Survey on adverse influencing factors in the way of successful requirement engineering

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Abstract: *Requirement engineering is the first phase for the development of any software. Software have been discarded due to poor and ambiguous requirements. This study based on the results of surveys conducted to the professionals that have industrial experience in development of software. Numerous investigations carried for the identification of factors cause of poor requirement. These factors have deep effects on productivity and communication among the individuals involved in software development. The qualitative and quantitate research techniques were adopted to carried out this work. This research examined how cultural barrier (e.g., language, attitudes, roles, social organization, and time) affect the communication process in software development projects. The study showed that language and attitudes as dominant factors for communication that impact software productivity. Time, roles, and social organization had less influence. Also various cultures have different attitudes and behaviors, which in turn have distinct impacts on productivity in terms of more rework and delay.*

Keywords: *Requirement engineering, Problems in requirement engineering, Cultural factors affecting requirement engineering*

I.   Introduction

Requirement engineering is most important for engineering discipline. Yet it has been considered relatively easy part of Software Development Life Cycle. This is not obvious as it's a critical part in software development. The history of software project [1], gives most of the credit of software failures to poor and inadequate requirement process. Dealing with different stakeholders during requirement engineering process is an art. For requirement engineering process this art can be opted through extensive knowledge and experience to perform and manage the requirement engineering activities like inception, elicitation, specification, negotiating , validation and verification. The success of RE process depends on understanding the needs of users , customers stakeholders and the context in which the developed software will be used[2].

Issues in RE process faced by requirement engineers:

There are numerous issues faced by requirement engineering team during requirement engineering process. As requirement engineering is a social process that involves interaction among different stakeholders. Three major groups participating in requirement engineering process are, client organization, requirement engineering team and development team. These three categories faces social and cultural issues to some extent.

The main objective of this study is to Highlight some cultural issues as there are number of cultural issues that are as follows; Time zones differences, language and terminology issues, religious and racial differences , ethical issues, political differences issues, business environment issues. The main focus of this study is to find the social and cultural issues (language, attitudes, roles, social organization, and time) in requirement engineering process.

To investigates the impact of cultural factors on the software development teams with respect to team productivity.This research illustrates how cultural factors (e.g. attitudes, language, time, roles, and social organization) [3] , might affect the communication process in software development projects, which in turn affect the overall software project management and productivity.

II.   Review Of Literature

[4] Conducted empirical studies of 12 software companies. Their studies declare that many prerequisites difficulties are generally organizational as an alternative to complex, and that there is any relationship among companies' maturation and behavior connected with prerequisites difficulties. Results proposed the organizational problems aggravate all kinds connected with prerequisites problem.

[5] Illustrated that Powerful connection in the office locations increased production. They've got perused the particular factors (related to help team communication) that contain a significant influence on job pleasure.

[6] Described that software Requirement Engineering (RE) is one of the most important and fundamental activities in the software life cycle. With the introduction of different software process paradigms,

the Requirement Engineering appeared in different facets, yet remaining its significance without a doubt. The software development outsourcing is considered as a win-win situation for both developed and developing countries.

[7] Stated that In the globalized world we are living, all economic, technological, social and cultural aspects affecting many different countries are strongly connected. In some contexts, social and moral values also have a role to play. Moreover, engineers are sometimes identified with environmentally damaging technologies, so they are being forced to become aware of the wider social context in which they are working.

[8] illustrated that requirements for a particular software / system are the detailed description of services it offers with operational constraints. Where the process of gathering, analyzing and documenting these services and constraints is knows as requirement engineering (RE). In RE process various issues occurs in users and system level requirement and its segregation accordingly. The user requirement depicted in natural language, diagrams or using different modeling techniques. Where the system requirements are set of operational services and it constraints. The system requirements further categories into three levels, functional, non-functional and domain requirements.

III.   Research Question

Based on the literature review and the previous studies in software team management, there is a research question that emerge.
• Question : Does understanding cultural factors that affect communication:
- Reduce the amount of rework (increase productivity), and/or
- Minimize conflicts/errors during the software development life cycle, which in turn, reduce delays?

IV.   Methodology

To carry out this research work mixed research methodology were adopted. Initial the literature is used to stream line the problem area. The second phase consisted on described survey for empirical investigation.

Survey, interview and questionnaires are the conversational methods that are used to gather data from stakeholders and other sources[9],used in this research.

The two research instruments/elicitation techniques (questionnaires, interview) have been designed and prepared for the formal and informal studies aiming to investigate the impact of cultural variables on requirement engineering teams and productivity. The surveys are built based on previous validated instruments for measuring the cultural factors and communication in teams.

"Traditional techniques" include a wide variety of methods to gather data from various stakeholders including interviews, questionnaire, surveys[10]. The questionnaire is a method of requirement elicitation which is simple and requires lesser time and cost [11].Interviews expressed a will and understanding for the need of a better and more structured elicitation process, that would produce high requirement coverage, high traceability, and high understandability [12].

Informal Study- Procedure:

The informal study's survey consists of two sections: General Questions and Specific Questions. The first section asks some general questions/demographic information (e.g. time/date and place of interview, survey facilitator's name and participant's name, years of experience and number of projects, as well as level of education). In this study, 8 software engineers were interviewed providing their knowledge/experience working in multicultural software teams. The average and the median of the participants' years of experience in the field of software engineering are around 8.5 years..

The second set of the questions addresses specific information about their knowledge, experience, and opinions with respect to software engineering development projects, and software teams. The participants were given a short statement about communication in software teams and discussed the cultural factors that might influence the communication process for the purpose of helping them understand the survey instrument. Based on Deresky's communication model [3] , seven cultural factors might influence communication in multicultural teams: Social organization (values, methods, priorities), attitudes (interpret messages), language (express feelings, translate idioms), thought patterns (reasoning process), roles, time, and non-verbal communication.

Formal Study Procedure:

The formal study was conducted on people who have experience in software development projects, focusing on the RE tasks. The analysis involves the entire set of data, in which all data was analyzed together without organizing them into categories.

The questionnaire consists of 41 questions. The question types include questions with short answers, multiple-choice, partially close-ended questions, and closed-ended with ordered response choices, where the participant were asked to circle a number between 1 (strongly agree) and 4 (strongly disagree) on each scale.

First section of the questionnaire consists of background information in which, the participants were asked to provide short answers to 14 questions that provide general information(language, year of experience, number of projects involved in) .

The second section of the questionnaire depends strongly to fill out the personality test.

The third section of the questionnaire consists of 17 questions. In general, this section measures communication, language, time, and roles in terms of perception of who should make the decision.

The fourth section consists of 11 questions. The questions are designed and prepared to measure the effect of cultural factors (e.g. attitude, social organization, time, roles, and language) on communication and productivity in terms of rework and delay)

Twenty -eight (28) people participated in this study, where 22 (66%) of them were male, 6 (18%) were female.11 (38%) of the participants had less than four years of experience in software development projects, 7 (29%) had four to eight years of experience.

V.   Result And Discussions

Result and discussion of informal study:

Based on the informal study, all seven factors might have some impact on multicultural teams, and some of them might overlap based on some common characteristics. However, for formal study, the aim was to narrow down the focus to 3-4 factors instead of investigating all of the seven factors due to limited research time frame, and to make this research more focused on specific cultural aspects.See Table 1.1

Table 1.1: Cultural factors that affect communication process in software teams & RE

Cultural Factors	Impact	Included
Attitude Language	More- impact	Yes
Time Role Social Organization	Nominal	Yes
Thought Patterns Non-verbal Communication	Less -impact	No

Result and discussion of formal study:

Based on the participants' experience working on software projects and focusing on the RE tasks, Attitudescome at the top of the list of the factors that have more/critical impact on communication, followed by Social Organization, Time, Roles, and then Language. All the five cultural aspects have influence on communication in software teams and RE. Based on peoples' experiences, these factors "often to sometimes" cause miscommunication. See Table 1.2

Table 1.2: Cultural factors that cause miscommunication in software teams & RE

No.	Cultural factors	Percentage	Occurrence
1	attitude	76%	Often to sometimes
2	Social organization	73%	Often to sometimes
3	Time	68%	Often to sometimes
4	Roles	63%	Often to sometimes
5	Language	58%	Often to sometimes

VI.   Conclusion

People encounter a number of obstacles while eliciting, communicating, and negotiating the requirements on their project teams and with clients during the RE process. As expressed earlier, different cultures have different miscommunication issues. This research studies also indicate that miscommunication occurred at some level, and produced errors/defects (or conflicts) that led to an increase in the amount of rework and caused delays in the project. Further, cultural differences caused miscommunication and conflicts that increased the risk of delivering the final software product on time and within budget, as well as affected the overall project productivity.

Question: Does understanding cultural factors that affect communication: Reduce the amount of rework (increase productivity), and/or Minimize conflicts/errors during the software development life cycle, which in turn, reduce delays?

Yes. Understanding the cultural factors that affect communication reduces rework and delay.

The research used different instruments such as surveys, interviews, and questionnaires for measuring the cultural variables (i.e., attitudes, language, social organization, roles, and time) that could affect communication.

Others can use these instruments to measure the mentioned factors, and study their impacts on communication in teams.

References

[1]. J.M.C. Gea, J. Nicolás.,J. L. F. Alemán,and A. oval, A. Vizcaíno, Reusing Requirements in Global Software engineering. Department of Informatics / MOBIS, University of Hamburg.2013. 171-197.

[2]. A. Haroon, and S. Sahibuddin, The Strength and Weakness of Requirement Engineering (RE)Process.2nd International Conference on Computer Technology and Development (ICCTD), 3 (12) ,2010, 56-59.

[3]. H. Deresky, International Management: Managing Across Borders and Cultures. United States of America, Addison-Wesley, 2007.

[4]. T.Hall, S. Beecham and A. Rainer,Requirements problems in twelve software companies : an empirical analysis, IEEE Proceedings online , 49(5) , 2002, 153-160.

[5]. T.Javed, M. Maqsood and Q . Durrani, A Survey to Examine the Effects of Team Communication on Job Satisfication in Software Industry. ACM SIGSOFT,29(2), 2004, 50-55.

[6]. I. Perera , Impact of Poor Requirement Engineering in Software Outsourcing: A Study on Software Developer's Experience. Int. J. of Computers, Communications & Control, 6(2), 2011, 337-348.

[7]. P.L. Sánchez, J. M. Cámara, C. Represa, Social skills and moral values in engineering education. Journal of Accessibility and Design for All (CC) JACCES, 3(1), 2013, 28-43.

[8]. I. Sommerville, Software Engineering.Addison Wesley,(New York-USA. ,2004),520-525.

[9]. M. R. Beg, M. Muqeem, M. F. Farooqui, Extending Application of Non-verbal Communication to Effective Requirement Elicitation. Advances in Computing and Information Technology ,177 , 2013 , 623-630.

[10]. A.Khalid, and C. Mayer, From Conception to Maturation: A Systems Engineering Approach. International Journal of polytechnic studies.Southern Polytechnic State University, 1(1), 2011, 3-4.

[11]. T.Rehman , and M. N. A. Khan,Analysis of Requirement Engineering Processes, Tools/Techniques and Methodologies.I.J. Information Technology and Computer Science , 2013,42-43.

[12]. R. Nilsson, and G. Olsson, A Case Study in Market-Driven Requirements Engineering and Release Planning. Lund University Faculty of Engineering, LTH Department of Computer Science,8 ,2008, 10-17.