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An Improved Framework for Requirement Implementation in the context of Global Software Development: A Systematic Literature Review Protocol

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Abstract

Context: Global Software Development (GSD) is the software development across the globe in which stakeholders are related to different countries and cultures, and they communicate each other by emails, fax, mobile, videoconferencing or any other communicating media. There are a lot of problems in implementing requirement engineering process for global software development. There is a need of requirement implementation model which guides us how to implement successfully requirement engineering in the context of GSD.

Objective: To Find Critical Success factors (CSF) and challenges in requirement implementation in the context of GSD through Systematic literature Review (SLR), and to find the practices for the proper implementation CSF and challenges as proposed by Requirement Implementation Model (RIM).

Method: - SLR is the methodology used to fulfill the objectives of this research.

Expected Outcomes: - SLR protocol is developed for RIM. Expected output of this study is to list out all the factors and challenge which the stakeholders are facing in implementing requirement in the context of GSD through SLR.

Keywords*: Requirement Engineering, Requirement Implementation, Systematic Literature Review Protocol*

1. Introduction

Requirements Engineering (RE) is a branch of software engineering which shows needs of stakeholders which are fulfilled by the software[1]. Requirements are prerequisites which should be explore before developing the product [2]. RE is the first stage of the software development life cycle (SDLC) that desires to capture, analysis, specify, validate and document stakeholders needs [3]. RE is a crucial activity because an inaccurate or wrong requirement can lead to a more costly software development than the original estimation, or lead to a dissatisfaction of the customer/end-user [4]. RE gains and developing user requirements and provide as the base for the whole project [5]. Requirement implementation (RI) is not easy especially when we talk about global software development. GSD is the software development across the globe in which stakeholders belongs to different countries and cultures, and they communicate each other by emails, fax, mobile, videoconferencing or any other communicating media. GSD is becoming an encouraging methodology which is building quality software at a low cost and short time-to-market [6]. Throughout the world GSD is gaining the more interest of the software industry [7]. Requirements elicitation is the most concerned and difficult phase of GSD [5]. RE is not only difficult when it is done locally but it is more difficult

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when it is done globally [8]. GSD gained strength as it acknowledge amazing advantages [9], however, it also invited attention due to the complexity and challenges related.

2. Background Study

Daniel Méndez Fernández [10] point out that still knowledge of grounded empirical investigations is missing in RE process. Research objective of this paper is to find empirical findings which will help how to solve practical problems.Niazi[11] in his paper work for the improvement of RE process by finding the demanding success elements. According to Niazi et al [6] there is a growing interest in GSD for software development companies. In addition to the challenges that are related to the GSD business nature and cultural differences, there are other challenges associated with the tools used in GSD. These challenges range from unsuitable or missing features in these tools to the non-existence of tools in some GSD areas. There are other challenges related to the cultural and time zones difference issues. In addition, the existing tools are neither comprehensive nor compatible with each other to allow tools integration. Asma Batool [12] in his paper gives concept of scrum framework which extend the concept of traditional requirement engineering to agile method. Scrum is an agile method and by apply this method will helps us to better elicitate, analyze and specify and implement requirements. Nasir Mehmood Minhas[7] presents an enhanced framework and the objective is to manage change in the requirement specially in global software development . Neetu Kumari.S [13] in his paper discusses the current trend in the key elicitation issues and challenges in GSD projects. The author says parameters like quality, cost of rework is dependent on how well the requirements are elicitated, the current research by this author points out that there are a lot of problems in effective elicitation of requirements and there is a need of proper attention to that. Daniela E. Damian [8] in his paper points out the challenges faces by multi-site organizations in implementing requirement engineering. The research focus is on distance in this paper that how it effect the requirement engineering process. Check land's [14] soft system methodology (SSM) was conducted for his work. "SSM provided a powerful mechanism that considered the wider organizational context in identifying the requirements negotiation space in studies of distributed requirements engineering" [15]. Miguel Romero [16] in his paper focuses on the importance of knowledge and skills in requirement elicitation and introduce a simulator surrounding to advance experience that are fit in GSD requirement elicitation for engineers in which students (do the act and appearance of requirement engineer) collaborate with different stakeholders. Muhammad Asim[17] Noor examined 108 software development outsourcing experts the purpose of which was to enhance the RE process for outsourced software development projects.
Gabriela N. Aranda[18] in his paper propose a framework for requirement elicitation which focus on problem predictions and propose different strategies which decrease the effects of these problems and improve the performance of projects in the context of GSD. The strategies focus both on the environment in which the elicitation takes place and also on the stakeholder cognitive selection of technology selection. Wesley James Lloyd [19] in his paper suggests that success factor of effective requirement implementation is when the stakeholder, in this case a customer regularly participate in synchronous activities of requirement process. Azeem Ahmad [1] in his paper addresses the importance of requirements prioritization and its effect on product. The author conducts two experiments to analyze the Requirements Prioritization effects. Catherine Lowry Campbell [20] in his paper points out that the big success factor is face to face communication as lot of problems and conflicts are solved in this type of elicitation.in this paper the importance of negotiations and discussion is addressed as a lot of conflicts solve as a result of effective negotiation. Daniela Damian [21] says by working in new methodologies for requirement implementation like agile process distributed teams will need more awareness structures. Yvonne Hsieh [22] says cultural diversity and

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geographical change is a big challenge .Further the author says there is a need of shared mental models through which coordination of team is achieved. There is a need of coordination which reflects social and behavioral characteristics. Need of practices along with knowledge is must.

3. Aims and Objectives

Our main purpose is to point out all the factors and challenges which the stakeholders are facing in implementing requirement engineering in the context of global software development through SLR and to propose a model based
Aim of my research is development of RIM (Requirement Implementation Model), in requirement engineering from vendor's perspective in the context of GSD.
We plan to achieve this aim using the following mile stone.
1. To Find Critical Success factors and challenges in requirement implementation in the context of GSD through Systematic literature review.
2. To find the practices for the CSF and challenges in order to implement them through questionnaires survey.
3. To give a propose structure of RIM.

4. Research Method

Systematic Literature Review (SLR) will be our methodology[23]

4.1 Systematic Literature Review (SLR) Process

According to Kitchenham [24] SLR is divided into 3 main stages. These are planning the review, conducting the review and conducting a review.

4.2. SLR Protocol Developments

Before conducting the systematic review, review protocol was developed. A pre-defined protocol increases the hardship and iteration of the review [24-27]. Procedures and review plan is specified through SLR. The various stages of SLR process are aim and need, research questions, search string, involrment and removing criteria, form of data extraction and arrange data from papers.

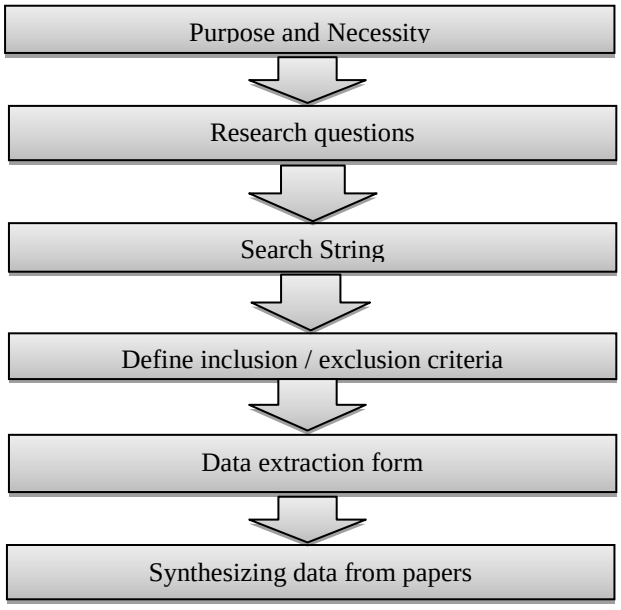

Figure 1. Development Process for the SLR Protocol

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4.3. Research Question

As we are aware of the fact that how much importance of requirement implementation in GSD is, yet no SLR is done on requirement implementation practice in GSD context and the description of factors that have a considerable impact on vendors. Now we have the following research questions.

RQ1.What are the critical success factors, as discussed in the literature, to be developed by software development vendor organizations which support them in implementing requirements engineering processes throughout the organizations in context GSD.
RQ2**.**What are the challenges, as discussed in the literature, elaborated from software vendors view in implementing requirements engineering processes throughout organizations in context GSD.

4.4. RIM model development stages

Five stages will be used to design this model as shown in Figure 1.

1) Mention criteria for RIM model
2) Collection of data and its analysis
3) Rationalization and structuring of results
4) RIM model development
5) Case studies to evaluate RIM model

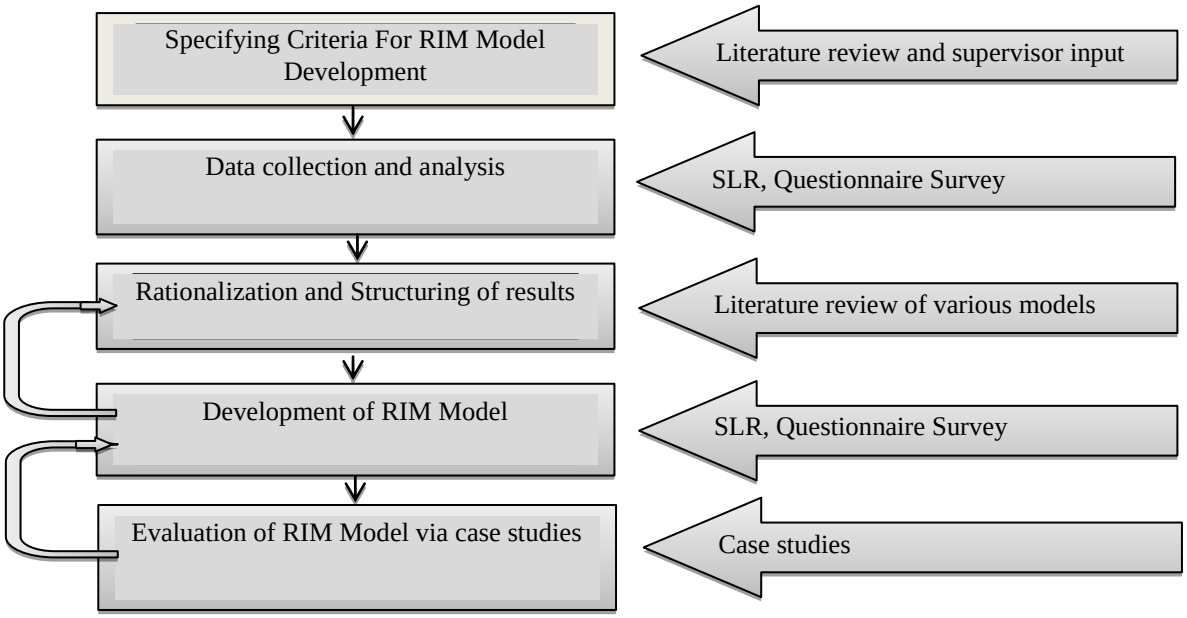

Figure 2. RIM Development Stages

4.5. Making of Search Terms

In construction of search string for discussing the factors as mentioned in the research questions, the following categories will be included.
People: Clients and Vendors included in GSD.
Interference: Factors, Challenges in requirement implementation.
Outcomes of relevance: Better implementation of software requirement in GSD.

5. Search Procedure and Plan.

We discuss strategy for searching from the following aspects

- Range of search (time and space)
- Method for searching

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- Electronic data sources used
- Strings for the search
- Validation of search
- Documentation of the search
- Management of search result

5.1. 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).

5.2. 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.

5.3. Electronic data sources used.

1. Google scholar
2. Science Direct
3. Springer link
4. Acm portal
5. IEEE Xplore

5.4. Strings for the search

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

A. Preliminary search string: This will be initial string which will help in preliminary search.

B. **Big search string:** Using Boolean operators and by combination of major terms and its equivalents we can obtain this string.

C. 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.

5.4.1. Trial Search

Using search string we carried out following preliminary search on Science Direct digital library. (Requirement implementation OR "Requirement engineering") AND ("Global Software Development" OR "Distributed software development" OR "Offshoring").

5.4.2 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.

RQ1: ((Requirement engineering OR requirement elicitation OR requirement analysis OR requirement specification OR requirement gathering OR requirement achieving OR requirement execution) AND (factors OR elements OR parameters OR characteristics OR drivers) AND (Global software development OR GSD OR distributed software development OR international software development OR multisite software development OR offshoring) AND (vendors OR "service-provider" OR developer)).

RQ2: ((Requirement elicitation OR Requirement engineering OR requirement analysis OR requirement specification OR requirement_gathering) AND (risks OR barriers OR challenges OR "Negative impacts" OR obstacles OR hurdles) AND (Global software development OR GSD OR distributed software development OR international software

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development OR multisite software development OR offshoring) AND (vendors OR "service-provider" OR developer)).

5.4.3. Breakup of Search Term
In the search term we will use the search strings RQ1 AND RQ2. We will break the search term into smaller sub strings as some of the databases (i.e. Google Scholar and Springer Link) do not take the long search strings and will do divided search for each of these search strings.

5.5 Validation of search
By giving the following search terms only few papers found initially (Requirement engineering OR requirement elicitation AND ("Software outsourcing" OR "distributed software development") AND (factors OR drivers OR motivators) AND (Global software development OR GSD) AND (vendors) using Google Scholar, Springer Link and Science Direct.

5.6. 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

6. Selection of Publication

- Involvement Criteria
- Removing Criteria
- Determination of Publication Quality

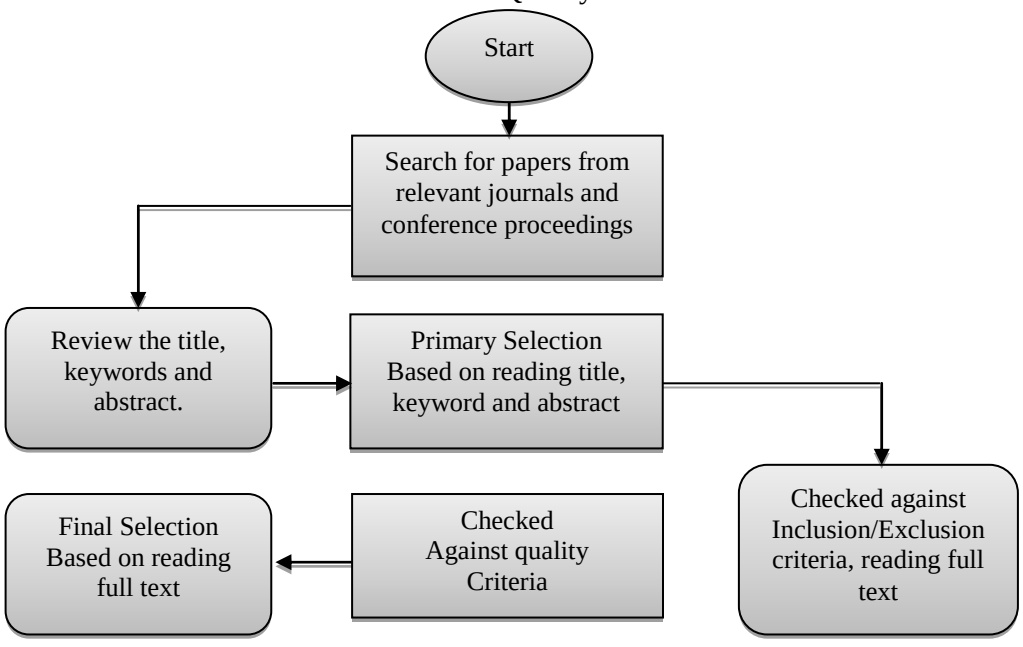

Figure 3. Publication Selection Process

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6.1 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.

6.2 Exclusion criteria: On the basis of removing criteria we decide which paper will be removed from the final list. Detail of the involvement and removing criteria is shown in table1.those papers will be removed which have no relevance to the topic.

Inclusion Criteria	
S.N	**Criteria**
1	Studies that are reported in English language only.
2	Studies that discuss factors/motivators for software requirement implementation in GSD.
3	Studies that discuss factors/motivators for software requirement process in GSD.
4	Studies that discuss criteria for a successful software requirement implementation.
5	Studies that discuss software requirement engineering process in GSD.
6	Studies that discuss issues in software requirement implementation in GSD.
7	Studies that evaluate vendor's capabilities for requirement implementation in GSD.
8	Studies that describe challenges in requirement implementation in GSD.
Exclusion Criteria	
1	Studies those are not related to the research questions.
2	Studies that do discuss risks in requirement implementation in GSD not.
3	Studies that do not discuss the elements that requirement implementation process improvement in context of GSD.
4	Studies that do not discuss requirement engineering process in GSD.

6.3. Publication Quality Assessment
Quality measurement of the final selected papers will be done on the basis of following criteria as shown in the table below.

Criteria	**Notes**
Is it clear how the factors for requirement implementation between clients and vendors were identified?	Yes =1, No =0 Partially=2,NA=3
Is the author seems biased to publish positive results more than negative results?	Yes =1, No =0 Partially=2,NA=3
Is it clear how the challenges in requirement implementation were identified in GSD?	Yes =1, No =0 Partially=2,NA=3=0

Each of the above factors will be marked as "YES", "NO", "Partially" or "N.A". A secondary reviewer will score a small subset for validation.

7. Strategy of data extraction

7.1 Primary Study Data: The data Extracted from publications will contain the following. Figure 4 shows the data extraction process.

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

7.2 Data Extraction Process: one person will do the extraction for review. Secondary person can provide the guidance if he find problems in data extraction

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7.3 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), Database, Methodology (interview, case study, report, survey etc.), Sample Population, Target Population, Publication Quality Description, Organization Type (software house, university, research institute etc.), Company size (small, medium, large), SPI Certification, location of the Analysis, Year, CSFs and challenges in requirement implementation in GSD.

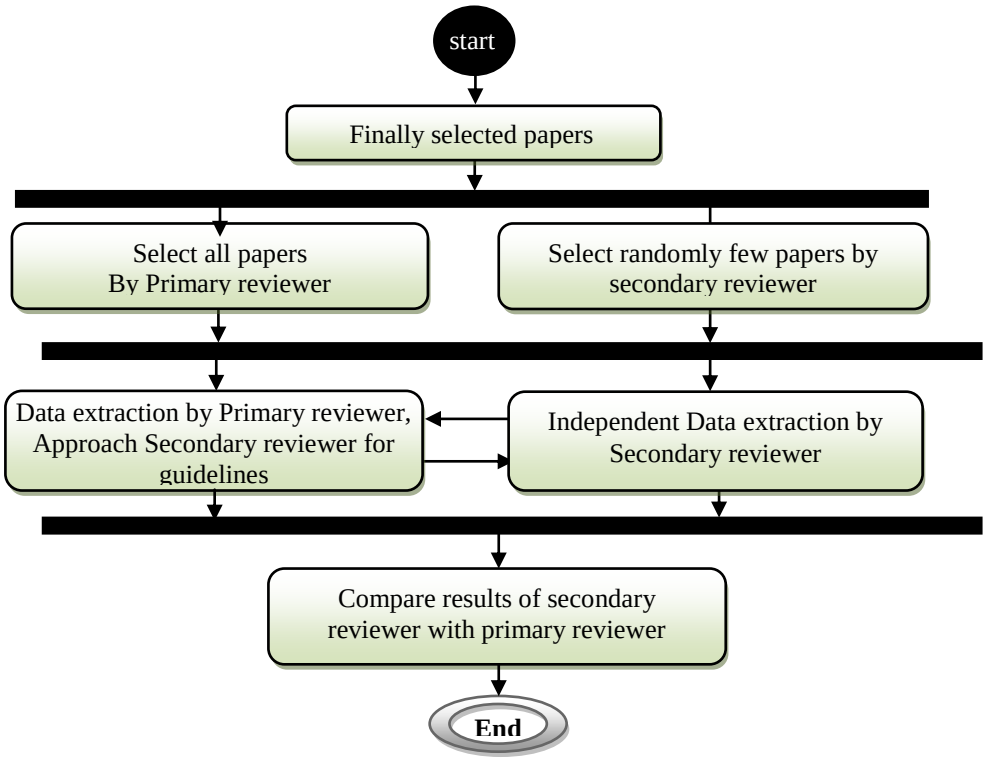

Figure 4. Data Extraction Process

8. Protocol validation

A first version of protocol was submitted to my supervisor Dr. samad baseer for review who suggested some modifications. It was further analyzed by my colleague Sikandar Ali.

9. Conclusion and Future work

SLR protocol is explained in this paper for showing the factors and challenges in requirement implementation in GSD. The final goal is the development of Requirement Implementation Model (RIM) and regarding this SLR is the first step of RIM development. RIM will address critical challenges and success factors GSD faces during requirement implementation. The model will also address practices and solutions for proper implementing the factors. The complete structure of this model is already presented in ICICT[28]. In future questionnaire survey will be conducted for the validation of the factors and case study will be used for the evaluation of the model. This model will be used as tool in industries to get help. Furthermore no SLR and such work is done previously in this area to address our research questions so this work will reduce much gap for researchers in future. The protocol development will help the researchers for doing systematic review in better way than previously done.

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