

# Critical Challenges for Requirement Implementation in Global Software Development: A Systematic Literature Review Protocol with Preliminary Results

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## ABSTRACT

**Context:** Successful requirement engineering (RE) leads to successful delivery of software. There exist a lot of challenges during RE process especially in Global Software Development (GSD). The aim of this study is to find challenges during RE in context of GSD.

**Objective:** The objective is to find and analyze the challenges in RE process.

**Method:** Systematic Literature Review (SLR) is used as research method to achieve the goals.

**Result:** SLR protocol is developed. Expected output of this study is to list out all challenges which the stakeholders are facing in implementing RE in the context of GSD through SLR. As a result of SLR protocol, 71 papers are identified.

## Keywords

Systematic Literature Review; Requirement engineering; Requirement Implementation; Global Software Development; Systematic Literature Review Protocol.

## 1. INTRODUCTION

RE is a systematic way of collecting requirements from user in a proper way by applying various elicitation techniques [1, 2]. RE consist of four phases [17]. Requirement elicitation is the first phase in which we collect requirements from users, requirement analysis phase is the second phase in which user requirements are analyzed, In specification phase, final list of functional requirements are specified in document known as SRS. In validation phase, requirements are validated against SRS. The quality of final deliver software is totally depended on proper requirement implementation [3][18]. The more errors and bugs remain in this phase, the more is the chances of failure of the software and the more it is expensive to fix it latterly on [3]. RE needs more attention and much effort is required. The RE is difficult when implemented it locally but in case of GSD the case is worst because there exists some challenges like culture difference, physical and geographical change, language and terminology difference, lack of face to face conversation and time zone difference [3-5]. Their exists communication and coordination problems during requirement elicitation in GSD [6]. To overcome the challenges, some practices and success factors are Needed [7][19]. We need to address these challenges systematically and should analyze these challenges through company size, different continents, decade and experimental methodologies. Our objective is to find critical challenges in path of RE process in GSD through SLR. SLR protocol is developed and discussed here in detail. After protocol development and SLR process will be conducted.

## 2. BACKGROUND STUDY

According to Yvonne Hsieh [3] culture diversity causes coordination problems and is a big challenge because people belongs to different cultures and have different explanations and translation of requirements. Coordination and collaboration is a big success factor in GSD. According to Daniela Damian [4] the cause of improper conversation is due to time difference because most of the time if there is a night in one country the other country has day so difficult to communicate. According to Paula Laurent [1] lack of an appropriate technical infrastructure prohibit inter-site collaboration. Face to face communication is the best way to resolve issues and misunderstandings but in GSD the big challenge is that teams are physically separated. According to Vibha Sinha [8] requirement change management is very difficult because it needs proper negotiations and discussion which is difficult without face to face meeting. Common understanding of requirements requires integration with communicating environment. According to Barkha Javed [9] knowledge sharing is big problem during RE process due to culture diversity and terminology difference and there is a lack of proper and effective communication due to which knowledge management also becomes difficult. Paolo Tell [10] also discuss the issues arises due to lack of communication which cause improper negotiations in time. According to Daniela E. Damian [11] building trust in GSD is very difficult because there are some factors which are necessary for trust building like face to face meeting and proper discussions but due to distance and culture diversity building trust becomes challenge. Coordination and collaboration is also a big source of trust building. The author says that language and terminology difference is a big challenge and it affects requirement elicitation process because this phase of RE process requires direct communication with clients to gather requirements and transfer knowledge and this factor causes difficulty. According to Nosheen Sabahat [12] proper global project management is necessary to tackle all the challenges and to bring coordination among the team members. Brian Berenbach [13] also discusses the importance of role of project management in GSD and according to him one of the observed issue was lack of effective leadership. According to S. Arun Kumar [14] requirement management is a big challenge in GSD and it needs change management frameworks and models which can solve these problems. The author discusses the challenges which arise due to low involvement of customers in GSD.

S. Sakthivel [15] says that experience with new technologies and the complexities arises from technologies are considered as barrier in path of negotiations and discussing requirements.

The author further says that cost of infrastructure is also an issue for client's side mostly to discuss the requirements. Besides understanding and selection of proper RE process is not easy task so it needs to focus more.

### 3. RESEARCH METHOD

SLR is different from ordinary literature review as it is more planned and methodically executed because in ordinary literature review we randomly search publications without following any systematic and planned procedure. Figure 1 shows step by step execution of research methodology. Other authors also used the same method [16] [20] [21].

#### 3.1. SLR Protocol Developments

Before conducting the systematic review, review protocol was developed. A pre-defined protocol increases the hardship and iteration of the review. Procedures and review plan is specified through SLR. The various stages of SLR process are aim and need, research questions, search string, involvement and removing criteria, form of data extraction and arrange data from papers. Fig1 shows SLR protocol developments stages.

#### 3.2. Research Questions

The following 5 questions were arises while conducting SLR.

RQ1. What are the challenges, as discussed in the literature, elaborated from software vendor's view in implementing requirements engineering processes throughout organizations in context GSD?Based on objective and the above Research Question some further questions arises like

RQ2. Is there any relationship between these challenges and size of organization in GSD?

RQ3.How these challenges vary from continent to continent in GSD?

RQ4.How these challenges are related to different research methods in GSD?

RQ5.What is the impact of changing period on these factors in GSD?

We will make search string for the RQ1 only, papers selected based on RQ1 will be analyzed for answering the rest of questions.

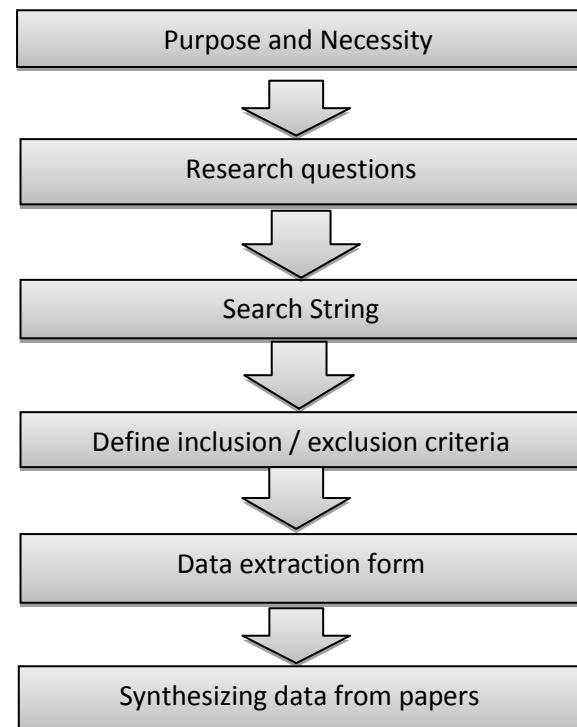


Fig 1.Development process for the SLR Protocol

#### 3.3. Making of Search Terms

The following factors should be consider while conducting SLR.

1. **People:** Clients and Vendors included in GSD
2. **Interference:** challenges in requirement implementation.
3. **Outcomes of relevance:** Better implementation of RE in GSD.

Research questions contain the following above information's.

RQ1. [What are the challenges, as discussed in the literature] "**Interference**", elaborated from software vendor's view in [implementing requirements engineering] "**Outcome**" processes throughout organizations in context [GSD] "**People**". ?

#### 3.4. Search Strategy

It include the following sections.

- 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

### 3.4.1. 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).

### 3.4.2. Method for searching

There are two search method automatic searches or manual search. Search string is executed on search engines of electronic data sources in automatic searching while in manual searching search is done by browsing through specific journals or conference proceedings.

### 3.4.3. Electronic data sources used

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

### 3.4.4. Strings for the search

Search string is split into three types of sub search strings.

- Preliminary search string: This will be initial string which will help in preliminary search.
- Big search string: Using Boolean operators and by combination of major terms and its equivalents we can obtain this string.
- Smaller sub search string: As some of libraries do not get long string so we will divide it into smaller strings and will do the independent search for each string

### 3.4.5. Search terms identification

The below steps (strategy for searching) are used for making of search terms.

**Step1:** Major terms derivation: For the derivation of major terms use the research questions, by identifying people, medium and outcome.

**Step2:** Find the substitute spellings and synonyms for these major terms

**Step3:** Find out the key words in any related paper;

**Step4:** Use Boolean Operators for combination if the library allows. Use “OR” in case of substitute spellings and synonyms and use “AND” in case of combination of major terms.

### 3.4.6. 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
- 

## 3.5. Selection of publications

Fig 2 shows the detail of publication selection process.

- Involvement Criteria
- Removing Criteria
- Determination of Publication Quality

### 3.5.1. 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.

### 3.5.2. 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.

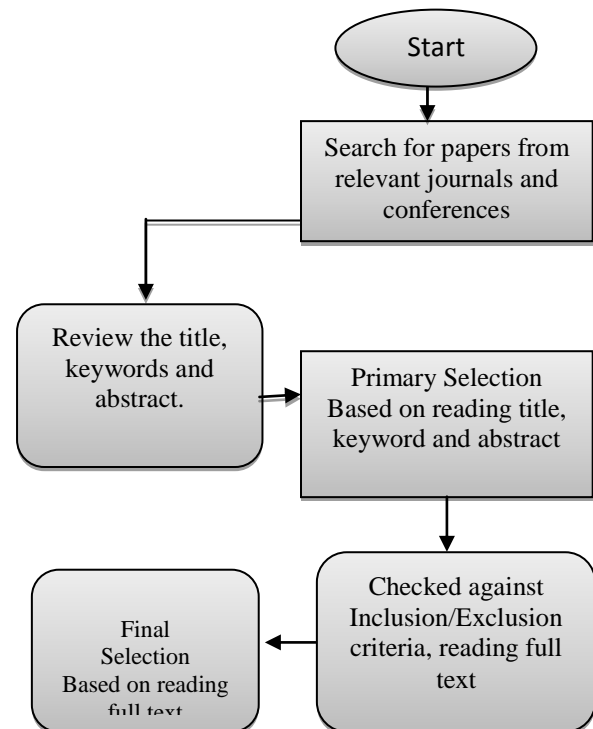


Figure 2. Publication Selection process

### 3.6. Strategy of data extraction

Data extraction consist of the following section.

#### 3.6.1. Primary study data

The data Extracted from publications will contain the following.

#### 3.6.2. Data extraction process

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

#### 3.6.3. Data synthesis

We will synthesize the extracted data in SLR 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

## 4. RESULTS

Total of 71 papers were selected after applying inclusion and exclusion criteria as discussed. The SLR protocol was executed as planned. All papers are mention in appendix list below.

**Table 1: final selected papers**

Resource	Total Results	Primary selection	Final selection
IEEE explore	1139	60	36
ACM	1200	15	07
Science Direct	2735	23	06
Springer Link	500	18	06
Others	2500	55	16
Total	8074	171	71

## 5. CONCLUSION

SLR protocol were developed and discussed in detail. The next step will be to apply this protocol and do SLR process. After SLR we will identify list of challenges and will mark some factors as more critical and will make analysis of the factors. In future we will find practices needed to implement RE in GSD successfully. The end goal is to make Requirement implementation model which will address the challenges and its solutions and practices in the context of GSD.

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