

Exploration Of Requirement Engineering Problems

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Abstract: Requirement engineering or requirement analysis is the branch of software engineering focusing about the real-world goals- functions and checks on software systems. The Requirement Engineering (RE) is the most crucial stage of the Software Development Life Cycle (SDLC). This stage is used to translate the incorrect, incomplete and inconsistent needs of the capable users of software into complete, accurate and consistent specifications. Therefore the urge of Requirement Engineering is tremendous to produce effective software in order to reduce software faults at the early stage of the development of software. A lot of analysis and research is done in order to find out relevant issues but a little focus has been done on finding out the depth and diversity of these issues. This paper tries to find out different requirement engineering issues and challenges while developing efficient software.

The findings of this research will be beneficial for other researchers who are interested in this field of requirement engineering.

Keywords: Challenges in Requirement Engineering, Changing requirements, Requirement engineering, Software development.

1. Introduction

In this competitive world, customer satisfaction is the utmost essential thing for the software industry. Customer satisfaction simply depends upon the standard of the software product to be delivered. Software industry has seen a remarkable growth in last few years and success of software projects mainly depends upon the time, budget and quality of software being produced. Most of the software project fails due to delayed, over budget, lack of requirement analysis, poor requirement quality, missing requirements, inadequate requirements validation and verification and inadequate requirements management.

Since the customer is not well known to explain 100% of what he require for the system to be developed. The urge of requirements can be generated in later stages of development. It becomes very difficult to add missing requirements as the whole systems integrity depends upon the new requirement that is being added. Sometimes

it becomes expensive too, to add missing requirements especially if they are of utmost importance [1].

Requirement engineering is the main phase in the software development lifecycle. Research studies shows that if requirements are not identified properly, it can become one of the most important source of customer dissatisfaction for delivered systems[18] and also incomplete requirements and specifications with changing requirements and specifications are the main root of system failures as reported by the Chaos Report[5] . The requirement is essential for the success of every project. Hall et al. in [2] reports that a large percentage (48%) of development problems arises due to problems with the requirements. Moreover, fixing requirements-related problems can lead to high cost of rework in later stages of development [3] [4]. The chaos report from the Standish Group [5] reports that 44 % of the projects are unsuccessful due to insufficient requirements.

This review paper aims at observing common requirement issues and challenges in requirement engineering. A lot of analysis and research is done in order to find out relevant issues but a little focus has been done on finding out the depth and diversity of these issues. This paper tries to find out different requirement engineering problems and challenges while developing efficient software.

2. Background and related work

Section 2.1 present's literature review of different authors based on our search in different publications and Section 2.2 focuses on the different challenges identified during our research in different review papers.

2.1. Background on Requirement engineering challenges

This paper shows previous research work done in order to list requirement engineering challenges. Numerous efforts have been done to in order to find the different challenges of requirement engineering. For conducting this research various databases of digital library has been reviewed- such as IEEE Explore, ACM Digital Library, Google Scholar, Springer-links, Shodhganga, Elsevier, Scopus and Science Direct. There are many research papers, articles and conference papers related to requirement challenges, but filtered only 14 papers which were found more relevant for our research.

Table 1 shows the search strategy both manual and automated searches which helps us to do the quality research.

Table 1. Search strategy

Search Strategy	
Publications	<ul style="list-style-type: none"> • International Journal of Computer Applications • Software IEEE Proceedings • Journal of Object Technology • International Journal of Software Engineering • IEEE International Conference on Computer Science and Information Technology • Requirement Engineering Journal
Search on	Abstract–Title–Keywords
Period	January 2005 to September 2019
Language	English
Digital Libraries	<ul style="list-style-type: none"> • IEEE Explore • Springer • ACM Digital Library • Science Direct • Scopus • Elsevier
Boolean operations used on search strings	AND , OR

Here we discuss different Requirement Engineering Challenges proposed by different authors. The role of the selected articles is to strengthen the further research in this field which is discussed below.

Donald Firesmith (2005). In this paper [6], the author has given a brief summary of the reasons why requirement completeness is important, also a brief look at different kinds of metadata about requirements that could possibly be missing are also presented in this paper.

Donald Firesmith (2007). This paper [7], addresses the most common requirement engineering problems, its negative consequences and also suggested solutions to avoid them. Some requirement problems addressed in this paper are poor requirements quality, inappropriate constraints, requirements not traced, missing requirements, inadequate verification of requirements quality and inadequate requirements validation.

Sohail and Mahrukh (2010). This paper [8], has highlighted requirement engineering Challenges encountered during software development. This paper also

showcases a model that includes seven major challenges that persist during requirement engineering phase.

Azlana and Shamsul (2010). In this paper [9], authors have identified list of issues identified during software project development such as Lack of RE knowledge, Lack of REP(Requirement Engineering Process) Elements, Lack of International Standard Implementation, Less Exposure on RE techniques etc. This paper identifies the strength and weakness in RE in order to reduce the gap of current requirement practice in Public Sector.

Javed, Rodina and Sabrina (2014). This paper [10], objective is to help in reducing RE issues in software development by suggesting empirical based framework that maps RE issues to relevant best practices.

Tejas and Patel (2014). In this paper [1], they tries to evaluate important issues and challenges of RE in different software development methods. Some of the significant issues identified in this paper are Enhancement in Requirement Quality, Lack of Standardized RE Activities, Assimilation of RE Models, Elicitation Technique Selection, Contradictory Viewpoints Amongst Teams(Global Software engineering), Precision and Performance Measurement of Requirements, Semi-Automatic Procedure of Generic Template Design, Collaborative RE Tool Care, Awareness of Security at RE Level and Prioritizing of Requirements.

Aquila and Sagrado (2015). This paper [15], addresses whether Bayesian network can be applied on Requirement Engineering. A systematic analysis was conducted to find the areas of enhancement of RE using BNs. This review recognized a number of major challenges such as networks validation, embedding the models formed by Computer Aided Software Engineering tools (CARE tools).

Sehrish, Asim, Shahid and Dr. Amr (2017). The intention of this paper [11], is to provide the limitations of requirement engineering phases in Agile practices and the problems and challenges that an individual face during this phase. This paper tries to find out different requirement engineering practices in agile (Prioritization of Requirements, Emergence of Requirements, Continuous planning , Requirement Analysis pairing, Prototyping etc.) and also the challenges like Direct Communication, Change Requirement, Negligence of NFR , Missing Requirements, Conflicting Requirements etc.

Schon, Winter, Escalona and Thomaschewski (2017). This paper [16], focuses on identifying the key challenges and dealing with those challenges by agile techniques and tools. This paper also focuses on future studies to find the appropriate methods to deal with the problems of agile requirement engineering.

Tawfeeq, Maria and James (2019). This paper [17], addresses the importance of cultural activities of customers in capturing their needs accurately. A systematic literature review was carried out by the help of snowballing technique to regain the information related to the cultural characteristics that inspire RE activities which will help RE practitioners to solve problems.

Research work, Author(s) and Year	Description	Limitation
Requirement Engineering Challenges in Development of Software Applications and Selection of Customer-off-the-Shelf (COTS) Components (Dr. Sohail Asghar & Mahrukh Umar, 2010)	This paper has emphasized about requirement engineering Challenges faced during software development life cycle. A framework was created to solve the issues.	There are blank spaces in framework in point of future work for unidentified glitches and challenges.
The Strength and Weakness of Requirement Engineering (RE) Process (Azlena Haron and Shamsul Sahibuddin, 2010)	This paper helped in finding the assets and flaws in RE in order to decrease the gap of current requirement practice.	Implementations of the challenges were not found.
A Framework to Resolve Requirements Engineering Issues in Software Development Outsourcing (Javed Iqbal, Rodina Ahmed & Sabrina Marczak, 2014)	A Two- Panel Delphi technique is used to develop the framework with the help of literature review, the questionnaire- based surveys and interviews.	Needs further research to resolve the challenges.
A Review of Requirement Engineering Issues and Challenges in Various Software Development Methods (Tejas shah and S V Patel,2014)	This review discovered five methods and their RE problems witnessed at industry level.	Further research is needed to discover the unidentified challenges in all software procedures and developing methodologies.
Bayesian networks for enhancement of requirements engineering; a literature review	With the help of Bayesian network, a systematic analysis was done to find out the known and unknown of requirement engineering.	More collaborative approach should be applied to achieve the goal.

(Isabel M.del Aguila, Jose del Sagrado,2016)		
Key Challenges in Agile Requirements Engineering (Eva-Maria Schon et al., 2017)	This paper addresses the most essential challenges in agile RE. An interactive expert judgement process was carried out for finding the challenges.	<ul style="list-style-type: none"> • The challenges identified were limited to agile RE. • Further investigation is needed to analyse the challenges for RE in general.
Cultural influence on requirements engineering activities: a systematic literature review and analysis (Tawfeeq et al., 2019)	In this paper, a layout is created that analyses and describes the influences of requirement engineering activities.	<ul style="list-style-type: none"> • A framework is yet to be created to solve the issues. • Validity is not approved.

Table 2. Comparison with related work

Table 2. shows the comparative analysis of the related research work which help the practitioners and researchers for further research work in this field.

2.2. Common requirement engineering challenges in software's

Different requirement engineering challenges exists while developing a software product, but through review work we come to know about some major requirement engineering challenges which every project has to go through. Even the survey done by NaPiRE (Naming the Pain in Requirement Engineering) [14] , a large scale survey project helping in Requirement Engineering problems also shows the same result which is being represented by the Figure. 1.

The survey done by NAPIRE shows that most of the projects failed during development phase because of the requirement engineering challenges.

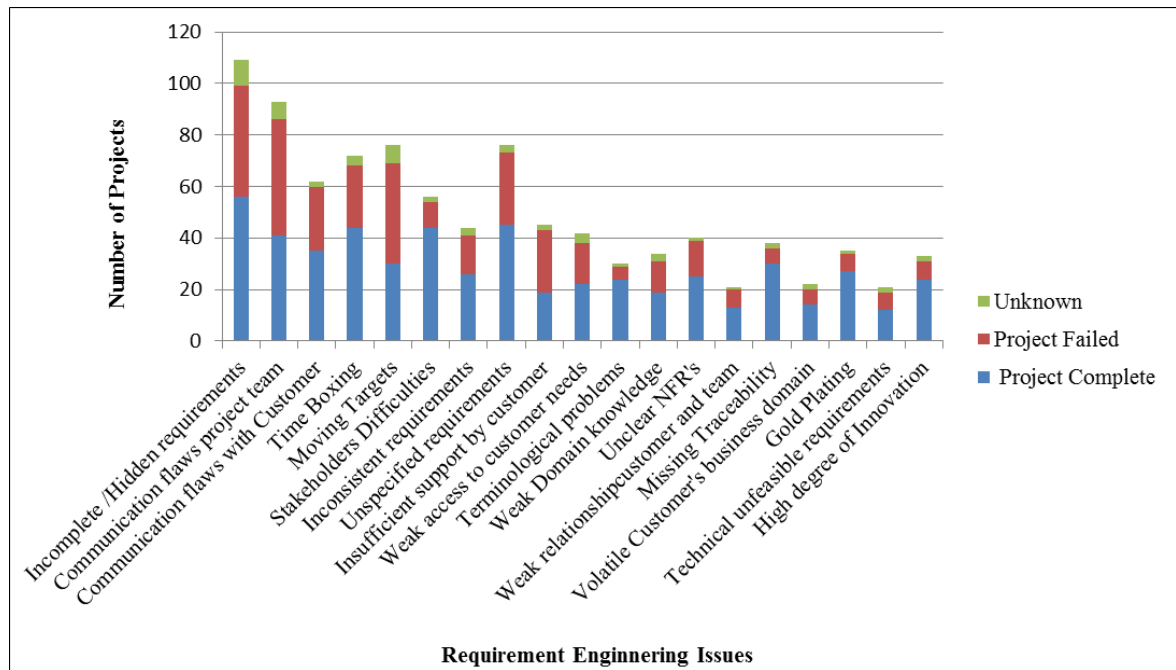


Figure 1. Common Requirement Engineering Problems

Table 3. Shows the results of survey conducted by NaPiRE, it shows the exact data about projects completed, failed and are unknown due to requirement engineering problems which are being identified during software development life cycle. This data will help the researchers to analyse the problems for their further research.

Table 3. Shows number of projects completed and failed due to Requirement Engineering Problems

Re Issues	Project Completed	Project Failed	Unknown
Incomplete /Hidden requirements	56	43	10
Communication flaws with project team	41	45	7
Communication flaws with Customer	35	25	2
Time Boxing	44	24	4
Moving Targets	30	39	7
Stakeholders Difficulties	44	10	2
Inconsistent requirements	26	15	3
Unspecified requirements	45	28	3

Insufficient support by customer	19	24	2
Weak access to customer needs	22	16	4
Terminological problems	24	5	1
Weak Domain knowledge	19	12	3
Unclear NFR's	25	14	1
Weak relationship with customer and team	13	7	1
Missing Traceability	30	6	2
Volatile Customer's business domain	14	6	2
Gold Plating	27	7	1
Technical unfeasible requirements	12	7	2
High degree of Innovation	24	7	2

Fig. 1 shows different software engineering problems which are being faced by the engineers' at different level. But we have filtered around 6 main RE problems out of 19 problems which may have rigorous effect on different software development models. The main RE issues are already discussed above which may help other researchers in their researches. Out of these Requirement engineering problems, we are going to discuss some major requirement engineering challenges which will be beneficial for further research work, which are as follows:

1. Incomplete or Hidden Requirements

This is one of the most important RE problems which are being faced by more or less by every project. Since the customer is not 100% well aware what he wants to be developed as end product, requirements can vary as required. Sometimes it becomes difficult too to find a hidden requirement which may affect the existing requirement until the system is integrated or tested [7]. Therefore, it becomes necessary for a Software engineer to focus on this for developing better software.

2. Communication Flaws

The lack of communication between the customer and the project team or within the team is one of the causes which will accelerate the problems of inconsistency, re-designing and implementation. It becomes difficult task for the development team to evaluate the problem and removes inconsistencies, conflicts and redundancy issues when the customer uses diverse terminology for defining the requirements [11] [12]. Not only this but the stakeholders' language and culture will also lead to

amplified complexity in requirement elicitation and compromise in global software development.

3. Time Boxing

Time Boxing is used as a project planning technique. Arranging time is one of the tough task and critical for software success. Generally the time required to complete the task is underestimated, but during delivery of task it gets delayed. Since engineers have to cope up and accomplish infinite tasks as a result engineers start to take short cuts or sometimes overlook the important aspects of the project. Due to which the requirements are poorly recognized or gets behind schedule. Consequently, the success of the entire software gradually goes to failure [8].

4. Inconsistent Requirements

A requirement is said to be consistent if, and only if, no subset of individual requirements described in software requirements specification conflict [13]. Many software failures originate from inconsistent requirements. Engineers have to look after the requirements whether they are consistent, as an error in requirement consistency will lead to redesigning of software requirement specification which in turn affects the success of the software.

5. Poor requirement Traceability

The tracing of the requirement is compulsory task to associate the origin of requirement to the design phase. In many projects, requirement tracing is manual procedure and representing of requirements to plan and construct is tough even with the modern tools used. The impaired requirement traceability makes it difficult to sustain proposed and actual changes [7].

6. Unclear Nonfunctional Requirements (NFR's)

The NFR includes attribute such as security, privacy, portability, scalability and many more. The different software development methods neglect the attention to the NFR's due to requirements. There is also problem of evaluating NFR's as client get very less time for providing the feedback for each release of the software [1].

3. Conclusion

This review is an attempt to study different software engineering problems in different software development method. Since manufacturing practices have fixed some issues and provided different solutions to overcome it, but still some challenges remains unsolved.

The problems which are being identified only gives an insight to the RE practitioners and researchers. Additional research work is desirable to find out the unknown challenges and possible techniques to resolve them. A framework needs to be designed which can handle major software engineering challenges which will be the part of our future research work.

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