EMPIRICAL EVALUATION OF REQUIREMENTS ELICITATION TECHNIQUES

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Abstract—The success of any software development cycle for producing the software product is based on the software requirements. The elicitation of requirements is the first and most important activity in the Requirement Engineering (RE). The problems in requirement elicitation process will result in poor requirements which can lead to the development of unsatisfactory software system. Moreover, the development of such unsatisfactory software system may be unacceptable to the user. The poor requirements have high maintenance costs, or undergo frequent changes. By improving requirement elicitation, the system development process can be improved, resulting in production of a much better system. Requirement engineering is a process including various activities namely requirement elicitation, analysis, specification and review/validation. This paper provides a comparative study of different requirement elicitation techniques. An empirical study in the form of questionnaires was conducted to evaluate the best requirements elicitation technique among Joint Application Design (JAD), Quality Function Deployment (QFD), Soft System Methodology (SSM) and Prototyping. After empirical analysis it can be concluded that none of the elicitation technique was judged best in comparison to other. On the basis of the finding of the study it is suggested that software developers, depending upon different parameters may select different software requirements elicitation technique.

Keywords—Requirement, JAD, QFD, SSM, Prototyping.

I. INTRODUCTION

Requirement Engineering (RE) is the first and most effective phase of software development process. In this phase the relevant and good requirements are collected from stakeholders [1]. Requirements engineering is a process containing activities namely discovering, analysing, documenting, validating and maintaining a set of requirements [2]. Requirements elicitation is the first stage of the RE process. “The success of the requirement elicitation activity has a high impact on the achievement of the goals set for RE, which leads to the development of correct software system. Hence, the development of any software is indispensable from incorporating good practices of requirements elicitation”[3].

Beichter et al. [4] in their research concluded that 70% of the system error occurs due to the inadequate system requirement specification and 30% of the system errors are due to design issue.

Virendra et al. in their paper illustrated, that Joint Application Design (JAD) can be used in the scenario where development of large computer systems is involved. The involvement of all stakeholders in the design stage of the product by means of well-structured and purposeful meetings is the major objective of JAD. Typical participants in the meeting include the end users of the product, a facilitator, main developers and observers [5].

According to Jonasson, it is the facilitator who is most important to the success of JAD sessions and customer [i.e. user] is the most important person for gathering requirements. Moreover, it is scribe who is the key to accurate documentation of everything. He also concluded that in a JAD session chaos will be created by the poor facilitators [6].

Tousif ur Rehman et al. in their paper defined JAD as a business analysis approach to solve a problem quickly and for rapid decision making, where a large number of stakeholders are engaged. JAD is a structured approach where all actions, steps and roles of participants are defined for the session. The major aim of a JAD session is to focus on the needs and desires of the business and users, but not on the technical issues [7].

Tuyet-Lan Tran et al. in their paper proposes Quality Function Deployment (QFD), as an effective tool for capturing and refinement of requirements. They concluded that, by using QFD the product quality will improve; communications between system engineers, customers, testers and programmers will improve and QFD will reduce the cost of projects [8].

Nancy Mead described QFD as a means of translating customer requirements into the appropriate technical requirements for each stage of development of product. According to author, the major focus of QFD is on the customer needs throughout all product development activities. By using QFD, organizations can reduce development time, promote teamwork, prioritize action items and can define objectives clearly [9].

Checkland [10] illustrated that Soft System Methodology (SSM) deals with problem situations in which there is a high political, social, and human activity involved. The SSM can deal with “soft problems” that are difficult to define, rather than “hard problems” that are more technology oriented. According to Franklyn Chukwunonso [11], SSM approach can structure unstructured problem situations in uncertain and dynamic environments.

According to M. Mcclendon et al. [12] prototyping is probably the most expensive method. This technique
provides the flexibility to users and stakeholders to work with an initial version of the system where the additional missing requirements are identified. Prototyping is used for elicitation where the users have no knowledge about their requirements and where early response is required from the stakeholders [13].

II. OBJECTIVES OF STUDY

The objective of this study is to have the understanding of different activities involved in requirement engineering process & requirement elicitation techniques and to compare different techniques of requirement elicitation empirically.

III. RESEARCH METHODOLOGY

To achieve the goals of this study both literature study and an experimental survey is done. The questionnaire based survey on different requirement elicitation techniques is conducted among the experienced persons who are currently involved in requirement elicitation methods in the software industry. The study is based upon approximately ninety respondents who had replied the questionnaire. The questionnaire consisted of twenty five questions.

IV. ANALYSIS

An empirical study in the form of questionnaires was conducted to evaluate the best requirement elicitation technique among JAD, QFD, SSM and Prototyping. The questionnaires were distributed among the personnel working in various software development organizations in northern region of India and basically doing requirement gathering. The filled questionnaires were received by e-mails postal services and in-person. The study is based upon 82 respondents who had replied the questionnaire. The following observations were made on the basis of responses received through the questions:

- In response to whether JAD reduces development time, a higher percentage of 82.92%, agreed in the favour of JAD, making JAD better than other requirement elicitation approaches under consideration.
- 78.04% respondents believe that Joint Application Design (JAD) improves system quality and the remaining were against the thought. Thus JAD was favoured.
- A high percentage of 75.60% believed that JAD enhances communication and relationships between business end-users and IT personnel. Hence JAD was preferred.
- On the parameter of cost, QFD was voted first 38.09% in comparison to 30.95% of JAD. Hence QFD was voted as better than any other requirements elicitation approaches under consideration as depicted in Figure 1.

- With reference to the question which requirements elicitation approach increases the revenue, the respondents preferred QFD 52.27% as shown in the Figure 2.

- The cross-functional communication is best derived from QFD as per the respondents of the questionnaires with QFD being highest at 56.09%, JAD being at 34.14% and prototyping being at 9.75%. The Figure 3 shows the QFD at the top in comparison to others requirements elicitation approaches.

- The respondents highly favoured QFD for creativity in the sense of getting multiple perspectives by examining competitor’s products as 75.60% favoured the QFD.

- In terms of design reliability JAD was most preferred as requirements elicitation approach 51.21% as Figure 4 shows the same.
SSM was highly appreciated for its ability to solve unstructured and poorly delineated system with 68.29% value. Also, SSM was preferred highly for software process improvement to an extent of 82.92%.

JAD 40.47% was closely preferred in comparison to QFD 30.95% for its ability to resolve discrepancies. The Figure 5 shows the same.

Prototyping was highly favoured for identifying misunderstanding between software developers and customers. The prototyping was voted 65.85% and SSM got a meagre vote of 7.31%. Hence prototyping was favoured.

For user interface consideration again prototyping was highly favoured up to the extent of 80.95% and SSM was not at all voted in favour.

JAD and QFD were voted the same for promoting team building as shown in Figure 6.

For the parameter of reusability, QFD 73.17% is highly favoured in comparison to other requirements elicitation approaches under consideration.

SSM is favoured 68.29% to give preferences to customer values which show that SSM is better for customer values than other approaches for requirements under consideration.

Prototyping is an ideal when it comes to feedback and it is easily possible to quickly review the software requirements specification. For feedback and refining the requirements the respondents favoured 85.36% and in case of SRS quickly reviewable it is 75.60%. Hence Prototyping is favoured for feedback purposes by the respondents.

The most likeable requirements elicitation approach was JAD 63.41%. The least liked requirements elicitation methodology was SSM 7.31% to make software requirements specification as shown in the Figure 7.

CONCLUSION

In this paper different requirement elicitation techniques were studied and compared using review of literature and experimental questionnaire based survey. The results gathered were analysed using various parameters namely development time, system quality, communication and relationships between business end-users and IT personnel, increase in revenue, cross-functional communication, creativity, design reliability, resolving discrepancies, identifying misunderstanding between software developers and customers, user interface, promoting team building and reusability. It can be suggested on the basis of findings that every elicitation technique has its own strength but, the selection of the technique is mostly dependent on the type of the application being developed.

REFERENCES


[7] Tousif ur Rehman, Muhammad Naeem Ahmed Khan,


