Overcoming Social Issues in Requirements Engineering

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Abstract. Aim of this research paper is for creating awareness and consciousness of the importance about Social issues in requirements engineering by identifying those issues and analyzing it with the inputs given by several companies across the world. This paper also discusses overcoming those social issues and how currently software industry is handling those issues.

Keywords: Requirements Engineering, BESPOKE, Social issues, Elicitation.

1 Introduction

In the recent few years requirements engineering has become an important phase in software development processes. The factors that affect requirements engineering process directly or indirectly have the influence in the software development. Requirements engineering is the contiguous process of pre-study, elicitation, preparation of requirements specification document, analyzing those requirements, reviewing those requirements, prioritizing those, managing change requests, re-validating the requirements, re-negotiations. Requirements engineering tells about what the system will do without mentioning how it would do [1]. Over the period of time various studies show that requirements engineering is not only influenced by technical things and also by socially related things. Seldom requirements engineers think in line with social aspects of requirements engineering. Various factors of society such as cultural, linguistic, gender, nationality, race, and politics are also playing crucial role in requirements engineering phases started from pre-study to winding up the project. When we identify the social issues which all are common to all projects and overcoming impacts causes by those issues would take requirements engineering into next level of advancement.

2 Research Questions

This research paper answers the following research questions,

1. What are social issues meant in Software industry?
2. In general what are all the considered as social issues in requirements engineering?
    Sub. Question: What are all the potential issues in each requirement engineering phases?

3. What is the impact of social issues identified in the requirements engineering phases?
   Sub. Question: How much impact in elicitation phase?
4. How does industry handle the social issues in elicitation phase?
5. What are the level of negotiations and re-negotiations in all the phases of requirements engineering?
6. What is the co-ordination level between teams?
7. Do software companies need psychologist or sociologist in requirements engineering process? [2,3]
8. What are the recommendations for overcoming social issues?

In the subsequent sections, with appropriate research methodologies answers for these research questions are found out and reasons are analyzed. By analyzing answers of these research questions, mitigations for these issues are discussed and identified. The first and second questions are answered through literature review. Various papers published on these social issues requirements engineering topics had been studied and rest of the questions are formulated. For the third question it is answered with the combination of literature studies and the inputs that had been received from the companies through interviews. Fourth question is answered with the inputs from industry. Rests of the questions are answered with the inputs from company and analyzing it parallel with the literature available. For interviewing with companies a set of questionnaire is prepared and given to few selected companies across the globe.

3 Background and Related Work

In each phase of requirements engineering human interaction is inevitable. Wherever people involvement is there, inadvertently social –cultural impacts also be present. Requirements engineering also does have impacts influences caused by social issues. Very few software engineers think that social issues are relevant in requirements engineering perspective. According to Joseph A.Goguen, requirements engineering is no more a technical domain, considering social dimension is a necessity [4].

Because of global market software development had been distributed across the boundaries. To have a better software product, distributed processes had to be integrated well. For an example, "FDSA" system has to be developed and implemented in USA. Requirements for this system would be elicited by engineers from Sweden. Specifications would be written by Chinese employees of the Swedish company and development work would be outsourced to India. Finally the developed system would be tested by US engineers for implementation. In this imaginary scenario different software development processes including requirements engineering are spread across the people with different cultures, languages, belief systems, life style, and political mindset. In this long relay race when baton is passed without any issues, "FDSA" system would be implemented as expected. When we want to trace things back for example, any clarification on newly added requirement it has to be traced back to
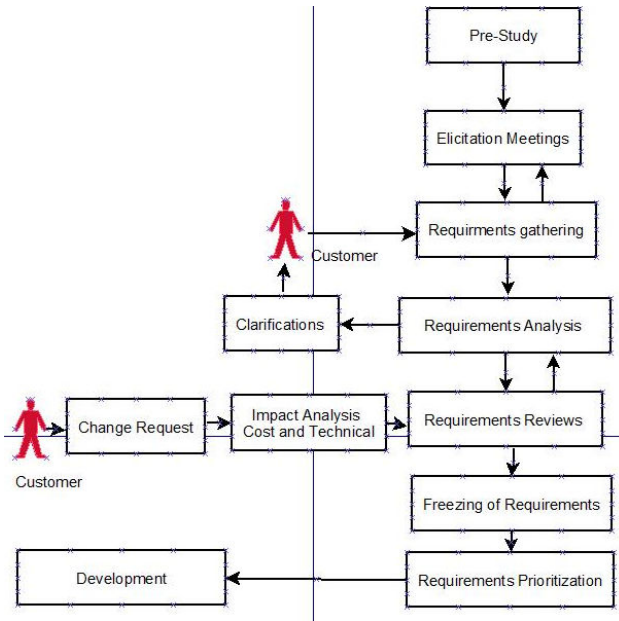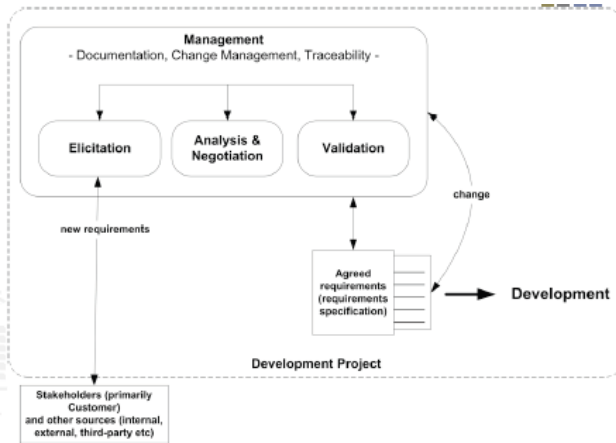
Fig. 1. Requirements engineering phases

Fig. 2. BESPOKE Process [17]

specification document and to originally elicited, India-Sweden-USA. General assumption is technology is being dealt in 'English' but in real scenario there are many hidden aspects to be handled. Effective communications, level of clarity, interest towards the success of the project are varying factors from people to people, culture to culture. Software companies may practice processes, systems to regulate but at the end of the it is people who have to abide.

BESPOKE and MDRE (Market driven requirements engineering) are two main classification of requirements engineering [1]. Success of the software product in both BESPOKE and MDRE depends upon how well requirements engineering process had been done. As involvement of people in requirements engineering directly influence requirements engineering process, studying the impact of these social aspects has become important in this study. People always tend to show their culture that they have been brought in. Before elicitation meeting knowing about the political cultural scenario about the company that is going to be elicited would help in a great way to know all the requirements needed by the customer. Being biased is one of the traits of human beings. Engineers from one country may have biased opinion about other country's employees. Clashes of different culture and work styles may affect the cohesion of the relationships in turn it would affect the effectiveness of the requirements engineering process. Analyzing and evaluating social scenarios shall add an additional value to requirements engineering studies.

Social perspective in requirements engineering is one of the areas which had been explored less. J.A. Goguen "social issues are inherent to the requirements process, because the needs that drive that process are necessarily embedded in the social, cultural and political world of those who want the system, and hope to benefit once it is built"[4]. J.A.Goguen's works on Social issues in requirements engineering had been taken as the basis of this research paper [4]. Goguen's research was based upon major groups that participate in the requirements engineering process [4].

Classic example of librarian and computer scientists are discussed as two culture clashes which talks about social instincts affect the requirements process [10].

    a.   issues within the customer organizations
    b.   requirements team issues
    c.   issues between customer organization and requirements team [4]

Systematic review had been done extensively for writing this paper.

3.1   Systematic and Literature Review

Search string: ("Social issues" OR "Social perspectives"OR "Ethnography studies" OR "Social Analysis" OR "Social techniques") AND ("Requirements Engineering" OR "Elicitation" OR Prioritization).

With the above mentioned search string literature review was done.

The research is based upon Joseph A.Goguen's work on Social issues in Requirements engineering. This paper gives the outline of the social issues in requirements engineering [4].

Social analysis study of Viller S.Sommerville I is referred for this research [5].

Barry Boehm's how two cultures clash in requirements engineering is studied [10].

Marina Jirotka , Joseph A. Goguen's paper on social and technical issues affect the requirements engineering had added more values to the study.

Table 1. Systematic review articles list

Title	Author(s)
Social Issues in Requirements Engineering,	Joseph A.Goguen,
Social analysis in the requirements engineering process: from ethnography to method	Viller, S.; Sommerville, I.
Sociologists can be surprisingly useful in interactive systems design.	Sommerville, I., Rodden, T., Sawyer, P. and Bentley, R.,
Challenging Universal Truth of Requirements Engineering,	J. Siddiqi,
Requirements Engineering: Reconciliation of Technical and Social Issues	J. Goguen,
Requirements engineering, expectations management, and the Two Cultures,	Barry Boehm, Marwan Abi-Antoun, Dan Port, Julie Kwan, and Anne Lynch,
Techniques for requirements elicitation	Goguen, J.A. Linde, C.
Integrating ethnography into the requirements engineering process	Sommerville, I. Rodden, T. Sawyer, P. Bentley, R. Twidale, M.Dept. of Comput., Lancaster Univ.;
Human errors and system requirements	Sutcliffe, A. Galliers, J. Minocha, S.
Requirements engineering: social and technical issues	Marina Jirotka , Joseph A. Goguen,

4   Research Methodologies

Specific method for collecting data analyzing it is research method. Quantitative, Qualitative and mixed method are three kinds of approaches used in research [6] Using post positivist claims for enhancing knowledge is quantitative approach [6]. Survey and experiments which deals with statistics are used in quantitative approach [6]. Claiming on constructivist perspectives is called as qualitative approach [6]. Mixed method is using knowledge claims on practical perspectives [6].

This research topic requires information from both qualitative and quantitative approaches. From the literature review and studies social perspectives to the requirements engineering had been leant. Methods, approaches and processes taken by companies to overcome social issues are collected through interview and are compared with studies already done on social related studies on requirements engineering.

Concurrent triangulation strategy is chosen for collecting the qualitative and quantitative currently. Since this method is more familiar it had been chosen for this research topic. Reason behind for choosing this strategy is, "*concurrent triangulation helps to confirm, cross validate or corroborate findings with in single study*" [6].
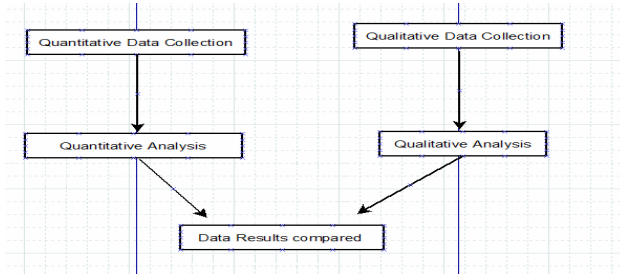

Fig. 3. Concurrent Triangulation Strategy [6]

4.2   Experiment

4.2.1   Experiment Definition
A goal is defined for having a directed way of what should be done and what are all the process to be followed for this research. Goal Question Metric [18] approach is used for defining the goal. The goal defined is divided into four parts. The goal states the purpose of the research and issue to be identified and upon which it has been detected and in whose point of view.

Table 2. Goal definition

Goal	Purpose	To evaluate and arrive recommendations
	Issue	Social issues
	Object	Requirements Engineering
	Viewpoint	From Management and project manager's point of view.

Number of Questions asked: 21
Number of Companies interviewed: 3
Number of people interviewed: 3

4.2.2   Context Selection
The experiment context is requirements engineering involves certain social issues accordance with political, geographical boundaries, race, religion, gender and language. Attributes of the experiment are how these factors are affecting requirements engineering process.

Table 3. Company details

Company Name	Number of Employees	Reason for Selection
Scope International	More than 5000	It is situated all over the globe, and they use video conferencing for elicitation
BSG Leatherlink	50	Medium Sized company
Oviam LLC	3	Small sized and situated in US and done work with customers all over the world.

The following is the list of questions that had been given to the companies.

Table 4. Questionnaire for the interview

1	How are your clients disseminated geographically?
2	Are the same proficiencies to elicit the requirements are used for all the clients?
3	During the discussion with the requirements gathering team will you include a member who belongs to clients country?
4	Do you think that the method used to gather the requirements is beneficial?? if yes justify?
5	While gathering the requirements, what are the several social issues that you face?
6	What is the impact of governmental change upon requirements engineering process?
7	How can the Requirements engineering team assure if the requirements analyst is clarified?
8	Do the requirements engineering team of your organisation have politics among the team?
9	What are the measures taken by you, when the software requirements specification is prepared at one country different from the country where development is to be done?
10	What is the impact of racism and culture while gathering the requirements?

Table 4. *(continued)*

11	Is there any case where your request for changes has been rejected?
12	During financial negotiations are there any problems?
13	What will you do in a situation when your employee is not well dealt and could not conform with the clients employment culture?
14	Do conflicts such as gender bias arise during the process?
15	Will you train the employee who is going onsite for a project regarding social issues of the client countries culture and language?
16	How can correlation be maintained among different teams when disseminated over different countries?
17	How can a situation when a member 'A' of requirement analysis team has not been given proper response by a member 'B' of requirements specification team deliberately, can be handled?
18	What prioritization technique is used in the company? In case of 100 dollar how it is ensured that people are not favouring their own requirements to go up?
19	When your client comes ï
20	Is a formative contest promoted among the substitute teams of the requirements engineering team?
21	In general, what is your opinion about social encroachments in requirements engineering process?

All the questions are close ended questions, are prepared to avoid the ambiguity.

4.2.3 Preparation

Based upon the qualitative research questions were prepared and it was reviewed in the research team meetings. Subjects are chosen according to their pioneer level in this requirements engineering field. No training was required for the subjects before the experiment.

4.2.4 Execution

After completion of preparation phase execution of the experiment was started. Three companies was chosen in three different domains of software development and located across the globe. It took about a week to complete the questionnaire and in prior

to the telephonic interview, questionnaire was sent to them. Interview was conducted through Skype and Voice over IP internet telephony providers.

4.3 Hypotheses

Seeking answer for an interrogative statement is research question[6]. The predictions that a researcher wants to make is hypotheses [6]. Null hypothesis and alternative hypothesis are two hypotheses made in this research paper.

H0: Social issues never have any impact in requirements engineering. Hence social perspective to requirements engineering is not a necessity.

Here two variables are social issues and requirements engineering. According to Creswell "*null hypothesis makes a prediction in the general population no relationship or no difference exists between groups on a variable" [6].* When expected outcome is predicted based upon the prior literature is alternative hypothesis [6].

H1: Requirements engineering has many impacts because of social issues. Hence Social perspective to requirements engineering is necessity.

In order to reject null hypothesis and for supporting the alternative hypothesis questionnaire is prepared, a survey is conducted with software companies to know the current trends in industrial practices to overcome social issues.

5   Validity Threats

5.1   Internal Validity

In order to know how well is the study, validation on threats being analyzed. Internal threats talks about relationship between cause and effect of the study. In this research paper there are no control groups hence it is single group threats[16]. *History, maturation, testing, instrumentation, statistical regression, selection, mortality,* and *ambiguity about direction of casual influence* are the eight sub categories of internal threats [15].

1. History: This is one of the valid threats as experiment (conducting interview on social issues) is only related to the contemporary time. Social issues popped up few years ago are not being discussed.
2. Maturity: This is not been considered as threat experiment is for very short time.
3. Testing: This is not a valid threat as the experiment is conducted for only one time.
4. Instrumentation: There are chances of missing out some research databases due to lack of time and awareness. As far as the questionnaire is concerned simple unambiguous questions were prepared.
5. Selection: Selection of the companies and questions influences the study. Selection of only few companies falls into this category threat.
6. Ambiguity about direct influence: This is one of the threats of our study as size of the companies, number of employees in the company , number of projects that are sourced influences the answers that been given by the companies.

Statistical regression and Mortality do not apply to this study.

5.2 External Validity

1. Interaction and selection of treatment: Software companies are selected and it can be generalized as this study can be done with any software companies. Hence this is not a threat.

2. Interaction of setting and treatment: This is a threat as one-to-one in person meeting is not possible in the short duration of time interview had been conducted.

3. Interaction History and time: The data collected from different companies through interviews in different time and date do not affect the study.

4. Time schedule is made to retain the interest of company employees to answer properly. Interview been done during the time that they have got less work load.

5.3 Construct Validity

Inadequate preoperational explication of constructs, mono-operation bias, mono-method bias, confounding constructs and levels of constructs, interaction of different treatments, interaction of testing and treatment are the construct validity threats [16]. Among these hypotheses guessing, inadequate preoperational explications of constructs are two construct validity threats for this study. In hypothesis guessing the person who has been interviewed can guess what the hypothesis is so that intentionally he can deviate the intended answers. Evaluation apprehension is, most of the industrial people may not reveal the answers for the questions asked. Inadequate pre-operational explications of constructs are having clear understanding of the subjects.

5.4 Conclusion Validity

Conclusion validity is classified into seven subcategories as following: *low statistical power, violated assumptions of statistical tests, fishing and the error rate, reliability of measures, reliability of treatment implementation, random irrelevancies in experimental setting,* and *random heterogeneity of subjects* [16].Among these only reliability measures is the applicable threat to this study. Making the appropriate questions for interview and been conducted with different people across the globe. Since the variations in the answers is one of the main themes of this search , it is made sure that questions are appropriate to social perspectives of requirements engineering.

6 Discussions

6.1 Hypothesis Testing

The problem identified is companies have impact because of social issues in requirements engineering. Null hypothesis and alternative hypothesis are formulated.

H0: Social issues never have any impact in requirements engineering. Hence social perspective to requirements engineering is not a necessity.

H1: Requirements engineering has many impacts because of social issues. Hence Social perspective to requirements engineering is necessity.

Based upon the information collected from software companies null hypothesis rejected as all the companies interviewed had mentioned that they have the influences
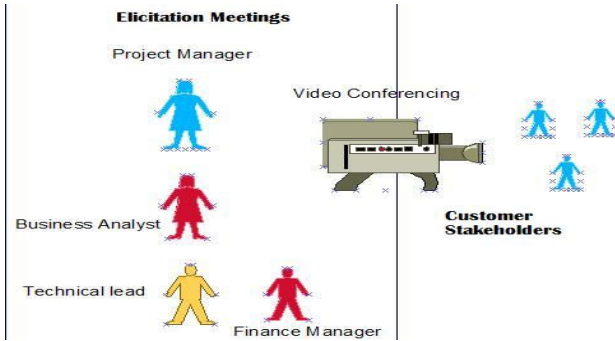
Fig. 4. Video conferencing Elicitation

of social issues in requirements engineering. Hence null hypothesis is rejected in the favor of alternative hypothesis.

6.2 Interview with Companies – Discussions

During our discussion with various companies we have gathered information that all companies have started to work on social issues which are related to requirements engineering. After our analysis among the different interviewed companies, one of the companies among them said that they will provide training on the client and country's culture and they also provide few basic linguistic knowledge of the particular country or region.

Although English is considered to be a global language and most widely spoken by all, some basic courtesy words when spoken during the discussion with the client will be an advantage and sets them into a good mood for a perfect elicitation meeting and he/she (clients) also may get impressed with the discussion and it will be an added advantage to the company

Employees are also given training who are to be interviewed in the elicitation and requirements gathering meetings.

Another company had also shared their views with us that if the time taken to train the people is too short then they will hire few people who are residing in the clients country so that this can carry away the issues on social interaction in a good manner. But this process mainly depends on the size and the cost of the project.

Dinner table discussions also play a vital role than the elicitation meetings itself so many companies are taking at most care in arranging food for the clients and the host teams. After all at the end of the day everyone works hard to fill their stomach

According to one of the Companies' managing director said that nativity linguistic skills plays a important role at crucial junctures in the elicitation process, he faced a problem that he is not able to understand the specific requirements and so he met the person and asked him for some clarification in his native language and got his problem solved though it includes a risk of groupism still it yields benefits.

When we analyzed about the internal politics among the teams in the company then they (companies) that was the only task they could not get away with.

Another company told us that politics are a part and parcel of life so they go on with these and getting rid of these can be done by getting the teams together and this reduces the drift among the teams.

When the discussion is going on about the impact of international politics on requirements engineering process we are said that during few years ago a war has occurred and the companies are not interested to give projects to them and just for no reason they have closed the head office which was located in that country.

Another great impact is the change in the government. It means that change of government in one country may affect the situation in another country

One of the companies we interviewed wanted to meet the real time users of the elicitation team so the people of the elicitation team went as if they are students so that they can know how the system is . While doing that they have come to know that there are potential problems within the employees because of this systems automation they would go on strike.

All the companies concluded that they do not have any issues related to the requirements clarification at the time of specification writing

In almost all the companies, few people from the elicitation team prepares a document and hands it over to the specification writing team after all these are confirmed by SRS team. It must be clear of all these documents as they are the people who finalize the document so they may ask for further clarification if the document cannot be understood

Among most of the companies elicitation team is kept separate from all other teams and if some person is creating any issues personally or intentionally among the teams few companies take a counseling session for him and try to get rid of his problems of why he is having so many issues.

During the company interviews it is to be said that a psychologist is required in each company to get away any mental stress of employees if they have, for example in sports having a psychologist in olden days is a weird situation but now a day's its necessary to get the players into a good form.

Mr.Karunakar Of SCOPE International said that Social consequences do not originate in their organization as they elicit the requirements by video conferencing possibly, social issues can be reduced by conducting video conferencing while gathering the requirements.

Oviam LLC, webhosting company has its customers both in India and USA.CEO of the organization said that emphasizing conflict arise when needs are specified by the client. For an instance, once if the websites design is given Americans rarely do request a change but clients who belong to India often request for a change and financial negotiations since the CEO acclaims India. Depending on the situations this has got both negative as well as positive consequences.

One of the most critical parts among the requirements engineering is the change request.

When a change request arrives it has to be evaluated, analysed revalidated and then it can be approved or rejected. This is the situation where all the members of the requirements engineering team are involved

The requirements engineering team must carefully look after that all the persons involved in the change request directly or indirectly cause any impact or not.

Many companies choose different elicitation techniques based on their companies requirement and on the locality.

Many of the companies choose the development and testing teams to be located at the same place or nearby place to get rid of miscommunication among the teams.

To get larger benefits among companies they outsource employees so that they can cut the cost of the project and can afford cheap laborers for the same work.

7   Recommendations

By nature requirements process itself social, it involves extensive interaction between engineers and clients.

1. Having social cultural training in prior to the elicitation meetings of the particular country

Motivation: Company shall get good name with the clients as they would think company is well prepared.

2. Hiring a person from customers region who can speak in line with client's management.

   Motivation: Easy communication

3. A week before the elicitation meeting elicitation team may visit clients place.

Motivation: It would give them a feel 'known place'

4. Video conferencing elicitation meetings

Motivation: As no interactions in person, people shall talk to the point unnecessary diversions in the meeting shall be reduced.

5. Frequent meetings of requirements engineering team

Motivation: Documents will not say everything. Regular meetings would increase the clarity level of documents.

6. As soon as management finds rifts and drifts between teams they should immediately arrange a meeting

Motivation: Negotiation shall solve all kind of problems.

7.1   Further Studies

The various social issues pertained only with BESPOKE organizations have been discussed. Further analysis can be done by communicating with MDRE (Market Driven Requirements Engineering) organizations. With the assistance of ethnography, social issues that conform to BESPOKE organizations can be improved as MDRE.

8   Conclusion

This research paper is compliment and enhancement of J.A.Goguen's work on social issues in requirements engineering [4, 9, 11, and 12]. The components that determine social and cultural consequences are always perplexed .consequences that are caused can never be anticipated, as human behavior cannot be predicted. Answers for these social issues count on several other factors .technical, financial and domain components affect the Requirements engineering adversely along with the social consequences.

Acknowledgements

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