

5

The Effect of Cultural Differences on Software Development

D Patel, C Lamson-Johnson & S Patel

This study investigates the cultural issues concerning software development in which the United States (US) and Europe outsource their Information Technology (IT) offshore to emerging countries. Though the benefits of Offshore Software Development (OSD) may result in reduced labour costs for UK and Europeans software development companies; there are concerns about the practice as there are other impacts. The virtual setting of the global environment inhibits team cohesion and interferes with the communication process as the teams collaborate across both regional and functional boundaries. This presents challenges in the cross-cultural relationship of OSD projects as it influences work ethics, task performance and other factors, not just at a management level but at all levels in the organisation. Evidence of the dynamic effect of culture is demonstrated through the experiences of experts associated with OSD; highlighting cultural variables that negatively influence the quality, time and cost of software development.

1. Introduction

Traditionally software is developed within a company's Information Technology (IT) department or a few stages are outsourced to other developers within the same region. In the 1990's, another category of outsourcing, offshoring was adopted as a method of dealing with severe shortages of (IT) professionals in the United States and Europe. With an abundance of skilled IT professionals in emerging countries such as India, software development was transferred to IT offshoring destinations to benefit from the pool of global talent which allowed for quick assembling of fully staffed project teams. This enabled IT projects to be completed quickly, within the schedule time and budget, thus resulting in huge profits for software development companies [Igbaria and Shayo, 2004].

Within a decade, the globalization of many IT firms, such as Microsoft, International Business Machines (IBM) and others, has contributed to software development being transferred to a number of other emerging countries in Asia, including China, Philippines, Singapore, Malaysia and others. The main benefit of OSD for US and European IT firms may be highlighted by the difference in wages for IT professionals. [Igbaria and Shayo, 2004] reported that IT professionals' wages in India were approximately 50% less than a US software development contractor. Though wages in Asia may have increased over a period; evidence still shows that increasing trends in offshoring have caused significant changes to the IT job markets. A global IT offshoring report from Horasis [2005] confirmed that US software development companies have cut full-time jobs by 50 percent removing large capital and valuable jobs from the US job market. In Europe,

the job of basic programming has drastically been reduced as software companies will often choose to subcontract IT projects [Meyer, 2006]. The trend in offshoring has caused many concerns for the IT Industry as it impacts on the process of software development as a whole.

Today, many software development companies are disappointed with the results of offshoring projects proving that OSD is more complex than finding IT skills and resources in low cost locations. According to Meyer [2002], at least 40 percent of software development offshore projects failed in delivering the expected benefits; mainly due to soft issues that cause problems and inhibit project delivery. Currently, there is very little analysis on soft issues such as cultural differences due to the difficulties in measuring the effect of the human factors of the process [Cherry and Robillard, 2008]. As software development heavily relies on human interaction to removed ambiguity from the development stages, it is important to determine the elements that inhibit the success of OSD projects. Studies of global teams in a virtual setting show that cultural differences affect work ethic, work hours, preferred method of communication, revering hierarchy and other factors which may have a negative influence on the experiences of team members [Edwards and Sridhar, 2002]. Therefore an awareness of the cultural factors that may impede the success of Global Software Development (GSD) may assist in effective management of OSD projects.

This study focuses on the cross-cultural context of GSD environment in an effort to determine the effect of culture on software development. In *section 2*, the nature of OSD environment is described and the concept of culture is defined to show how cultural differences may influence the software development process. *Section 3* describes the process used to examine the problems and complexities associated with cultural differences in OSD, while *Section 4* reports the research findings. The findings look at experts' view of how cultural differences interfered with the success of offshoring projects and further demonstrate the dynamics of culture on the global process of software development. Finally, *section 5* concludes by summarizing the main findings of the cultural impact on OSD projects and suggest future work in the area of IT offshoring.

2. Global Software Development Structure and Culture

The traditional approach of face-to-face in-house software development has been shifted to a more "virtual" nature using advanced communication technologies such as teleconferencing, videoconferencing, emailing and NetMeeting. This presents challenges in the management of GSD as team members are from a number of nations with varied social, economic and cultural background and are in diverse locations both onsite and offsite, spread geographically over time zones [Dafoulas and Macauloy, 2001]. Team members also belong to two or more organisations or one organisation and its subsidiaries, in contractual agreements across national boundaries [Huang and Trauth, 2007]. The separation due to the distance between team members interferes with the interaction process including feedback mechanisms, which are necessary for the advancement of the software development stages. For example, the time difference of 10 hours between

the US and India may create difficulties in scheduling of conference calls and meetings. Tasks that are passed backwards and forwards overnight may also encounter delays in clarifying information. Severe communication problems may develop which impacts directly on product delivery [Kobayashi-Hillary, 2005].

The software development stages are communication-intensive especially the requirements stage which is relied on to remove ambiguity from the process. Edwards and Sridhar [2006] confirm that mistakes made in this stage are passed into the latter stages of the development cycle. Even though English is the standard language used to communicate in offshore projects, among the participants there are variations of the language which influences the stages of software development. As a result, some participants are more comfortable with reading than speaking or listening to the language. Thus the team face challenges in pinning down requirements due to diverse interpretation and understanding while relying on sophisticated communication technologies [Huang and Truth, 2007]. The problems encountered in clarifying requirements create delays which impact on the project schedule. Similarly, odd English phrases are reported in the coding stages which require extended time in clarify terminologies and levels of details [Matloff, 2005]. When difficulties are frequently experienced with documentation, it increases the budget which may contribute to the failure of OSD projects.

Culture is a multi-faceted concept which is described by Hofstede [1982] as “the common characteristic which distinguishes the members of one human group from another.” It may be applied in terms of nations or regions or ethnic groups, but also to the collection of human groups within organisations. Global software development benefits from the differences in culture as it promotes creativity, innovation, and enables the adaptability of software to different nations in the global IT markets [Huang and Trauth, 2007; Edwards and Sridar, 2006]. However, cultural differences influence the relationship among GSD teams as it subtly shapes individuals’ perceptions, attitudes and behaviour [Mullins, 2007]. Studies by Olson and Olson [2003] exemplify how the US approaches software development differently compared to the Middle East. Time and deadlines are taken seriously in task oriented cultures, such as the US, than in other relationship orientated cultures, such as in India. Therefore team members from the US will settle down to work more quickly than their colleagues from the Middle East, who will spend more time getting to know each other. This implies that the teams’ impression of each other is unconsciously influenced from the beginning of OSD projects which may affect the day-to-day operation of the team. Subsequently it creates problems for the team to relate to each other which increase complexities in the management of projects; this further impacts the outcome of software development.

3. The Process of Investigating Software Development Offshoring

Data Collection

This study utilizes a semi-structured approach in investigating the present trend of the US and Europe offshoring to emerging companies. In determining the foundation of problems and complexities that are experienced in OSD due to cultural differences, paper

questionnaires were prepared to gather information from known software development companies such as Microsoft Corporation, IBM, Sun Microsystems, Intel and other large software vendors well known for IT offshore outsourcing. There was a very poor response from these large multinational software development companies as telephone conversations and email contacts unfortunately revealed that the time and resources were not available to lend their expertise on the subject. Through consultation with other experts, to maximise the response rates, a decision was further taken to convert the paper questionnaire to an online survey set up on a website that facilitated the collection of responses and provided numerical analysis of the data. The website tools facilitated both open and closed ended questions which were adequate for the transfer of the paper questionnaire. It incorporated Likert scaling which is frequently used in survey research to measure constructs such as attitudes and opinions [Wu, 2007]. This function enabled average scoring of the respondents' level of agreement to questions which was further used to analyse responses after the survey was completed.

Participants

The online survey Part 1 began at the end of June 2008. The online link to the survey was emailed to approximately 200 software development companies explaining its significance in managing OSD projects. The survey consisted of 10 questions of which questions 1 to 5 were generalised questions on offshoring; while questions 6 to 10 were more specific to culture. The slow progress experienced in the participation of software development companies, revealed that the subject of culture may be considered highly sensitive. It is possible that due to the specific nature of the survey questions, organisations may not be eager to express their beliefs for the fear that it may threaten the existence of harmonious relationships with their offshore counterparts. Many organisations may prefer to address a sensitive topic such as culture by using known professionals who provides cross-cultural training for OSD projects [Kobayashi-Hillary, 2004]. Nevertheless, the IT companies that participated revealed valuable information and insights into the developments of IT offshoring. The research findings are revealed in *section 4.1*.

The online research approach initiated a second part to the survey that began in July 2008. This part of the survey targeted knowledge-based experts in IT offshoring, with the aim of further examining in detail the dynamics of culture in the practice of GSD. A similar approach was taken where 10 questions were created that ranged from general questions of outsourcing such as risks and benefits, to more specific ones that included discrepancies between virtual and face-to-face software development collaborations. The survey was sent to approximately 100 experts after a careful selection of the most appropriate experts that could contribute knowledge in the area of culture in IT outsourcing. Informal emails were not as successful and may have been perceived as spam mail. Therefore formal emails were sent to the experts and after a fortnight more experts responded to the survey, than in Part 1. It was evident that the experts trusted the emails which successfully resulted in a professional relationship where they were more willing to provide experiences of cultural differences in OSD projects. Some

experts replied to the emails with openness to provide more information, others also expressed interest in the results of the survey. The research findings are revealed in *section 4.2*

4. The Influence of Culture in Global Software Development

4.1 Findings from Survey Part 1

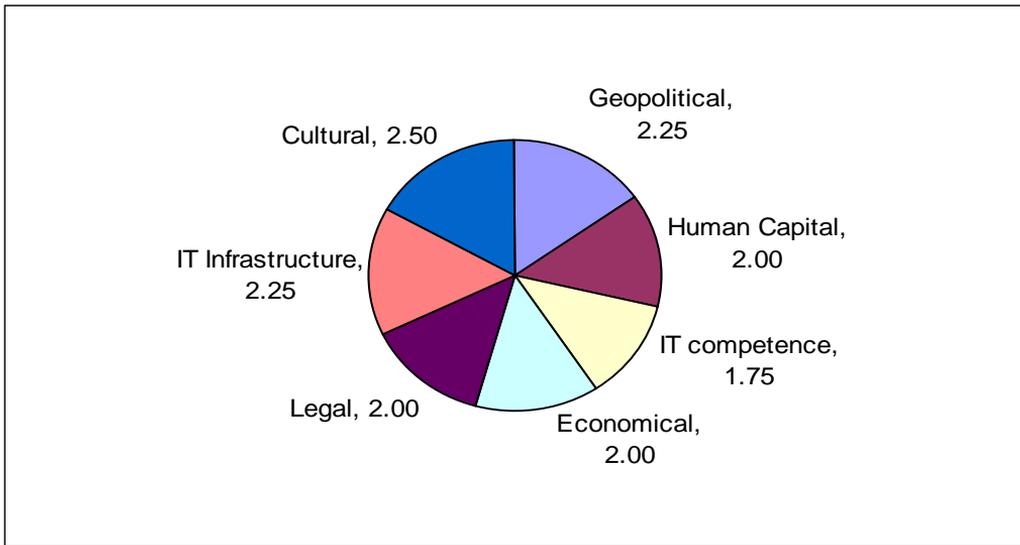
4.1.1 Popular Offshoring Locations

The findings from this part of the survey confirmed the importance of culture in the contractual relationship of GSD. India's language compatibility with the US and Europe has contributed to its popularity of offshore location over China and other Asian nations for a very long period. The responses from the software development companies substantiate that India has been a high quality software development destination. Offshoring to India was described as "cost-effective" and as having "advanced IT" capabilities. The percentage of IT organisations that offshore to China was quite significant although the reason for choosing china was not clearly defined. Although Huang and Trauth, [2007] revealed the potential of china as an offshoring location, India has remained the number one offshoring destination for a long time which is because of its language similarity with the US and Europe. The results confirmed that that similarity in cultures supports organizations' decision making in the choice of offshore locations.

4.1.2 Offshoring Risks

Inadequate risk management may result in IT projects exceeding its estimated time and cost [Sakthivel, 2007]. Moreover in OSD projects, it is crucial for US and European companies to consider the risk factors in deciding an offshore location. Minevich and Richter [2005] identified seven significant risk factors that are associated with offshore locations, geopolitical, human capital, IT competency, economical, legal, IT infrastructure and cultural risks. Based on Minevich and Richter [2005] risk factors, the results from the survey (Figure 1) showed Cultural risk on a scale of 1 to 5 scoring the highest rating average of 2.5. The complex nature of offshore outsourcing requires that the US and Europe analyse the cultural risk for software development destination in relation to language compatibility, cultural similarities, innovation and adaptability. The result signifies that cultural risk in terms of language compatibility is of great importance in determining the possibility of loss to offshore locations. This result is not surprising given that India with its English Language compatibility with the US and Europe, is quiet a popular choice for IT offshoring.

Figure 1: Average rating of Offshoring risks



4.1.3 Benefits of offshoring

Igbaria and Shayo [2004] identified “Low cost labour” as the primary reason for the US and Europe trend in IT offshoring. This theory is supported by Sakhivel, 2007 which pointed out that the IT companies benefited from relatively low cost labour from Asian countries, such as India and China. However the survey findings (*Table 1*) revealed on a scale of 1 to 5, ‘low cost labour’ scored one of the lowest average ratings of 3. IT Management expert Stan Gibson [2006] has reported a continued wage increase in Asia, specifically in India, and the results may be associated with the steady increase in wages over the period. Although wages in Asian offshore locations are not quite as low as in the 1990’s when the trend began, offshoring is valuable to US and European companies.

Table 1: Average rating of offshoring Benefits

BENEFITS	RATING AVERAGE
Access to Global Talent	3.25
Global Expansion	3.25
Limited Presence	2.5
Quick Completion	3.25
Lower Labour Cost	3.00

The results further substantiate that one of the most valuable benefits of IT offshoring is “access to global IT talent”. This has remained a priority for offshoring as it removes the burden of in-house software development and enables access to offshore resources [Oza et al., 2004]. The underlying theory of “global” software development is confirmed given that the US and Europe IT firms expect “quick completion” of OSD projects within the estimated time and budget. However many companies proved that the benefits of OSD may not be as explicit because the structure of software development is governed by the dynamics of national, regional and functional boundaries [McAllister 2003; Dafoulas and Macaulay, 2001]. The dynamics are displayed in the teams’ relationship which is revealed in the findings of survey part 2.

4.2 Findings from Survey Part 2

The experts that participated in this part of the survey worked or studied in OSD cross-cultural relationships over a period ranging from 5-20 years. Their vast cross-cultural knowledge and experiences enabled informed responses confirming that the geographical features of GSD have an effect on the quality of relationship among OSD team members. The responses provide evidence that software development team cohesion is inhibited due to the differences in perception and interpretation that are associated with national, regional and organisational boundaries. The remainder of this section highlights a number of the experts’ responses for the purpose of demonstrating the effect of cultural differences on the global practice of software development.

4.2.1 Different perspectives

Expert Response: “Power distance and the willingness to take initiatives in a business transformation project.”

The statement implies that the preferences of the Western and the Asian worlds are related to the cultural backgrounds. It is based on Hostede cultural dimensions, which is a conceptual theory that is useful in analysing the cultural characteristics of different nations. For Example, India is regarded as having a large power distance society which means that they have a strong preference for hierarchical team structures, which is the opposite for the societies of the US and the UK that encourage a flatter team structure [Macgregor et. al, 2005]. In India, a subordinate’s perception of the manager is as a “superior” that executes the rights of decision-making and his/her authority will remain unchallenged. Therefore the subordinate’s performance is dependent on the frequency of instruction that is given by his superiors. This attitude of dependency on management is quite normal in the Indian culture but when observed from a Western perspective such as the US and UK where managers and subordinates prefer a more consultative type of relationship, it may be regarded as failure in taking initiatives for the advancement of OSD projects [Narayanaswamy and Henry, 2005].

Expert response: “Typically Indian engineers are less likely to push back on issues or to innovate. American engineers and managers tend to be more out spoken. This leads to things being one sided and where American

outsourcers really don't know the true status of things with the Indian offshore provider."

The findings indicate that the different perspectives of the Western and Asian cultures result in differences in attitudes and behaviours. This factor influences the manager-subordinate perception in cross-cultural relationships in OSD as individuals' unawareness of cultural differences may result in increasingly negative criticisms on both sides. A US manager may criticize the lack of performance of Indian subordinates based on expectations of US teams or Indian subordinates complain for the lack of guidance throughout the software development process based on expectations of Indian Managers. Studies revealed that the different preferences of the Western and Asian societies are related to the characteristics of the educational systems. Huang and Trauth 2007 associate Chinese software developers' unwillingness to speak up in project discussions with Chinese Confucian philosophy and ancient tradition that emphasize authority; where it is not the custom to question a teacher. In contrast to the US where students are encouraged to participate in open class discussions, teachers in China tend not to engage students in open discussions [Matloff, 2005]. The traits have been established in the communication styles, work behaviour and the business cultures of the Western and Asian societies.

4.2.2 Lack of Trust

Expert Response: "When people are physically co-located it is much easier to observe and adapt to local norms (do as the Romans do). Over the phone much of the context is lost."

The expert statement confirms that software development is significantly different when conducted in-house than in a virtual setting. The physical distances between the team members in GSD give rise to misperception and misunderstanding that influences factors such as trust which from the outset creates difficulty in building relationships. From a Western perspective trust is earned based on assessment of competence and the ability to effectively perform. On the other hand, from an Asian perspective trust is based on perceived reliability and in the transfer of shared values and belief [Winkler et al., 2008]. These factors indicate that perceptions are influenced by the way tasks are performed by team members from other cultures. Each subsidiary in multi-site organizations will have its own "site culture" which means that "sites" members will share similar view in regards to the rest of the organisation [Armstrong and Cole, 1995]. Therefore biases that are shared among "site" members may lead to innovative ideas being withheld based on their perception of the rest of the organization. This proves that trust among the team member may be reduced because of the differences in functional, organisational and regional practices. The lack of trust influences the cohesion of the team's which may be difficult to improve given that some team members are onsite while others are in remote locations.

Expert response: "could think of Indian's way of performing only as many of our customers had complaints."

The findings from the expert confirmed that the software development team performance is frequently based on the expectation of the US and UK cultures. The Standard Software Development Methodologies used in offshore projects are from a Western perspective. However, it is important to understand that the application of knowledge and skills in emerging countries such as India is severely different from Western countries which may be misunderstood for incompetence [Edward and Sridhar, 2006; Winkler et al. 2008]. Based on US software development customs the team is expected to openly discuss misunderstandings. In Asian cultures, such as Indian and Chinese, there is a high importance of maintaining mutual harmony within the group and not embarrassing persons in front of the others [Yeo, 2001]. Therefore as direct confrontation is deemed rude and giving frank negative opinion of others is regarded as detrimental to the relationship of the group, there is a tendency for individuals to internalise their opinions to avoid conflicts [Huang and Trauth, 2007]. Another factor that reduces trust in GSD teams is the difference in communication styles. For cultures such as India, ‘yes’ does not necessarily mean ‘I agree’ but means ‘I heard’ which poses questions for US and UK colleagues in terms of how much of an instruction is clearly understood [Matloff, 2005]. Subsequently, India’s cultural custom of “nodding the heads” often confused US and European team members. Lack of trust influences GDS team morale reducing the quality of relationship throughout the OSD projects.

4.2.3 The Range in language Competence

Expert Response: “While working with Chinese partners it was clear that their language skills were limited. Conversations were very difficult over the phone. We had to switch to email in order to understand one another.”

The cultural context of communication places further pressure on the communication patterns in the software development stages that may be already experiencing difficulty because of OSD dependence on sophisticated communication technology. The communication technologies used in OSD may create “noise”, thus causing the context of information exchange to be lost. The concept of “noise” means anything that interferes with the communication process of the team collaborating across geographical boundaries and time zones. Furthermore, though English may be the standard language used among the US, UK and the emerging nations that engage in OSD, team members are from different continents which create communication barriers caused by semantics given that words may be absent, or have different meanings or translation in a particular local language (Kobayashi-Hillary, 2004). Some words and intonation may have different meanings to people from a local region or even a country. Therefore misunderstandings and disagreements may develop which may lead to conflicts that increase complexities in the management of OSD projects.

Expert Response: “Communication and ‘business’-communication in particular is impacted by the cultural context. If wrongly understood this will/ may lead to misinterpretation.”

The research findings based on the experts' perspectives show that the cultural context of the environment impacts on the communication because of the range in language skills that create difficulty in cross-cultural conversations. Thus the team dispersed over multiple time zones using sophisticated communication technology, is a challenge in itself as it influences the knowledge transfers and information exchange. The gradual advancement of the software development stages is impeded as the geographical distance prevents informal communication that creates difficulties in clarifying issues. This leaves room for assumptions in the requirements stage that causes problems in the latter stages of the development [Edwards and Sridhar, 2006]. The range in language competence also affects the documentation of processes including the codes that contains phases or comments which may be inconsistent in meaning in Western and Asian countries [Matloff, 2005]. This results in an offshoring hidden cost, as codes need to be written again which significantly affects the contractual relationships. The factors indicate that the interaction in GSD is affected by cultural context of the environment which in turn will influence the development process as the complexity of the situation will produce disagreements over functionalities, tasks, processes and methodologies which will encourage conflicts.

4.2.4 Conflict and its influence on other variables

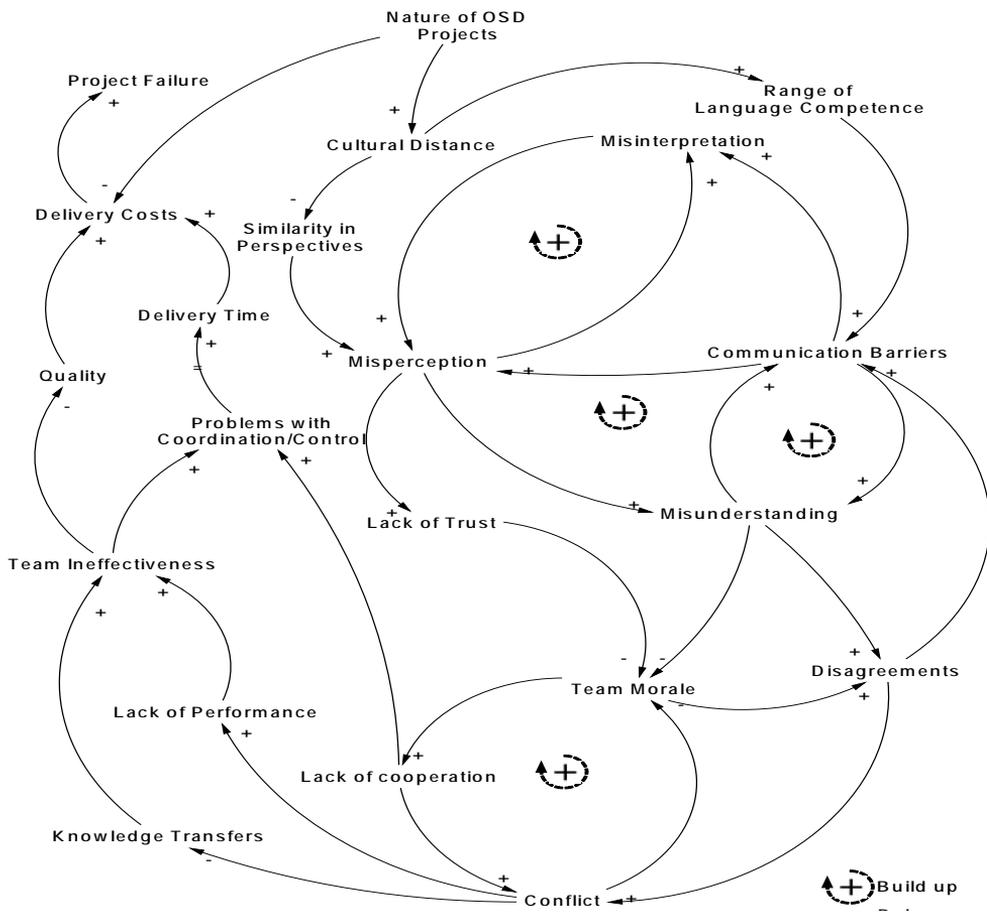
Expert Response: "My research findings show that cultural differences become apparent as behavioural differences in service delivery. It is important to be sensitive to such behavioural differences, as they may negatively affect relationship quality (e.g., if conflicts occur), which in turn has a negative influence on offshoring success (e.g., reduced service quality or project delays)"

The experts' responses confirmed that the success of OSD projects is dependent on the knowledge and understanding of the persons that are employed in offshore contracts. As team members are incorporated from different regions of the world, it implies that different specialist knowledge is to be shared for the success of offshore projects. The difference in preferences, attitudes, behaviour and communication of the Western and Asian societies subtly influences OSD teams' expectations of each other producing conflict that reduces the effectiveness of the team. This decreases knowledge transfers that are critical for the advancement of OSD projects, thus influencing factors such as innovation in the software development process. Persistent conflict adds complexities to the management of the software development projects. This problem further increases misunderstanding and causes teams members to constantly disagree with each other over requirements, methodologies and other issues. Subsequently the continued conflict damages the communication structure influencing other factors that create more difficulty in the coordination and control of OSD projects. In essence, it reduces the level of team performance and affects the quality of product development; hence a time delay occurs that pushes forward the project deadline and adds to the delivery costs. Therefore the spiralling of the cultural factors identified often results in failure of software development offshore projects.

4.3 The influence of culture

The dynamics of cultural differences are experienced at various levels of the organisation where its subtle appearance is demonstrated through the preferences of individuals and groups, work practices and other areas in IT offshoring. The survey findings proved that cultural differences have contributed to a number of problems in OSD projects. The evidence shows that the harmony of the team, the stages of software development and also the management has been affected due to the subtle differences in values and beliefs of multi-national teams. For effective management of OSD projects, it is important to understanding the elements that lie behind the differences. Therefore the variables identified are used in an influence diagram (Figure 2) to conceptualize the complexity of problems associated with cultural differences in the US and Europe offshoring software development.

Figure 2: The Effect of Culture



The influence diagram reveals the basis of cultural distance to include time, distance and cultural differences, which are critical factors to the success of OSD Projects. The dynamics of the variables shows that the perspectives of nations (US, Europe and the emerging countries of Asia) that are involved in IT offshoring are significantly different based on their cultures. The different preferences in hierarchical structures, software development tools, communication, work ethics and other factors pose problems with misperceptions and misinterpretations that affect the level of trust among OSD teams. Additionally, the range in English language competence increases communication barriers in the stages of software development which further escalates into misunderstandings and disagreements. These factors influence the persistence of conflict that continues to deteriorate the team's morale, cooperation, performance and knowledge transfers. Finally, the ineffectiveness of the team obstructs the progress of software development and increase complexities in the coordination and control of offshore projects.

5. Conclusion

The research finding shows that cultural diversity in offshoring may complicate factors that lead to the failure of software development projects. Individuals from the Western (the US and Europe) and emerging Asian nations such as India and China, collaborating across continents will approach situations and tasks from opposite perspectives. The varying perspectives interfere with the manager-subordinate and the peer-to-peer relationships as each nation have different preferences in the practice of software development. This influences the quality of the development process through misperceptions and misinterpretations resulting in poor communication and reduced trust in the relationships. The gradual progress of the software development stages are inhibited due to communication difficulties which includes the range in English language competence of the team members. These human variables interfere with the day-to day team interactions producing misunderstandings and disagreements that lead to persistent conflicts. Persistent conflict influences other variables such as the knowledge transfer, the team effectiveness, performance and, coordination and control increasing the complexities of managing the software development process. A culmination of the challenges experienced decreases the quality of the product, increases the time and overall cost which often result in failure of OSD projects.

The team members of GSD are located in different regions of the world, using sophisticated communications technology, over geographical distances and time zones. This factor restricts the team's cohesion and interferes with the communication process in OSD projects. Additionally, individuals' tendencies and preferences are present from the start of offshoring projects due to national, functional, organisational and soci-cultural backgrounds. The cultural expectations subtly influence how the members relate to each other and based on cultural distance, the nations will not behave in a similar manner. Nevertheless, the main problems experienced in OSD projects lie in the fact that the nations approach communication and work from opposite perspectives. Many organisations that engage in offshoring are unaware of the subtlety of culture that

influences the outcome of software development projects. Therefore this study shows the importance for organisations to develop strategies to mitigate the negative effect of culture as it impedes the success of OSD projects.

Cultural compatibility and similarity is an important factor in the US and Europe offshoring software development as it contributes to the decision making of offshore locations. The study confirmed that India's language compatibility with the US and Europe has assured the country the number one offshore location for quite a long period over China and other Asian nations. Presently, the US and European firms are taking the opportunity to transfer software development to countries in their regions due to the geographical proximity and the cultural compatibility. A report from The Times of India [2005] confirms US "friendly policies" to develop Latin America countries such as Brazil, Argentina, Mexico and Costa Rica into high quality nearshoring locations. The same trend is expected in Europe for Russia, Poland, Romania and Hungary. Though Asian nations, such as India are still quiet competitive as an offshoring destination, nearshoring locations score higher points for communication due to the similarity in languages and cultural understanding [Meyer, 2006]. This result indicates that cultural compatibility is changing the trends in IT offshoring locations. The developments in this area require future research as it will provide further evidence of the dynamic nature of culture. The studies will provide valuable insight into the future of software development outsourcing.

6. References

- ARMSTRONG, D. AND COLE, P. (1995) *Managing Distances and Differences in Geographically Distributed Work Groups, Diversity in work teams: Research paradigms for a changing workplace*, Distributed work. Cambridge: MIT Press pp.187-215.
- CHERRY, S. AND ROBILLARD, P. (2008) The social side of software engineering- A real ad hoc collaboration network, *International Journal of Human-Computer Studies* Volume 66 Issue 7 pp. 495-505.
- DAFAULAS, G AND MACAULAY, L. (2001) Investigating Cultural Differences in Virtual Software Teams, *The Electronic Journal of Information Systems in Developing Countries* 7 (4) pp.1-14.
- EDWARDS, H.K. AND SRIDHAR, V. (2002) Analysis of the effectiveness of global Virtual Teams in Software Engineering Projects, *IEE Computer Society*. In: Proceedings of the 36th Hawaii International Conference on System Science.
- EDWARDS, H.K. AND SRIDHAR, V. (2006) *Collaborative Software Requirements Engineering Exercises in a Distributed Virtual Team Environment*. [Online] Hershey: Idea Group Publishing.
- GIBSON, S. (2006) *Is India losing its wage edge?* [Online] Available from: eWeek.com. <http://www.eweek.com/c/a/IT-Management/Is-India-Losing-Its-Wage-Edge/>.
- HOFSTEDE, G. (1982) *Culture's Consequences*, international differences in work related values. Abridge ed. Newbury Park: Sage Publications.
- HORASIS (2005) *Release of the global outsourcing report*, The Global vision Community. [Online] Available from: Horasis.org http://www.horasis.org/press_releases_all_4.php.
- HUANG, H. AND TRAUTH, E. (2007) *Cultural Influences and Globally Distributed Information Systems Development: Experiences from Chinese IT Professionals*. In: Proceedings of ACM SIGMIS-CPR

- Conference, St Louis, Missouri, USA, April 2007 pp.36-45.
- IGBARIA, M. AND SHAYO, C. (2004). *Strategies for managing IS/IT personnel*. Hershey, PA, Idea Group Pub.
- KOBAYASHI-HILLARY, M. (2004) *Outsourcing to India: The Offshore Advantage*. Berlin: Springer.
- KOBAYASHI-HILLARY, M. (2005) A Passage to India, Pitfalls that outsourcing vendors forgot to mention, *Queue* pp. 56-60.
- MACGREGOR, E., HAIEH, Y. AND KRUCHTEN, P. (2005) *Cultural Patterns in Software Process Mishaps Incidents in Global Projects*. Paper presented on Human and Social Factors of Software Engineering from ACM, St. Louis, Missouri, USA.
- MATLOFF, N. (2005) Offshoring What Can Go Wrong?, *Perspectives*, pp.39-45.
- MCALLISTER, N. (2003) *Offshore Outsourcing: Navigating the Globe*. Offshore Development
- MEYER, B. (2002) The unspoken Revolution in Software Engineering, *The Profession* pp.124, 121-123.
- MEYER, T. (2006) Offshoring to new shores – Nearshoring to central and Eastern Europe, *Deutsche Bank Research*, pp. 1-12.
- MINEVICH, M AND RICHTER, F. (2005) *The Global outsourcing Report-Opportunities, costs and risks*. The CIO Insight Whiteboard.
- MULLINS, L. (2007) *Management and Organisational Behaviour*, 8th ed., FT/ Prentice Hall.
- NARAYANASWAMY, R. AND HENRY, R. (2005) *Effects of culture on Control Mechanisms in Offshore Outsourced IT Projects*. In: Proceedings of ACM SIGMIS-CPR Conference, Atlanta, Georgia, USA, April 2005 pp.139-145.
- OLSON, J. AND OLSON, G. (2003) Culture Surprises in Remote Software Development Teams, *Focus Distributed Development*. pp. 52-59.
- OZA, N., HALL, T., RAINER, A. AND GREY, S. (2004) *Critical Factors in Software Outsourcing – A Pilot Study* In: Proceedings of Workshop on Interdisciplinary Software Engineering Research, Beach, California, USA, April 2004 pp.67-71.
- SAKTHIVEL, S. (2007) Managing Risk In Offshore Systems Development, *Communications of the ACM*, 50 (4) pp.69-75.
- THE TIMES OF INDIA (2005) *India is outsourcing to compete with nearshoring*. [Online] <http://timesofindia.indiatimes.com/articleshow/1338040.cms>
- WINKLER, J.K., DIBBERN, J. AND HEINZL, A. (2008) The impact of cultural differences in offshore outsourcing: Case study results from German-Indian application development projects, *Information Systems Front*, 10, pp. 243-258.
- WU, C.H. (2007) An Empirical study on the transformation of Likert Scale data to Numerical Scores, *Applied Mathematical Sciences*, 1(58) pp.2851-2862.
- YEO, A. (2001) Global-Software Development Lifecycle: An Exploratory Study, *CHI 2000*, 3, (1) pp. 104-111.

Endnote

The diagram in **figure 2** is based on the Systems Thinking Methodology. It conceptualizes the complexity of problems associated with cultural differences in OSD projects. The minus (-) signs indicates that there is a negative effect on the defined variable while the plus (+) sign indicates the opposite. The result is highly subjective to the variables identified in analysis of the effect of culture on the global practice of software development.