Involvement of Users in Software Requirement Engineering

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Abstract

User involvement is an important component in the development of effective software engineering system. This paper focuses on a study to draw the facts and to establish the involvement of users in influencing the software requirement practitioners and the system as a whole. It also analyses the effects of different characteristics of the users in the requirement process. Twenty-two software practitioners working in different software multinational companies across the world were involved in the survey. In addition to this eight software practitioners working in three companies were interviewed through internet chatting. The analysis of the results of interviews and a survey showed that requirement differs when the users are from different educational backgrounds and geographical locations. It also showed that documenting user's requirement improves the system considerably, but as the number of user requirements increase substantially, the customer-user differences also increases proportionately.

1. Introduction

The primary measure of success of a software system is the degree to which it fulfills the purpose for which it was intended. The goal of software systems Requirements Engineering (RE) is the process of identifying stakeholders and their needs, documenting, and subsequent successful implementation. Customers are often considered to be the most important stakeholders as they pay for the system [1]. The success of the system is complete only when it is implemented, accepted and used by the user. Thus user should be considered important as it is they who are the ones who finally use the system.

A number of research publications are available to prove that the user involvement is good for mature project design and implementation. But all the publications are silent about other features of user involvement. This paper tries to explore the same.

2. Related works

User involvement is important concepts where RE design teams have direct contact with potential users [2], to understand and document user requirements needs. Keil and Carmel [5] suggested that the direct contact to the users and customers helps the software practitioners to study the actual requirements that were evaluated as successful by managers. They also suggested that indirect contacts are less desirable to use because of the indirect filtering and distortions.

Literatures studies also show that the user involvement has generally positive effects on the project success and more user satisfaction. In short, user participation improves the quality of requirement engineering process in a company. However the role of the user involvement in RE needs clarification and it should not be overlooked in a system. If the users have no adequate knowledge about the system than their requirement needs, then it may lead to a mahout misunderstanding about the system as whole.

The user requirements are also seen as to describe how a product (which under consideration) can help the users to achieve their objectives. This research is to study the different features and its effects in defining user requirement in a system. All the roles and features of the user involvements are analysed from both the users with direct and indirect contacts. Results of this research are expected to provide a preliminary empirical study for developing the user involvement and the requirement elicitation practices in software projects.

3. Research method

This research work was designed as a case study to examine the effects of user requirement feature in a software system. The study was conducted in two phases: a survey and an interview. The aim of this work is to help the companies to improve their stakeholder driven requirements engineering practices.

3.1. Survey

The survey involved twenty-two senior software professionals working in different multi-national companies (such as Infosys, TCS, Ultra Soft Lock and US Technology) from India, USA and Germany. The role of the survey respondents are shown in Table 1. The companies

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participated in the survey have no separate engineers to implement RE process. The project manager or leader is usually responsible for requirement documentation. But in some case project manager will empower a senior software practitioner to implement the RE process.

Table 1 – List of Respondents

Role of the respondent	Number
Project Manger	7
Project Leader	8
Quality Assurance	2
Test Manger	1
Senior Software Engineer	4
Total	22

In order to make the survey results more reliable, the software practitioners were asked to answer questions based on the most recent project they participated in during the requirement engineering phase. This will avoid the mere opinions and generalisation of the practitioners. Moreover, the questions were carefully formulated in such a way that the information gained was as concrete and undistorted as possible.

The questionnaire consists of ten sections dealing with personal information, project information, requirement engineering process, user requirement, user involvement, customer requirement, requirement analysis, project evaluation, and requirement process evaluation. The questionnaire was formatted in *.doc format and send to software professionals via email. PDF version of the questionnaire is available here: http://www.vinuvdas.com/papers/questions/userRE.pdf

The personal information includes name of the respondent, the kind of role that he had in the project, name of the company in which he was working during the project and the geographical location of the company. The project information sections have details about the kind of project developed, size and duration of the project and whether it used any older version of the systems modules.The RE process details are collected in the third section. General involvement of user and user groups in the requirement process is also surveyed in this section.

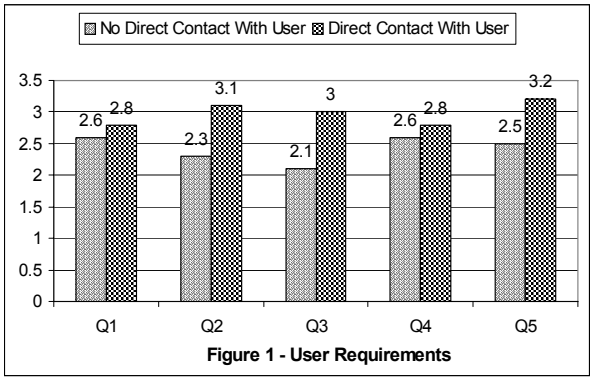

Figure 1 - User Requirements

Next six sections containing thirty-one questions are analysed using Likert Scale method. A four point scale was used, ranging from 1 (strongly disagree) to 4 (strongly agree) to evaluate the quality of the requirements such as completeness, validity, correctness and understandability of the user involvement. Besides, there was a no-opinion or do-not-know option which has no point.

The following requirement sections have thirty-one questions (numbered from Q1 to Q31). They emphasizes on general requirement needs, geographical location, age, profession, customer involvement, error factor and implementation of RE process.

The questionnaire was pre-tested by several senior software engineers before it was dispatched for the respondents. The final questionnaire was distributed to 45 selected software professionals. Twenty-two responses were received. Thus the response rate was approximately 48.89%.

3.2. Interviews

The result obtained from the survey was almost same as that of interviews. The interviews done via internet chatting, which gave a deep understanding of development projects and current state of practices to validate the survey results. As part of this research work, eight software practitioners (four senior software engineers, three project managers and one test mangers) were interviewed mainly based on the given open ended questionnaire in the survey. This is to complement the credibility of the result obtained from the survey evaluations.

The interviews were semi-structured and the discussion also came upon the topics such as stakeholder's involvement, requirement elicitation, effects of different user characteristics on their needs, problems and improvements on RE process.

The survey is validated by the guidelines given by Straub [7]. The sample data which is under consideration was relatively small and may not be representative of all development projects and companies. Thus the survey and interview do not address all the issues to provide sufficient coverage of all situations. However, this research work was

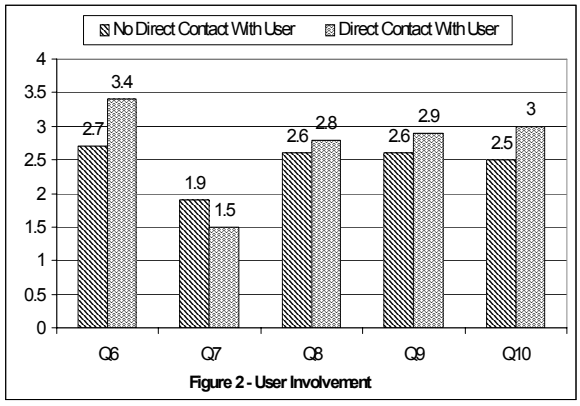

Figure 2 - User Involvement

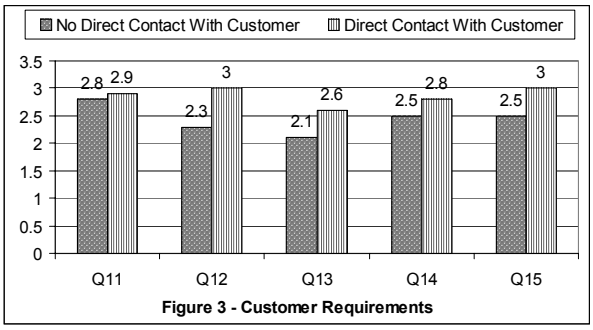

Figure 3 - Customer Requirements

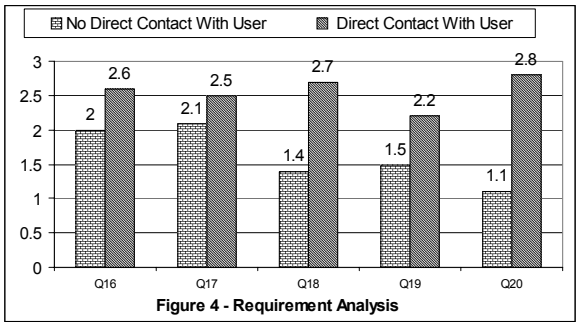

Figure 4 - Requirement Analysis

done on a sample data on typical projects and understanding the common phenomena found generally in software development phases. Thus the findings yield interesting early insights.

4. Results

The data collected from the survey is statistically analysed in two separate categories: respondent having direct contact with user on their requirement needs and respondent having no direct contact. Out of twenty-two respondents, fifteen of them have direct contact with user and seven of them do not. The results are analysed in the individuals section from Q1-Q31.

4.1. User requirement

In the survey, all the respondents agreed that they have identified the users in the documentation phase itself. All the user requirement needs are met and documented properly. Figure-1 shows the user requirement responds chart analysis. Overall mean of the points awarded by the respondents were given in the each bar diagram block.

If there is no direct contact with user then the requirement engineers may not be documenting the user needs from the user point of view. And they also agreed (3.2 point out of 4) on the user requirements being useful for better implementation of the project. The statistical analysis shows that user involvement in the requirement documentation phase is very important.

4.2. User involvement

The study shows that user needs differs when they are from different geographical places. Software practitioners strongly agree on the fact that experience, exposure to the requirement practices and other skills of the user plays an important role in documenting useful requirements. Figure 2 shows the bar diagram of the user involvement. They strongly disagree that the culture of the society has considerable important on the user's requirement.

4.3. Customer requirement

If there is no direct contact with the customer, then there is a chance for requirement engineers to leave some requirement needs undocumented. The statistical analysis in Figure 3 of the customer requirement shows that all the respondents agree on a common fact that customer involvement in the early phase of the documented is useful for the project.

4.4. Requirement analysis

The result in Figure 4 shows that, if the requirement engineers have direct contact with the user while documenting their needs, then there are moderately few errors in the requirements. Software practitioners also agreed that all the requirements were understandable enough for those who are not part of the project. The differences between the stakeholders needs could be reduced by directly contacting them, understanding, and interpreting the requirement process correctly.

4.5. Requirement process evaluation

The customer-user requirements needs have substantial difference over each other when number of users is considerably increased, on which more than 70% of the respondents agree. This is because the customer and the

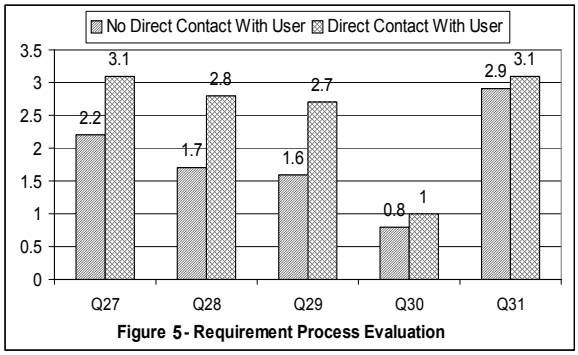

Figure 5 - Requirement Process Evaluation

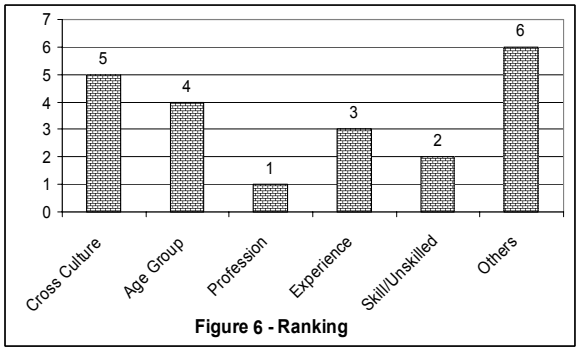

Figure 6 - Ranking

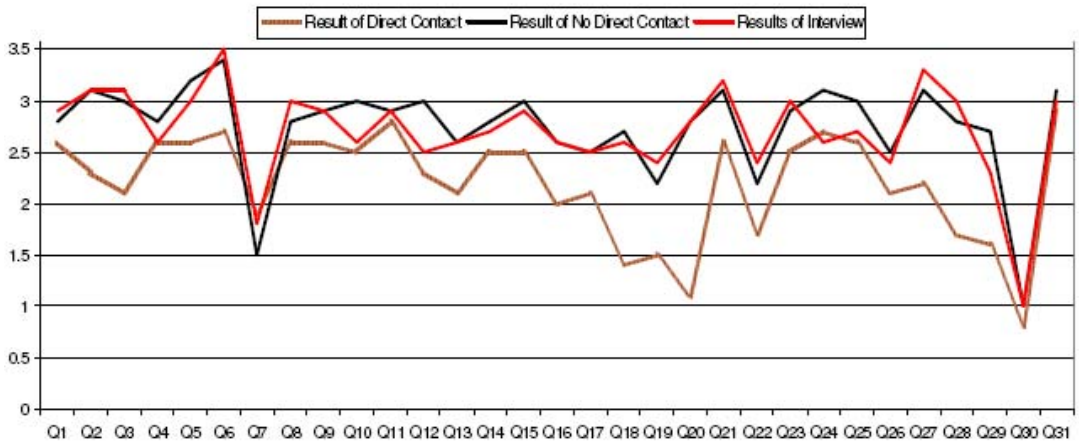

Figure 7 - Analysis of survey and interview results

user, views and implements the project in different ways with different motive in their mind. While the customer has an eye on profit, the user sees the system as a useful product to ease their daily routine. Figure 5 shows the bar diagram of evaluation of the requirement process.

Both the organization and respondents feels that the user involvement in requirement engineering has improved the project. But they strongly disagree that the user involvement information in one project is in no way useful for any other project.

The Figure 6 analyse the factors that has more difference on requirement process. The ranking is given 1 as highest to 5 being lowest. Almost 98% of them agree that if the user's profession is of a similar nature to software, then more constructive requirements needs may be suggested.

The study also shows that skilled and experienced users would also give useful requirements. The effect of age and culture of the user in the user involvement in requirement process is negligible.

4.6. Analysis of survey and interview results

The result obtained from the interviews complimented the survey results. The discussion helped to interpret the actual fact as the respondents wanted it to be. Figure 7 shows the overall analysis for the question Q1-Q31 from three different category users: Result of user having direct contact with developers, Result of users having no direct contact, and Results obtained from respondents via interview. The lines in Figure 7 follow almost the same path. This has improved the credibility of the overall result evaluation analysis and findings which led to a correct conclusion.

5. Conclusions

This paper has presented a research work on the topic User Involvement in Software Requirement Engineering, which is a study on the different characteristics and its effects of users on requirement documentation process. The main contributions of this study are fourfold. Firstly, early involvement of user requirement in the documentation phase is very important and it helps the project to make it a success. Secondly, the user's profession or skills on the requirement engineering have helped to contribute more useful requirement needs. Thirdly, the culture of the society and age of the user has no important role on the user's requirement needs. Finally, the customer-user requirements needs have substantial difference over each other when the number of users is considerably increased.

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