Managing Requirement Risks in Global Software Development

Aurangzeb Khan
DCE, College of E & ME
National University of Science and Technology (NUST), Islamabad, Pakistan

Dr. Farooque Azam
DCE, College of E & ME
National University of Science and Technology (NUST), Islamabad, Pakistan

Muhammad Shoaib Zafar
DCE, College of E & ME
National University of Science and Technology (NUST), Islamabad, Pakistan

ABSTRACT
Now a day's trend toward software development is changed and Software organizations are distributing their development processes worldwide. Many organizations are interested in Global software development (GSD) as compared to in house development due to cheap human resources and to increase their revenue. Risk factor is also increased in GSD. In this study we will see how to mitigate the risk in requirement gathering phase of GSD.

Keywords
GSD (Global Software development), SDLC (Software development life cycle), RE (Requirement Engineering)

1. INTRODUCTION
In global software development organizations extend their operations worldwide, here point arises why organizations needs to distribute their operations worldwide regardless they can manage their activities easily under one roof and in one office. Managing peoples and resources at one place is much easier than at distributed places. Software development needs that development team should be at the one development point, so that team can communicate easily and develop the same understanding against common issues. Working at globally distributed projects there are many difficulties for planning and managing people, for developing understanding to requirements usually cultural and communication issues arises. Jealousy factor increased between the more costly and cheap resources who are reluctant to train their cheaper counterpart in fear of losing their jobs. It is considered that more than 70% software's are failed due to poor requirement elicitation. Requirement elicitation is the back bone of any software project. Well understood requirements leads project toward success. Requirements are the foundation stone of any software project, if requirements are poorly understood and poorly gathered then there are lot of bugs in the application and in many cases software cross their schedule and leads toward project failure. In global software development there exist many barriers in gathering requirements like communication gap, cultural differences and professional background, requirements gathered in the local market leads project toward successfulness beside cultural issues, behavior of the peoples in different region of world impact a lot while requirement gathering. In GSD development teams are distributed over the worldwide, engineers from different cultures and from different ethical background are working at the same project so they may impact differently on the project (Boehm, 1991). Due to low labor cost in the developing countries organizations outsourced software development teams from these regions to increase their productivity and earn more profit. In GSD software quality is also reduced due to globally distributed teams and their approaches toward work. GSD is not an easy approach to adopt due to cultural differences and complex communication requirements of virtual communications and informal communication plays very vital role in GSD [1], to overcome this problem several techniques are used in GSD like video conferencing, conference calls and requirement workshops but it needs to pay more attentions and efforts to resolve these issues in requirement elicitation. Cultural differences plays very vital role in requirements gathering phase because different people react differently against same problem. In this study we will try to manage the risk arises due to poor requirement elicitation. This study will introduce a new technique of requirement elicitation in global software development to mitigate the software failure risk due to poor requirement elicitation.

2. PROBLEM DESCRIPTION
Global software development approach is growing day by day and many organizations are shifting toward GSD due to less resource cost as compared to in house development. Regardless of its advantages there are certain issues arises by using this approach, organizations that adopt global software development approach faced many difficulties in requirement gathering phase in term of communication, cultural differences and acquiring suitable resources. Personnel sitting at different locations they can't communicate efficiently as they can communicate under one roof. Communication is very important in the offshore software development [16]. Organizations out sourced cheaper resource for developing software in outsourcing team software quality decreased due to poorly skilled professionals and inappropriate monitoring. Software developed at global platforms has higher risk percentage of than locally developed software. Cultural differences played a major role in requirement gathering phase in GSD.

Requirement gathering phase is very important phase in software development life cycle (SDLC). In global software development requirement misunderstanding risk increases and poorly gathered requirements leads toward incorrect software functionality implementation. Requirement engineers are unable to understand the context of requirement due to absence of user what actual user wants from software which is one of the major risk of software failure and a big challenge for requirement change management team.

3. PROPOSED MODEL SURVEY

Different researcher proposed different methods and techniques for gathering requirements in global software development. One technique that is frequently used in global software development is electronic communication, cultural and social processes development. Carmel (1999) suggested that success factor in global software development is increased by implementing rigor on the development team. Distributed software development becoming norm due to attractive cost structure [2]. When considering RE process Damian and Zowghi (2003) said that inadequate communication in global software development may leads to challenges and contribute too many problems. Stakeholders faced difficulties while RE practices. In 1993 Zack states that main distinction in global and local software development is communication and it's very important managerial issue in GSD teams. Requirement elicitation needs a lot of communication. To manage proper and up to date communication is difficult task in global software development. Requirement represents the interest of the client and can be consider heart of project [3]. In requirement gathering process following points are very necessary.

Training teams should have soft skills like cultural differences, Communication, knowledge management and they gather requirements successfully from clients especially when they belong to different culture for globally distributed development teams.

There should be strong processes in the organization so that every team member aware of his job responsibilities and they knows what to do.

Performance and monitoring meeting are conducted frequently to track the progress of work and check whether it is accordance with stated requirements.

Different techniques used frequently like emails, video conferencing, call conferencing and requirement workshops are very effective so that right requirements are gathered and have proper requirement change management mechanism.

Techniques that are used for requirement elicitations are:

Interviews
Prototypes
Requirement Workshops
Questioners
Conference calls
Legacy systems

To avoid the failures and achieve the success client firms should provide the domain specific trainings to service providers [17].

4. EXISTING SYSTEMS/CURRENT STATUS

Efficient requirements engineering plays very important role in developing global software applications ,without collecting proper requirements software system has no success, in this research we will discuss the process of gathering requirement in global software development. Offshore software development carried out after the make and buy decision [15]. IT organizations used the traditional methods for requirements gathering e.g. emails, conference calls, video conferencing and requirements workshops for requirement gathering, in mails client share a document that contains the detail description of problem, requirement engineers after reviewing and analyzing the problem they start documenting the requirement and prepared questions for doubtful requirements that are asked from client in time to time requirement gathering meetings. One technique use that is standard contract to speed up the negation process [18] This process is very lengthy for requirement elicitations and takes a lot of time in requirement elicitation phase and have certain risks and limitations, these meeting rely on internet communication and internet unavailability factor cause schedule overrun. Beside communication risk cultural differences also plays major role in requirement gathering phase in global software development [19]. Globally distributed software must involve participants with strong organizational and process skills [20]. Lake of face to face communication with client creates difficulties for the requirement engineer to understand the body language and tone of client. Besides communication and cultural differences, different countries have different time zone this factor also creates problems for stakeholders working in global software development environment. It is necessary for requirement engineer /Business analyst to understand the communications and social complexity during requirement engineering phase (Thanasankit 1999), Requirement gathering research focuses on the tool and techniques used for requirement elicitation phase. Many researchers shows the more formal techniques used in requirement elicitations makes requirement more clears and fruitful. Using old traditional methods for requirement gathering impact negatively. Most of the work carried out for focusing that global software development is addressing technical dimensions of meeting application system or tools such as computer aided software engineering tool [10]. In some cases requirement engineers in the global software development are sent to clients place where they collect requirement by face to face communication and sent back requirement specification document to their staff office in water fall approach [4].Global software developing organizations faced challenges on communications with their head quarter and site offices. By minimizing impact of this issue organizations conduct weekly meetings for requirement management and strategic planning and negotiation of tradeoffs demands, knowledge management is not properly handled in GSD [11]. Key knowledge is not communicated with developer for constructing application. Miscommunication and misunderstanding occur at the sites where less experienced resources are working in global software development. Before the project some preparation is need in term of requirement gathering [5].Strategies used for cultural difference are cultural differences training, stakeholder are fully aware of the cultural difference barriers but they have to cope with the situations, trainings are given to requirement engineers to understand the culture of target client to avoid the requirement misunderstanding. Good solution need proper centralized platform [13]. There is the great deal of security problems in the outsource software [22]. Sometimes requirement engineers take advantages of other resources who already visited the client site for requirement gathering and they know about the behavior of client in process of requirement elicitation and interests toward application and his way of work. Virtual mentoring techniques are used that is based on virtual actors in an interesting way to motivate stakeholders to understand the cultures of other countries [6].Seminars and review literature techniques are used for minimizing cultural difference gap. Language difference is also one of the major issues in global software development that creates problems for requirement elicitations because in global software development stakeholders don't have the same native language. To overcome this issue

organizations take services of interpreter for communicating with client. Normally English is used as a medium of communication for requirement elicitation, stakeholder from different region have idiomatic differences challenges in communication. Ontology technique is used to minimize language differences. Ontology provides the framework for people with own needs and view point having their own context [7].

Ontology plays very important role for elicitation requirements because it clarify the structural knowledge and reduce the ambiguities in conceptual and terminological understanding [8]. Requirement gathering and requirement engineering is human centered process [9].To minimize the technology selection issues in global software development technology is selected by consulting with development team that is hired for project. Global software development becomes the business [12] in the global world and number of organizations expanding their operations over the world wide. The key to managing successful relationship in outsourcing projects is contract between service provider and the client [21].

5. POTENTIAL RESEARCH AREAS

Developing software applications in global environment is very difficult job, because there are many requirement elicitation issues arises in global software development, while developing GSD software applications that are easily tackled in local software development because there is no face to face communications with the client in global software development. These issues are only resolved by only skill full managers who are involved by GSD [14]. Medium of communication is normally electronic media which is very time consuming, in this study we are addressing the issues that are faced during requirement gathering phase in GSD. We have interviewed from different requirement engineers belongs to different software developing organizations, who are involved in requirement gathering phase for the projects that are developed globally. During the interview one of the requirement engineer belongs to Makabu private limited (it's a software developing company situated in Islamabad Pakistan) has explained the current process of their requirement gathering phase, for requirement gathering they used video conferencing, conference calls and emails technique. Client share the document that contains problem description after reviewing and analyzing document requirement gathering team built a requirement document of well understood requirement and for ambiguous requirements they construct a questionnaire for client to develop understanding of unclear requirements client respond to requirement engineers questions and team update the requirement document and newly understand requirements are included in the requirement document after developing the understanding to problem team develop a story board that covers all possible client requirements, story board is sent to client and after the approval of client development team start working on application, the major drawback of this approach is that development team can't understand that what the actual user of application wants that is arises due to physical absence of actual user which is not faced in local environment and second drawback found is that medium of communication in GSD that working with that client who has different native language other than English, creates a problem to minimize this problem organization hired interpreter for communication with client but this seems risky whether interpreter delivering right requirements or not. Two projects are chosen for this study both projects have global clients for one project old traditional technique is used for requirement gathering and for second project new strategy is adopted its client is located in Germany, In this technique one stakeholder from client side is seated with development team he had remained with requirement gathering team in complete requirement gathering phase, he worked with requirement gathering as well as development team and transfer requirement understanding to requirement engineer and development team, once he transferred requirement of one module to development team, development team converts requirements to working application after his approval team gets signoff by him and start working on second module, this technique cover the following problems that are faced in traditional approach

Minimize requirement gathering time
Speedup development
Increase software quality
Application developed with in time and budget
Increase design quality

This technique also resolved the communication problem the client representative have fully command on germen as well on English so this factor minimize the communication risk also he has same native language of development team. He gets requirements from his organization in germen and then transferred to development in their native language, this technique mitigate the requirement misunderstanding risk because requirement engineering team feel comfortable while requirement elicitation in their native language. Client representative was aware of development team culture this factor minimize the cultural difference risk between development team and client. The outcomes of this study is that if the client is seated closely to development team in global software development this will increase productivity of team and minimize the following risks

Requirement misunderstanding risk
Software failure risk
Schedule overrun risk
Improve client involvement
Mitigate communication risk
Minimize cultural difference risk
Minimize design quality risk

Adopting new technique helped a lot in requirement gathering phase as well in development phase. This technique improves the relationship with client in term of business prospective. The project for which team used old traditional method for requirement elicitation, requirement are not gathered properly and it was very difficult for change control team to manage requirement change and client for continuously insisting for change and this cause following issues

- Requirement misunderstand
- Difficult to manage change requirement
- Schedule overrun
- Poor quality software
- Budget over run

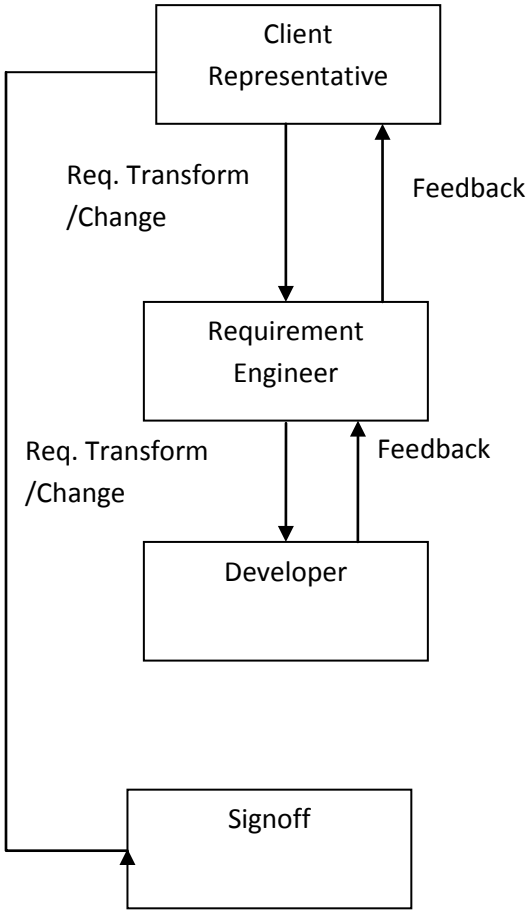

Fig 1: Software Development Process

6. EVALUATION AND RESULTS

Table 1.Risk factor table

Category	Risk Factor
Requirement Misunderstanding	Decreased
Software failure	Decreased
Schedule overrun	Decreased
Client Involvement	Decreased
Communication risk	Decreased
Cultural Difference	Decreased
Design Quality	Decreased

7. CONCLUSION

This study increased the knowledge of requirement gathering in global software development. Interviews were conducted by experienced requirement engineers that are involved in global software development that helps to understand the different techniques used in global software development. Many issues are identified in requirement elicitation phase and many lessons were learned. This study enables to understand the basic techniques used in global software development and introduce a new technique used in developing global software application. This enables us to understand relationship between client and software developing team working under one roof that leads to minimize the requirement misunderstanding, cultural difference, communication issues and schedule overrun problems in global software development. The limitation of this technique is that some time client representative is not willing to travel to software developing organization's country. In future work will be done to minimize impact of this factor on requirement elicitation phase.

8. ACKNOWLEDGMENTS

Our thanks to the Makabu experts who have contributed towards the successful implementation of this research.

9. REFERENCES

[1]. Damian, D. & Moitra, D., "Gdevelopment: How far have we come?" IEEE Software, 2006.

[2]. Oberg, R., Probasco, L., and Ericsson, M., "Applying Software White Paper, Cupertino, CA, 2000, pp. 3-5.

[3]. Ramesh,V. and Dennis,A.R. object oriented team:lesions for virtual teams from global software development,Proc.of HICSS35,Hawaii,2002

[4] .Finkelstein,A. Requirements Engineering: an overview. 2ndAsia-Pacific Software Engineering Conference (APSEC'93), Tokyo, requirements engineering. International Journal of Software Japan, 1993.

[5]. Sims, E.M., Reusable, lifelike virtual humans for mentoring and role-playing. Computers &Education, 49), (2007) 75-92.

[6]. Uschold, M. and Gruninger, M., Ontologies: Principles, Methods and Applications. Knowledge Engineering Review, 11), (1996) 93-115).

[7]. Chandrasekaran, B., Josephson, J.R., and Benjamins, V. Ontology of Tasks and Methods. In KAW'98. Alberta, Canada1998).

[8]. Heeks, R., Krishna, S., Nicholson, B., & Sahay, S.(2001). Synching or Sinking: Global Software Outsourcing Relationships. IEEE Software,18(2), 54-60.

[9]. Sahay, S., 2003. Global software alliances: the challenge of 'standardization". Scandinavian Journal of Information Systems. Vol. 15,2003, pp.3-21.

[10]. Ramzan, S., Ikram, N., 2006. Requirement Change Management Process Models: Activities, Artifacts and Roles. Multitopic Conference, 2006 INMIC '06 IEEE.

[11]. Mathiassen, L. Saarinen, T.Tuunanen, T. Rossi, M., 2004. Managing Requirements Engineering Risks: Analysis and Synthesis of the Literature.Helsinki School of Economics Working Papers W-379, 2004.

[12]. Ralyte, J.; Lamielle, X.; Arni-Bloch, N.; Leonard, M, "A framework for supporting management in distributed information systems development", Research Challenges in Information Science, Second International Conference on Digital Object Identifier:, 2008 , Page(s): 381 -392

[13]. Bass, M., Paulish, "Global Software Development Process Research at Siemens," The 3rd Int. Workshop on Global Software Development, 2004

[14].Robert K. Wysocki, "Effective Software Project Management, " Wiley Publishing, Inc. USA , 2006 , pp. 112-113

[15]. McIvor, R., P.K. Humphreys, and W.E. McAleer, "A Strategic Model for the Formulation of an Effective Make or Buy Decision." Management Decision, 1997. 35(2): p. 169-178.

[16].Christiansen, H.M., "Meeting the Challenge of Communication in Offshore Software Development, in Software Engineering Approaches for Offshore and Outsourced Development," S. First International Conference, Zurich, Switzerland, February 5-6, 2007. Revised Papers, Editor. Springer: Berlin / Heidelberg. p. 19-26. 2007.

[17].Rottman,J.W., "Successfully outsourcing embedded software development." Computer, 39(1): p. 55-61, 2006.

[18]. Tafti, M.H.A., "Risks factors associated with offshore IT outsourcing." Industrial Management & Data Systems,. 105(5): p. 549 - 560. 2005.

[19]. Khan, N., et al. "Evaluating Offshore IT Outsourcing in India: Supplier and Customer Scenarios. in hicss". 2003. Hawaii, USA.

[20]. Cusumano, M.A., " Managing software development in globally distributed teams ", ACM 2008 51 (2): p. 15-17

[21] .Bryson, N. and O.K. Ngwenyama, "Structuring IS Outsourcing Contracts for Mutual Gain: An Approach to Analyzing Performance Incentive Schemes." Journal of the Association for Information Systems, 1(9): p. 1-14. 2000

[22]. Ahmed, Z., "Outsourcing exposes firms to fraud, in Thursday, 16 June 2005, 22:42 GMT 23:42 UK,"http://news.bbc.co.uk/2/hi/business/4094894.stm, Editor. 2005: 23.02.2008.