Communication Issues in GSD

Yasir Hassan Shah[1], Mushtaq Raza[1] and Sami UlHaq[2]

[1]*Abdul Wali KhanUniversity Mardan, Pakistan*
[2]*Shaheed Zulfiqar Ali Bhutto Institute Of Science & Technology, Islamabad, Pakistan*
yasir_simplicity@yahoo.com

Abstract

Global Software Development (GSD) is gradually becoming the standard practice in the software industry. The core reasons for popularity of this approach are the substantial reduction in cost and development time, access to specialized skilled manpower across the globe, strategic flexibility and availability of support to perform 24/7 operations. Despite several benefits of GSD, there is still room for further improvements as it faces many challenges. One of the main challenges in distributed development is to establish effective communication and coordination mechanisms among the distributed teams to exploit their full potential. In this paper we have made an attempt to identify several communication issues that usually cause serious problems for developers, customers and testers of the GSD projects. We also suggest some measures to overcome these challenges.

Keywords: *Global Software Development, Distributed Software Development, Global Virtual Teams, Communication and Collaboration Issues in GSD, Communication Management*

1. Introduction

Software development environment is increasingly becoming distributed. In the last two decades, a paradigm shift in the software development approach from a purely centralized to a highly distributed development environment has been observed. Now software companies have development teams spread all over the globe that produce software through collaboration via electronic networks. The value of offshore software development market has increased 25-fold in the US over the past 10 years and predictions are that one-quarter of US spending on software development, integration and management services will go to offshore companies [14]. The prime reason for the popularity of distributed development of software projects is that GSD offers a number of benefits over the conventional techniques. The most important of these benefits is the substantial reduction in the development cost because of the disparities in wages of software engineers working in the developed and developing countries. GSD also leads to reduced development duration due to greater time zone effectiveness, as companies practice the so-called ‘follow-the-sun’ software development model. Additional benefits of GSD include access to a larger and better skilled developers’ pool, the possibility of greater innovations, learning and transfer of best practices because of enhanced interaction among development teams working across the globe. Furthermore, GSD can facilitate closer proximity to markets and customers. However, GSD also suffers from a number of challenges relating to communication, coordination and control of the software development process. The main challenge in distributed software development is to bring in place effective communication and collaboration practices so that teams working at distant locations can discuss issues and complexities associated with the software projects. Researchers like [1, 2]

have identified different issues that can cause problems in GSD communication and have accordingly proposed some solutions to solve these problems. Hanisch and Corbitt [4] particularly targeted communication issues associated with the Requirement Elicitation phase of the software development process. The involvement of customer and requirement for frequent communication among the teams have been stressed in the recent past [5] and accordingly the effect of formal and informal roles on GSD communication have been discussed [6, 7]. Diversity of spoken languages or cultural backgrounds can help to increase creativity, innovation and problem solving potential of a team [11]. Despite the previous work in this area, still many issues particularly related to communication and collaboration need to be addressed.

This paper is divided into five sections. In this section we outlined a brief introduction of GSD, its benefits and challenges. The next section provides an in-depth survey of literature to highlight the importance of addressing communication issues of GSD. In the third section we discuss some techniques to aptly manage communication and collaboration issue. The prospective future work to this research is described in the forth section and finally we conclude in the last section.

2. Literature Review

This section looks into the approaches used by different researchers to address the communication issues in the GSD context.

Aranda *et al.* [1] consider that the main problem in GSD is inadequate communication; and time, language and cultural differences are the main hurdles in devising effective communication strategy. The communication is mired due to nonexistence of knowledge management strategies and partly due to stockholder's cognitive aspects.

Min *et al.* [2] stress on the importance of communication with specific reference to GVTs (Global Virtual Teams) by identifying factors that affect communication including *selection & use of ICT, GVT management, degree of GVT virtualness, degree of GVTs' demographic diversity and task characteristics*.

Nordio *et al.* [3] analyze effects of distribution of locations and time zones on communication in distributed projects by demonstrating that the amount of communication in projects distributed in two locations is bigger than the communication in projects distributed in three locations as well as that the projects in closer time zones have more communication needs than the projects in farther time zones.

Hanisch and Corbitt [4] categorize communication issues associated with the Requirement Elicitation phase of the software development process with reference to the virtual domain into four types: -*Distribution of the Development Team, Distribution of the Clients and the Development Team, Cultural Differences between Clients and Development Team, and Cultural Differences among the Development Team*.

Korkala *et al.* [5] describe that rapid communication, regular agile meetings and involved customer are important success factors in distributed agile development, therefore, selection of the medium should be aligned with the needs of the task.

Cataldo and Herbsleb [6] describe the effect of formal and informal roles on the project by gathering data from two distinct GSD projects of two different companies. The study found that if there were no formal roles (e.g. architect, technical lead etc.) then a group of developers could act as liaison and work as gatekeepers to the geographical locations and manage dependencies between the teams; and the rest of

developers depend on these centrally positioned developers for coordination of their work with other locations. If formal roles are used then developers responsible for such roles tends to contribute less to the development effort.

Oshri *et al.* [7] emphasis that face to face meetings are sporadic, short, selective and formal to a great extent and hardly support the long term build up and renewal of interpersonal ties between dispersed counterparts.

Serce *et al.* [8] report that communication patterns in GSD are highly correlated to type of the task as well as culture and capabilities of the team.

Kobler *et al.* [9] describe that absence of effective communication and meetings among the GSD teams can lead to catastrophic consequence and the whole project may fail. The core reason is that the teams remain in a limbo and cannot maintain momentum due to lack of discussions, feedback and supervision.

Deshpande *et al.* [10] look into the effects of national and international cultural diversities on globally distributed projects and report that project managers have to deal with both national and international cultures making their job cumbersome.

MacGregor *et al.* [11] highlight that intercultural factors which are primarily based on fundamental values/principles of societies affect GSD activities as these factors explicitly or implicitly influence thinking and behavior of people.

Nguyen *et al.* [12] argue that cultural understanding, creditability, capabilities and personal visits are important factors in gaining the initial trust of a client, while cultural understanding, communication strategies, contract conformance, quality of delivered product, managing expectations and timely delivery are vital factors to maintain trust.

Grechanik *et al.* [13] explore the communication and coordination issues in the testing phase of distributed software development environments and reiterate that effective communication between testers and developers is vital to make the project a success.

Conchuir *et al.* [14] Debate that the benefit offered by GSD environment can easily turn into serious risks if the challenges faced by the GSD are not handled properly.

Jimenez *et al.* [15] examine challenges relating to DSD with particular reference to SME environments and stress that such challenges should be addressed upfront.

	Temporal Distance	Geographical Distance	Socio-Cultural Distance
Communication	Improved record of communications Reduced opportunities for synchronous communication	Closer proximity to market Access to remote skilled workforces Face to face meetings difficult	Innovation and sharing best practice Cultural misunderstandings
Coordination	Coordination needs can be minimised Typically increased coordination costs	More flexible coordination planning Reduced informal contact can lead to lack of critical task awareness	Greater learning and richer skill set Inconsistent work practices can impinge on effective coordination Reduced cooperation arising from misunderstanding
Control	Time zone effectiveness can be utilised for gaining efficient 24x7 working Management of project artefacts may be subject to delays	Communication channels can leave an audit trail Difficult to convey vision and strategy Perceived threat from training low-cost "rivals"	Proactiveness inherent in certain cultures Different perceptions of authority can undermine morale Managers must adapt to local regulations

Figure 1: Opportunities and Challenges in GSD [14]

3. Communication Framework

One of the strategies to overcoming inadequate communication practices being followed by the distributed development teams could be to impart training to software engineers on cultural differences by using ontology as communication facilitators [1]. The study of cognitive nature of people and the characteristics of their environment could be helpful in this regard. Emphasis on social communication between team members [2] should also be part of any type of training session on communication. Likewise, incorporation of *clear communication norms, use of synchronous technology and independence of tasks* are also probable solutions to communication issues [2].

The reply time for e-mails of projects with larger time zone difference are usually large [3], so it would be more appropriate to prefer voice communications using video conference or chat [4] on Skype or any other live chat software. However, the problem of difference of accent among various team members coupled with weak command on the foreign language (like English) by some team members could result in serious bottlenecks in effective communication. However, importance of face-to-face communication cannot be ignored even it is in the form of video chat.

Time zone difference causes more problems in GSD than cultural differences and can cause delays in exchange of view [4]. The integration problems and change in requirements are added factors in communication issues. There should be balance of experience on each side of communication as email serves a little in explaining system requirements. Therefore, GSD video conferencing is a suitable choice to achieve face-to-face communication.

In agile software development, information is not hidden among the teams and team members who make it agile a more suitable technique for GSD [5]. Rapid communication is likely to cut down the amount of time spent on major decisions and error rate could be decreased through the customer involvement. However, the customer involvement should be kept bare minimum as precisely to the specific issue so that they may not think that developers are transferring their responsibilities to them.

In GSD environment, the face-to-face meetings should be preceded and followed by certain activities [7]. Preceding activities may include video-conferencing so that counterparts located at distant locations can get acquainted and familiarize with each other's communication styles. The preceding activities should focus primarily on team building aerobics. The succeeding activities may include regular and frequent communication among the counterparts to discuss issues related with software development and on any administrative issues.

In GSD, task type seems to be the most important factor in promoting collaboration among the team members. The highest chunk of communication activities relate to *contributing behaviors, exchanging resources* and *feedback* [8]. *Planning* and *seeking input* behaviors have an equal proportion while the behaviors associated with *feedback seeking, organizing work* and *group skills* have the highest proportions in the planning and seeking input areas and *Reflection, monitoring* and *social interaction* have the lowest proportions [8].

Social-temporal norms and temporal structures of the participating team members in GSD projects are the root cause of insufficient meetings among them [9] which may lead to the failure of a project.

The challenges associated with the cultural diversity can be overcome by educating the GSD team members on cultural and religious values of different societies [10].

Moreover, few lessons on ethics and importance of respecting others culture and religion can help to counter the cultural diversity problems.

Cross-cultural issues can lead to miscommunication, misunderstanding, frustration and underutilization of talents [11] thus posing significant risks to the GSD process. Therefore, it is imperative to identify and address issues related to cross-cultural sensitivity. Differences in work-style and collaboration approach of teams which are not co-located and culturally non-homogenous manifest that both the managers and developers should work out modalities to increase trust, like acquainting themselves about other cultures and languages.

An important issue in GSD environment is to perform testing of the software developed at disparate locations for quality assurance purposes. Distributed testing entails strong sense of responsibility among the GDS teams coupled with effective communication and coordination mechanism among the team members.

In short, large time zone differences, cultural diversities, trust among customers and developers language diversities are the fundamental factors that can cause failure of a project. In view of this it is imperative to work out a framework that aptly addresses these challenges.

4. Future Work

Distinctive solutions for communication challenges in the GSD environment have been proposed by many researchers, but still there caveats are affixed with these solutions, For example, recommending videoconferencing for effective communication among the GSD teams can also suffer a pitfall of language and time zone differences. Emails and text messages on the other hand can be useful but teams members still needs to have good grasp on the language to effectively convey their view points. A possible solution could be to use modularization of work approach to decrease the flow of communication among the GSD teams [4], but this methodology may produce conflicts during the integration and change management phases. This requires that further research work is required to be undertaken to formulate a viable solutions for the communication challenges in the GSD environment.

5. Conclusion

One of the main challenges of GSD practices is to ensure effective communication among the team members as in most of the cases GSD teams use electronic communication media for correspondence. In this paper we have explored the key factors that create hindrance in communication like language difference, cultural difference, temporal structures and cognitive aspects etc. We also looked into the solutions proposed in the literature for making the communication process simpler and effective. The solution identified through this study include using ontologies as communication facilitators, modularization of work, study of the cognitive nature of people and the characteristics of their environment and training on cultural norms. Our study also finds that agile development techniques are best suited for GSD environment due to their direct approach on making software development process quicker.

References

[1] Gabriela N. Aranda, Aurora Vizcaíno, Mario Piattini, “Analyzing and Evaluating the Main Factors that Challenge Global Software Development”, The Open Software Engineering Journal, vol. 4, **(2010)**, pp. 14-25.

[2] Qingfei Min, Zhenhua Liu, Shaobo Ji, "Communication Effectiveness in Global Virtual Teams: A Case Study of Software Outsourcing Industry in China", Proceedings of the 43rd Hawaii International Conference on System Sciences, IEEE Computer Society, **(2010)**. pp. 1-8.

[3] Martin Nordio, H.Christian Estler, Bertrand Meyer, Julian Tschannen, Carlo Ghezzi, Elisabetta Di Nitto, "How do Distribution and Time Zones affect Software Development? A Case Study on Communication", ETH Zurich, Switzerland & Politecnico di Milano, Italy, **(2011)**.

[4] Hanisch, Jo, Corbitt, Brian, "REQUIREMENTS ENGINEERING DURING GLOBAL SOFTWARE DEVELOPMENT: SOME IMPEDIMENTS TO THE REQUIREMENTS ENGINEERING PROCESS. A CASE STUDY", School of Accounting and Information Systems, University of South Australia & Deakin University Melbourne, **(2004)**.

[5] Mikko Korkala, Minna Pikkarainen, Kieran Conboy, "A Case Study of Customer Communication in Globally Distributed Software Product Development", Proceedings of the 11th International Conference on Product Focused Software, Limerick, **(2010)** June 21-23, pp. 43-46, doi:10.1145/1961258.1961269.

[6] Marcelo Cataldo and James D. Herbsleb, "Communication Patterns in Geographically Distributed Software Development and Engineers' Contributions to the Development Effort", Proceedings of the International Workshop on Cooperative and Human Aspects of Software Engineering (CHASE), **(2008)**, pp. 25-28.

[7] Ilan Oshri, Julia Kotlarsky, and Leslie Willcocks, "BUILDING SOCIAL TIES for GLOBAL TEAMWORK", COMMUNICATIONS OF THE ACM, vol. 51, no. 4, **(2008)**, pp. 78-81.

[8] Fatma Cemile Serce, Ferda Nur Alpaslan, Kathleen Swigger, "Exploring Collaboration Patterns among Global Software Development Teams", Fourth IEEE International Conference on Global Software Engineering, **(2009)**. pp. 61-70, DOI 10.1109/ICGSE.2009.14.

[9] Felix Kobler, Marilyn Tremaine, Jan Marco Leimeister, Helmut Krcmar, "NON-OPTIMIZED TEMPORAL STRUCTURES AS A FAILURE FACTOR IN VIRTUAL TEAMS", Technische University Munchen, Rutgers University & University Kassel, **(2007)**.

[10] Sadhana Deshpande, Ita Richardson, Valentine Casey, Sarah Beecham, "Culture in Global Software development - a Weakness or Strength?", Proceedings of the 5th IEEE International Conference on Global Software Engineering, **(2010)**, DOI:10.1109/ICGSE.2010.16.

[11] Eve MacGregor, Yvonne Hsieh, Philippe Kruchten, "THE IMPACT OF INTERCULTURAL FACTORS ON GLOBAL SOFTWARE DEVELOPMENT", Proceedings of the 18th Annual Canadian Conference on Electrical and Computer Engineering (CCECE05), IEEE, **(2005)**, pp.920-926.

[12] Phong Thanh Nguyen, Muhammad Ali Babar, June M. Verner, "Critical Factors in Establishing and Maintaining Trust in Software Outsourcing Relationships", Proceedings of the 28th International Conference on Software Engineering (ICSE'06), ACM, **(2006)**, pp. 624-627.

[13] Mark Grechanik, James A. Jones, Alessandro Orso, Andre van der Hoek, "Bridging Gaps between Developers and Testers in Globally distributed Software Development", Proceedings of the FSE/SDP Workshop on Future of Software Engineering Research, ACM, **(2010)**, pp. 149-154, doi:10.1145/1882362.1882394.

[14] Eoin Conchuir, Par J. Agerfalk, Helena H. Olsson, and Brian Fitzgerald, "Global Software Development: Where are the Benefits?", Communications of the ACM, vol. 52 no. 8, **(2009)**, pp. 127-131.

[15] Miguel Jimenez, Aurora Vizcaino and Mario Piattini," Improving Distributed Software Development in Small and Medium Enterprises", The Open Software Engineering Journal, vol. 4, **(2010)**, pp. 26-37.

Authors

Yasir Hassan Shah

Yasir Hassan Shah has graduated in Master of Computer Science (MCS) from Abdul Wali Khan University Mardan (AWKUM), Pakistan. Currently, he is looking to take admission in MS. His research interests include software engineering.

Mushtaq Raza

Mushtaq Raza has done Master of Science in Computer Sciences, MS (CS) from Shaheed Zulfikar Ali Bhutto Institute of Science and Technology (SZABIST), Islamabad, Pakistan. He has been serving in Abdul Wali Khan University Mardan (AWKUM), Pakistan as assistant professor. His research interests include Software Engineering, Usability Engineering, Databases, and Global Software Development.

Sami Ulhaq

Sami Ulhaq has done BS (hons) in Computer Sciences from University of Malakand, Pakistan. Currently he is a full time student of MS (Computing) with major Software Engineering, at Shaheed Zulfikar Ali Bhutto Institute of Science and Technology (SZABIST), Islamabad, Pakistan. His Research Interests comprise Global Software Development, Software Requirement Engineering, Software Quality Engineering, Software Project Management and Data Warehouse.