutions are needed. The objective of this research is to find the practices needed to successfully implement RE process. Systematic Literature Review (SLR) is conducted for the identification of these practices

Keywords

Keywords: Practices/Solutions, Systematic literature review, Global software development, Requirement engineering.

1. INTRODUCTION

Requirement engineering (RE) is a systematic and proper way of collecting requirements from user by applying various techniques such as background study and interview [1]. RE is divided in some phases such as requirement elicitation in which we collect requirements from users, requirement analysis phase in which we examine user requirements using models, requirement specification phase in which we specify functional requirements of users and validation phase in which the collected user requirements are validated. The quality of implemented software is totally depended on proper requirement implementation. The more errors and bugs remain during RE, the more is the chances of failure of the software and more it is expensive to fix it latterly on [2]. So RE needs more attention and much efforts are required. In GSD, RE is very difficult because there exists challenges such as culture difference, physical and geographical change, language and terminology difference, lack of face to face conversation and time zone difference [3][4]. To successfully implement RE, we should implement success factors in order to reduce the effect of challenges [5]. For every success factor we need practices. Practices are required for requirement elicitation, analysis, negotiation, specification phase and validation phase [6][7]. In our previous study, we have identified critical success factors for RE in GSD through SRL

[8]. The objective of this research work is to find all possible

practices for implementing RE successfully.

2. BACKGROUND STUDY

Javed Iqbal [9] identified several RE practices in GSD. For requirement elicitation author identified practise like "collect requirements from multiple viewpoints", "reuse requirements from already developed similar systems", "identify stakeholders of the system and consulting them", "Recording requirement originating sources", "access system feasibility". He also identified practices like "define system boundaries", "use checklists for requirements analyses for Requirement analysis and negotiations". Further author identified practices like "model system environment", "Use structured methods for system modelling" for system modelling during RE. Practices for RE management like "define policies for requirement change management", "identify volatile requirements", "recording of the rejected requirements" are also identified by the author. Miguel Romero [10] discuss some of the practices for successful requirement elicitation such as the skills required for requirement elicitation in GSD are "English language skills", "virtual team skills", "computer mediated communication skills", "teamwork skills". Similarly knowledge and skills are required for requirement specification like "knowledge of the requirement attributes", "writing a draft of system definition document" etc. some practices for fundamental software requirements are also identified like "to know about different types of requirements and non-functional requirements also", "to analyse the requirements syntax", "knowledge of system requirements specification", "knowledge of the specification knowledge". Jyoti M.Bhat [11] in his paper identified some practices to achieve the strategic success factors. "Develop stakeholder viewpoint", "build the team vision collaboratively", "use a human facilitator in integrated", "rich communication media during decision making" are some of the practices for shared goals. For shared culture some practices like "provide culture training to team members", "train team members on using communication technology", "share requirements specification templates", "establish technology accessibility and compatibility for all team" are identified.

For trust building factor the practices like "build team vision collaboratively", 'get team together at the formation stage for a face to face kick-off session' are identified. Micheal Geisser [12] discuss some of the practices for requirement specification and quality of SRS like "correctness", "unambiguousness", "completeness", "consistency", "prioritization and stability ranking", "verifiability", "modifiability" in his paper.

Although from literature review, we identified some practices from the work of several authors but still we need SLR to identify from all possible literature best practices for the stated success factors discussed in section 3 below.

Previously we conducted SLR and identified success factors as shown in table 1. The factors were analyzed on different research methods, time period, software company size and continents [8]. Finding these success factors are the base for our current research work.

Table 1: success factor identified through SLR

S-no	Success factor	Occurrence
1	Effective and strong communication system	81%
2	3C (coordination, cooperation and collaboration)	68%
3	Using collaborative tools	58%
4	Knowledge Management and sharing	53%
5	Effective management	51%
6	RE modelling	50%
7	Proper discussion on requirements	45%
8	Software engineering process maturity	38%
9	Mutual Trust	30%
10	Requirement change management	30%
11	Training sessions	25%
12	Organizational proximity	17%
13	Use of new technologies	24%
14	Social networking	1%
15	Infrastructure and organizational setup	5%

3. RESEARCH METHOD

For the identification of practices for proper implementation of Critical Success Factors (CSFs), we used Systematic Literature Review (SLR) process. A similar approach has also been used by other researchers [13][14], we also studied these approaches. Figure 1 shows step by step design of research methodology. In first phase of SLR, research questions are finalized. In the second phase literature review will be conducted. The selection of relevant literature is selected on the bases of title and abstract in the third phase. In the fourth phase data are extracted from the relevant papers and also we synthesis these data into different categories. Finally, we classify these categories and identify practices for RE in GSD.

In order to identify RE practices for proper implementation of various CSFs in GSD, we have formulated the following research question (RQ1).

RQ1. What are the solutions/practices, as identified in the literature for proper implementation of success factors for RE in the context of GSD?

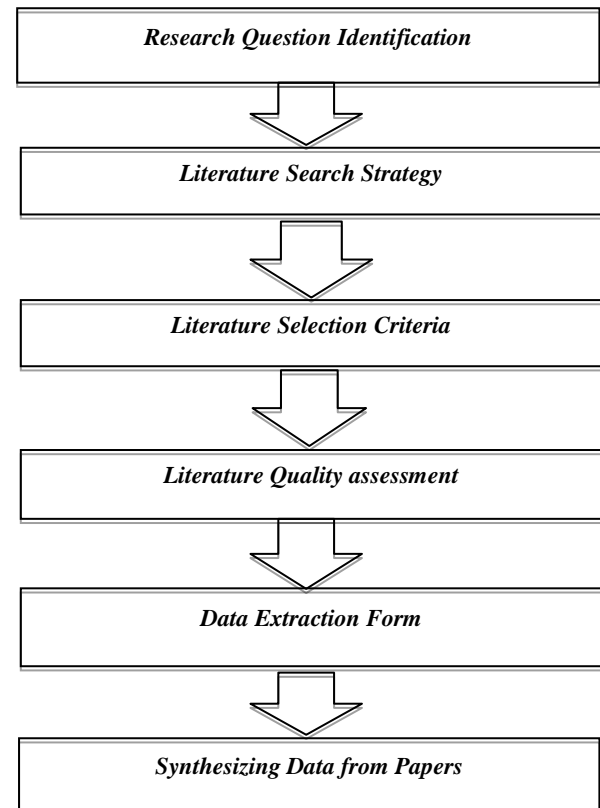


Fig.1 Development process for the SLR Protocol

3.1. SEARCH STRATEGY

Search strategy include the following phases;

- Range of search (time and space)
- Method for searching
- Electronic data sources used
- Strings for the search
- Validation of search
- Documentation of the search
- Management of search result

3.1.1. Range of search (time and space)

Refer to research questions we will search for all published literature with no bound and limit on any time (years).

3.1.2. Method for searching

A manual search was conducted for the determination of resources to be searched. We used the below resources for searching.

3.1.3. Electronic data sources used

The following digital resources are used for papers extraction

- Google scholar
- Science Direct
- Springer link
- Acn portal
- IEEE Xplore

3.1.4. Strings for the search

The following search string is used as a trial Search.

((Solutions OR practices OR "best practice" OR "lessons learned" OR Advice) AND ("Requirement Engineering" OR "Requirement Implementation" OR "Requirement Elicitation") AND ("Global Software development" OR "Distributed Software Development" OR "Software outsourcing"))

3.1.5. Documentation of the search

Proper documentation of search results is necessary, and the following data will be listed:

- Database name
- Strategy for the search

- Phase of the search
- Search date
- No of publications found
- No of publication chosen
- Decision of introductory chosen
- Decision of final chosen

3.2. Selection of Publication

Selection process consist of following.

- Inclusion Criteria
- Removing Criteria
- Determination of Publication Quality

3.2.1. Inclusion Criteria

Entry criteria will be used to limit the number of papers which are retrieved by applying search strings and which are included for final data selection. The following are some inclusion criteria

- Papers written in English only are acceptable
- Papers which are related to RE in GSD only
- Papers which discuss the challenges only during requirement implementation in GSD.
- Studies that are related to RE only but they are fitted in GSD also.

3.2.2. Exclusion criteria

On the basis of removing criteria we decide which paper will be removed from the final list. The following are some exclusion criteria on base of which we will exclude papers from selected ones

- Studies which are not related to our Research questions
- Studies that do not discuss RE in GSD
- Studies that do not discuss challenges during RE in GSD.
- Papers belong to GSD but they don't discuss RE
- Papers that discuss RE but don't fit in GSD.

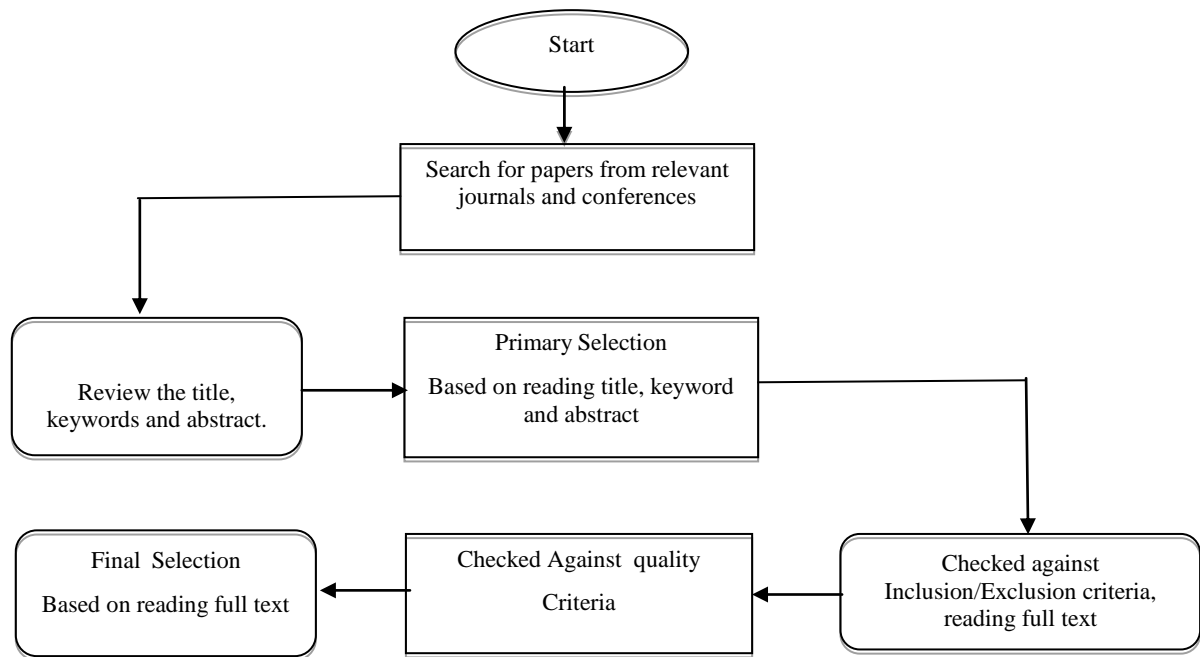


Fig. 2 Publication Selection process

3.2.3. Exclusion criteria

On the basis of exclusion criteria, papers that are not to be included will be decided. The following are some exclusion criteria defined for this study.

- Studies which are not related to our Research questions
- Studies that do not discuss RE in GSD
- Studies that do not discuss challenges during RE in GSD.
- Papers belong to GSD but they don't discuss RE
- Papers that discuss RE but don't fit in GSD.

3.3. Strategy of Data Extraction

3.3.1. Primary Study Data

The data Extracted from publications will contain the following.

- Publication detail (Title, Authors, Reference)
- Data related to research questions

3.3.2. Data Extraction Process

One person will do the extraction for review. Secondary person can provide the guidance if he find problems in data extraction.

3.4. Data synthesis

The extracted data as a result of SLR will be extracted which give answers of the research questions .The following data will be synthesizes.

- Date of review
- Publication details (Title, Authors, Reference)
- Sample Population
- Company size (small, medium, large)
- Location of the Analysis (continent)
- Publication year
- challenges in requirement implementation in GSD
- Publication Quality Description

Table 2 Study sources and results found

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

4. RESULTS

In this section, which is organized by the themes and sub-themes identified in the research, results related to our research questions are reported. Table 2 lists the results after applying and executing SLR protocol. Only 30 papers out of 1510 qualify the inclusion/ exclusion criteria. Finally the duplication was removed by excluded 10 papers from the final list of papers which were repeated across different digital library and the resulted final list of 30 papers are shown in appendix.

5. CONCLUSION AND FUTURE WORK

SLR protocol were developed and applied and as result 30 papers are retrieved from different digital libraries. In future, best practices for implementing success factors during successful requirement engineering process in GSD will be retrieved from final list of papers. Questionnaire survey will be conducted for the validation of the identified practices in GSD.

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