REQUIREMENT ELICITATION ISSUES AND CHALLENGES IN PAKISTAN SOFTWARE INDUSTRY

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ABSTRACT: Requirement elicitation is the actual description of the system that the software developers follow in the earlier stages of development process. It is one of the most important and primary part in developing a new application or project. It describes what a system should do and what it is capable of doing. There are some essential requirements of a system that must be met for its correct functionality. Many software systems fail due to the wrong requirement elicitation practices or poor requirement elicitation. Without the help of elicitation it is impossible to find out the needs and the requirements of the user. In Pakistan software industry, requirement elicitation practices are not followed. In this paper, we have analysed the issues and challenges being faced by the Pakistan software industry due to the poor requirement elicitation process. The identified issues in requirement elicitation process include change of scope, volatility problem, change in user needs, understanding problem, uncertain requirements, communication problem and missing requirements.

Keywords: Software Engineering; Requirement Elicitation; Requirement Engineering; Volatility

1. Introduction. Today organizations depend on the software applications for their day to day operations. This software development is based on the requirement engineering (RE) process. Requirement elicitation is the most important phase and the initial step in RE. It helps to gather and understand the user requirements by using different techniques. It is the process in which the project manager discusses and understands the problem and application domain that how the system should be and what should be the necessary features of the system. In this process, the user expresses his problems, demands and needs.

The way by which software industries of other countries adopt the requirement engineering processes, Pakistan should also practices those processes of requirement engineering. But unfortunately a large number of software industries in Pakistan adopt these practices incompletely or wrongly. The less knowledge about processes of requirement elicitation and implementation, time and cost are the reasons for incomplete adoption of requirement elicitation practices. A lot of issues and problems can happen while practicing the requirement elicitation. The happening issues are unavailability of required information from the clients and stakeholders, management problem, poor domain knowledge, changes from clients in requirements, increase of time and cost, unreal assumptions, communication or language gap, unserious behavior of the clients, mistakes in written documents and resource shortage [1].

If the requirement elicitation process not performs correctly and efficiently then it cause of poor software requirements, budget increase, dissatisfaction of customers and users, poor quality of system and failure of software project. During the requirement elicitation if the incorrect requirements are elicited then it will affect the whole processes of software development. So to solve the occurred problems due to bad requirements latterly will lead to a high cost and time. The problems that arose during the process of requirement elicitation are misunderstanding between the customers and developers of different backgrounds, changed requirements, poor communication, badly defined scope of the system, requirement incompleteness, ambiguity in requirements, conflicts between requirements, selection of unrelated stakeholders and techniques. Conflicting requirement means that may be different stakeholders describe the different requirements in
different ways at different times. So to manage these conflicts is very tough [3].

In requirement elicitation process the communication is used between the customers and developers to get the requirement of the system. A communication take place in a specific context and this context can be defined in the four dimensions which are physical, psychological, social and temporal. The physical dimension means the physical environment in which the communication takes place and the form of the message. The social dimension describes the relation between the members and the society where the communication is going to do. The psychological dimension states the condition of friendly behavior or serious behavior of the participant. It also describes that the communication will be held in a formal or informal way. The mean of temporal dimension is that at which time the communication take place.

In the requirement elicitation process the communication activities can be divided into three phases. Knowledge gaining is the first phase that includes the idea, knowledge, experience and the technology. The second phase is of the knowledge negotiation. In that phase the negotiation is done for the information of software requirements. The last and third phase is of knowledge integration. The complete strategy for the software requirements and the information is integrated in that phase. If this communication performs in a poor way then it becomes a problem to identify and define the systems requirements of customers. [4].

In requirement elicitation process many techniques are used to collect requirements. Brainstorming, interviews and surveys, checklists, scenarios or story boards, existing system study and requirement workshops are some requirement elicitation techniques [5]. System type, stakeholder, users, clients and the environment where the system will be deployed have a great impact in selecting the requirement elicitation technique. It is very important to select the good technique for requirement gathering correctly and efficiently. Correct and efficient requirement will lead us toward the correct, efficient and successful project or system [6].

In this paper, we have analyzed the current requirement elicitation practices which are being adopted in the Pakistani software industry. We also analyze the issues and challenges being faced by the Pakistan software industry due to the poor requirement elicitation process.

2. Literature Review: Authors [1] discuss that the software development organizations use requirement engineering as the essential part of the development. In the development culture of Pakistan there is high need of requirement engineering practices to improve the software development. The size of organization, project nature, users and the resources are very important in the phase of requirement elicitation. These parameters are supposed as success factors that will help us in the future of Pakistan software industry. Stakeholders have an important role in the process of requirement elicitation [13]. Many stakeholders need to design systems from the start with multiple actors of frequent cooperation. Sometimes in a project the number of involved stakeholders is more than one so there should be proper participation of all stakeholders but some of them do not put their contribution efficiently that will lead our project to the failure.

Requirement engineers should use such requirement elicitation techniques that gather both functional and non-functional requirements of the user for a system [7]. The elicitation of non-functional and functional requirements is one of the main responsibilities of requirement engineer. A project will not be successful if it meets the functional requirements only; non-functional requirements are important too.

First phase, requirement elicitation of requirement engineering, is very critical because if the errors are present in this stage so it becomes very tough and expensive to remove or solve these errors later than any other stage [9]. The author says that the 70% errors in the system are due to the poor requirements and remaining 30% are the result of inadequate design process. Some problems related to requirement elicitation are specified here that are problem of scope, problem of understanding and problem of volatility. According to the authors, the requirement elicitation phase can be divided into the 11 stages. These stages are that the information about user requirements and expectations should be gathered, training of stakeholders, description of user requirements in written form, interviews with users and stakeholders, keywords mapping of user requirements, classification and prioritization of requirements of both user and system, requirements of the domain, prototyping, prototype checking, cost and risk analysis and complete analysis of system.

Authors [10] present some issues involved in requirement elicitation are the issue to describe the system limit, understanding between the various groups which concerns with that system and the management of changing requirements. These challenges can become a cause of many other problems like poor or bad requirement, end of system progress, ineffective and useless output of the system which can increase the maintenance cost of the system. Different steps in the requirement elicitation process are to understand the application area, stakeholder’s identification, domain knowledge, and information collection of user needs,
study of Existing documentation and expectations and the restrictions of available resources.

There are four basic categories of requirement elicitation techniques [2]. These are conversational methods, observational methods, analytical methods and synthetic methods. In the conversational method, a verbal communication takes place between the users and requirement engineers. The observational method is actually the understanding of system domain by observing the routines of people. In the analytical method, an analysis takes place of those requirements which are collected by using the above methods. Synthetic method is very important method and also called collaborative method. Instead of using different methods individually, to use the synthetic method will be a good decision that is a combination of conversations, analysis and observations. By using this method the clear requirement of the demanded system are gathered.

Requirement gathering is very important in the development of any software system [11]. If the requirement engineering practices not perform correctly and completely then there will be a huge number of errors in software system latterly. More than 50% errors in a project are due to incorrect and incomplete requirement engineering process. In requirement engineering we identify the purpose of the system by the help of user requirements which are written in a requirement specification document.

If the requirement elicitation performed in an appropriate way then the developing software industry of Pakistan can increase the revenue level [12]. Three main problems related to requirements are discussed here globally and also from the Pakistan point of view. The first problem is related to the scope. The problem of scope comes in existence when the documented requirement does not reach to the information level which is needed for the developing system. In this case some necessary information is missing; unnecessary design information is given and poorly defined the system scope. Organization, its environment and the developing product affect the requirement elicitation process.

In Pakistan software industry both the requirement analyst and the clients are confused about the developing product. The requirement analyst are not sure how the developing system will look like or how it will perform. Similarly the clients are not aware about the features what they want in the needed system. So this confusion and ambiguity in the requirements is a big problem in the software industry of Pakistan. In the process of requirement elicitation another problem is of understanding. Almost 56% errors in the system are due to the poor communication between users and analysts or misunderstanding between the statements of both. 82% staff time is required to solve such type of problems and errors. If the requirements in the phase of requirement elicitation are not understood then it can result of incomplete, inconsistent, ambiguous and incorrect requirements [12].

3. Problem Statement: Requirement elicitation is a complex process. If this process is not followed in true spirit, many problems and issues arise. While performing requirement elicitation, one has to make sure that the elicitation process is free of errors and this can be possible if some necessary techniques are to be followed. In Pakistan’s software industry, the big issue is that they do not adopt or follow the good techniques and practices of elicitation process in the phase of requirement engineering. So, there is certain need to identify these issues and challenges due to the incompliance of the requirement elicitation. And also identify the best techniques which will minimize or finish the occurrence chances of these issues and challenges.

4. Research Questions: We have tried to answer the following questions:
   - Are there any issues and challenges in the requirement elicitation process in Pakistani software houses?
   - How already purposed requirement engineering techniques can effectively be used to resolve Pakistani software industry challenges?

5. Research Objectives: The most failures in software industry of Pakistan are due to the inadequate usage of requirement elicitation process. During the phase of requirement elicitation there are some problems that we have to face. The main objective of this thesis is:
   - To discuss those problems which occur during the requirement elicitation and to analyze the major barriers and problems in requirement elicitation that hinders the success of any project in Pakistan’s software industry.
   - To study the various already existing techniques of elicitation process and then identify the best technique from them for requirement elicitation regarding to the issues and challenges.
6. **Information Collection:** The most important and difficult part of the research is to collect data and to decide the parameters that may help us to define the problems in requirement elicitation and suggest the solutions too. So we collected data from 27 different software houses of Pakistan. We mainly target the senior software engineers, php and java developers, requirement engineers, QA analysts and others.

We performed a survey for the requirement elicitation process in the Pakistan software industry. We analyze the important things that are much needed for the successful implementation of requirement elicitation process. In our questionnaire there are many such factors which greatly affect the implementation of requirement elicitation practices in the software industry. So to finalize the most important factors from all of these is a challenging task. About 72 different employees with great working experience in the software houses are the sources of our data collection. Our targeted software houses are working on different types of projects. It must be known that who is involved in the process of requirement elicitation in a software house directly or indirectly. Requirement elicitation process can be performed by one requirement engineer or by a team of requirement engineers. It depends on the size of a software house. If the size of software house is small then requirement elicitation process can be performed by one requirement engineer and so on. Figure 1 shows the percentage of the different sources from which we have collected the data. The success of requirement elicitation process also depends on the type of projects in software houses. There are different techniques used for requirements elicitation and to select the one best technique depends on the type of project. In figure 2 we define the percentage of different project of various types that are developed in the software houses from where we collect the data.

Sometimes the customers and stakeholders are not clear about their actual needs of developing a system or maybe they can't describe the requirements correctly and clearly. So in that situation, the customers and stakeholders define many unnecessary requirements which can seriously affect the developing software system. These unnecessary requirements can affect the functionality of the system very seriously. The budget and time can also overrun due to these unnecessary requirements.

![Questionnaire sources](image)

This statement is proved from the percentages in the below figure3 that are achieved from our survey. 36.1% and 54.2% people of our survey are strongly agreed and agree with it. While 8.3% and 1.4% disagree with it. So from this, we can say that the unclearness situation of customers and stakeholders about the system requirements lead to the unnecessary requirements that can affect the system greatly.
Table 1 below presents the data analysis of the responses regarding expression of system requirements.

**Table 1: System Requirements Expression**

<table>
<thead>
<tr>
<th>The customers have an idea about the desired project but they cannot express it clearly.</th>
<th>N</th>
<th>Mean</th>
<th>Sig. (2-tailed)</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72</td>
<td>1.83</td>
<td>.000</td>
<td>1.64</td>
</tr>
</tbody>
</table>
In the below figure 4, the percentages of different issues are described which are faced during the communication process while eliciting the requirements. The most serious issue in communication process is miscommunication as shown in the below figure 4. Table 2 presents the data analysis of the responses regarding misunderstanding during communication. There can be two conditions of scope problem first one is when there is too much unnecessary information or too short information about the system requirements. In scope problem the limit of the system is blurred or unnecessary design information is given.

Fig. 4. Issues in RE

Table 2: Misunderstanding in communication

<table>
<thead>
<tr>
<th>Misunderstanding is a serious issue which occurs during communication in requirement elicitation.</th>
<th>N</th>
<th>Mean</th>
<th>Sig. (2-tailed)</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72</td>
<td>1.38</td>
<td>.000</td>
<td>1.26 - 1.49</td>
</tr>
</tbody>
</table>

The scope problem occurs when both the clients and stakeholders are not sure about the system requirements or functionalities. Sometimes the users give unnecessary requirements at the start of the project because they are not sure about the features which they want to see in the system. The problem of scope also accrues at another stage when the requirements are too ambiguous and the developers are not sure how the developed system will look like. The unclear scope and ambiguous requirements affect the development of whole system badly. From the analysis of questionnaire we have seen that 73% people are agree with the statement that the big problem of requirement elicitation is the unclear system scope. Only 26.7% people disagree with it.
Table 3 presents the data analysis regarding unclear scope.

![Bar chart showing the distribution of responses to the unclear scope of the system.]

**Table 3** Unclear Scope

<table>
<thead>
<tr>
<th>Unclear scope of the system is also a problem of requirement elicitation.</th>
<th>N</th>
<th>Mean</th>
<th>Sig. (2-tailed)</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>72</td>
<td>2.01</td>
<td>.000</td>
<td>Lower: 1.79, Upper: 2.24</td>
</tr>
</tbody>
</table>

In the following figure 6, we have stated some issues of requirement elicitation in Pakistani software industry which we analyzed from our research and study.
7. **Discussion And Future Work:** Requirements elicitation is the very important phase of software requirement engineering. Like the other countries, it is very important in Pakistan software industry to adopt the practices of requirement engineering and correctly and efficiently because it is the primary step in the development of any software system. In the requirement engineering, the very basic and essential phase is of requirement elicitation. In the Pakistan software industry while eliciting the requirements then many problems are being faced. So in our survey of different software houses, we study and analyze the different techniques and problems of requirement elicitation process. We hope that study will help us to Pakistan software industry to overcome these issues and problems of requirement elicitation. We have a plan to lengthen our work in future by proposing an efficient technique by which requirement elicitation issues can be decreased in Pakistan software industry. In future we will also propose the solutions to all the identified issues of requirement elicitation.

**REFERENCES**


