

**UNDERSTANDING THE CULTURAL AND SOCIAL IMPACTS
ON REQUIREMENTS ENGINEERING PROCESSES –
IDENTIFYING SOME PROBLEMS CHALLENGING
VIRTUAL TEAM INTERACTION WITH CLIENTS**

Jo Hanisch

University of South Australia, Adelaide, Australia
Tel.: +61+8+83020252, Fax: +61+8+83030992
jo.hanisch@unisa.edu.au

Theerasak Thanasankit

Victoria University of Wellington, New Zealand
Tel.: +64 4 4636886, Fax: +64 4 4635446
theerasak.thanasankit@vuw.ac.nz

Brian Corbitt

Victoria University of Wellington, New Zealand
Tel. +64 4 4635213, Fax: +64 4 4635446
brian.corbitt@vuw.ac.nz

ABSTRACT

There has been growing interest in virtual teams, and more specifically in virtual software development. Requirements engineering, which is a crucial phase in software development provides another dimension when software development occurs in a virtual domain. While formal software development methods are the obvious first choice for project managers to ensure a virtual software development team remains on track, the social and cultural aspects of requirements engineering cannot be ignored. These social aspects are especially important across different cultures, and have been shown to affect the success of an information system. The discussion in this paper is centred around the requirements engineering processes of a virtual team in a Thai Software House. This paper proposes a framework indicating that project managers need to encourage a balance between formal methods and social aspects in requirements engineering for virtual team members

1. INTRODUCTION

Organisations today have a flatter structure with “decentralised and autonomous units” including the extensive use of “task forces” [Drucker 1988]. Given this organisational structure, and the more recent emergence of the global economy and global markets [Karolak 1998], there is a change in both the type of work being performed and the way work is developed. For example, many companies operate entirely using Internet capabilities.

As businesses have changed, so have their information systems. Information systems (IS) support organisations as they achieve their business goals, however both the type of systems being developed and the nature of software development have changed. There is evidence of change from locally developed software to virtual (or global) software development [Carmel 1999]. As the technology now exists to enable collaborative team work over distance and time, virtual teams, in which virtual software development occurs, are becoming more recognised as the rule rather than the exception [Karolak 1999]. There is no doubt that virtual software development teams present some challenges to organisations. However, with improved understanding of the influences during virtual software development, organisations have the opportunity to develop strategies and techniques to manage this type of development. This in turn can help reduce the risk of failure of the systems being developed.

As Carmel [1999] suggests, one of the greatest challenges for business is defining its needs for a new information system. One particularly crucial phase in software development that requires clear communication is the requirements definition (engineering) phase [Darke and Shanks 1997]. This phase has been said to impact directly on the success or failure of new IS in organisations [Byrd et al 1982; Davis 1990]. Requirements engineering (RE) occurs early in the software development process, where the requirements for IS are defined and expressed in the form of systems requirements specifications [Greenspan et al 1994].

The main purpose of this paper is to explore some challenges associated with the RE phase of the software development process as it occurs in a virtual domain. This paper first reviews virtual teams and virtual software development, then the RE phase of software development is reviewed, followed by the discussion which is centred around a case study involving the RE processes in a virtual team as part of a Thai Software House. This paper is offered as a starting point for debate concerning two opposing forces perceived in the IS literature within RE and virtual software development.

2. VIRTUAL TEAMS AND VIRTUAL SOFTWARE DEVELOPMENT

Jarvenpaa and Ives [1994] describe successful organisations as those that are moving towards a dynamic network structure. They suggest that “dynamic network organisations are spun from small, globally dispersed, ad hoc teams or independent organisational entities performing knowledge or service activities” [Jarvenpaa and Ives 1994:26]. In this way organisations can respond quickly and efficiently to customer demands or changes in the external environment. Hacker and Kleiner [1996] support the notion that the extent to which an organisation is dynamic in an agile, competitive environment will affect its success.

Grenier and Metes [1995] state that some factors driving the trend towards virtual teams include mergers, corporate acquisitions, downsizing and increased use of new technology. As a result of downsizing on a global scale by organisations, much of their expertise becomes spread throughout the organisation across a number of countries or regions, so virtual teams may form, and these virtual teams may include members potentially from many different cultures. When business requires certain projects to be undertaken, virtual teams are established utilising expertise from any area of the organisation without the necessity for re-location of staff [Hacker and Kleiner 1996].

Hacker and Kleiner [1996:196] believe that virtual teams have progressed from the status of a “good idea” to “a critical strategy” for many organisations. Melymuka [1997] supports the idea that virtual teams have been touted as one way to circumvent problems associated with re-location of team members to a central business

site. This has been particularly evident with software development as there has been a dearth of skilled IS specialists globally over the past five years [Carmel 1999].

What are virtual teams and why are they important to management? “Virtual teams are groups of people working closely together even though they may be separated by many miles, even continents” [Beger 1995:36]. Hartman and Guss [1996:185] further define virtual teams as “*a temporary network of independent professionals, separated by geographic, temporal and psychological distance, whose use of telecommunications tools for business communication is interdependent, to satisfy the business requirement of sharing skills and working to meet a common goal*”.

Virtual teams are characterised by members who are physically isolated, who interact mainly through the use of electronic communication technologies and who rarely or never meet face-to-face [Jarvenpaa and Leidner 1997]. Virtual teams are said to be functional units of an organisation which are flexible, and which both quickly and professionally “execute multiple projects, anywhere and anytime” [Hartman and Guss 1996:185]. They are characterised by short-term (i.e., 6 months) project based work and by their nature virtual teams lend themselves to ad hoc teams or “task-force” work groups which come together for specific project objectives and disband once these have been fulfilled [Jarvenpaa and Leidner 1997].

Virtual (or global) software development teams are but one type of an array of possible virtual teams. Knowledge in the area of virtual software development is increasing, however this is recognised as an emerging field of research [Carmel 1999]. Issues which appear most frequently in the limited literature concerning virtual software development include loss of communication richness [Jarvenpaa and Leidner 1997; Carmel 1999], cultural differences [Carmel 1999], loss of identity with the team [Karolak 1998; Carmel 1999] and lack of management support [Karolak 1998].

At this point many organisations are still questioning whether this type of development is suitable for them, or whether they should wait to determine the success of the software developed by virtual teams. Studies concerning the management of virtual software development [Carmel 1999; Karolak 1998] indicate that formalising the software development methods is essential in virtual software development. Other researchers [Jones 1994; Meadows 1996; Grenier and Metes 1995] concur that virtual work requires a more formalised regime of work plans, deliverable progress reports and mandatory meeting schedules to assist the team to remain on track and focused for the delivery of the product. Researchers in the area of computer-based communication media [Damian et al 2000; Jarvenpaa and Leidner 1997] consider that formalised procedures aid in the success of communication between virtual team members and in the ultimate success of the project.

Given the research concerning the management of virtual teams and that of computer-based communication technologies, it appears that formal software development methods are essential in ensuring the successful delivery of new IS. However, before proposing that formal methods are the ultimate project management tool for virtual software development and that project managers should be rigorous in their application of formal methods, the influencing factors during RE (as part of software development) need to be considered.

3. REQUIREMENTS ENGINEERING

The development of an “effective IS requires thorough analyses of user information needs prior to IS design” [Byrd et al 1992:117]. RE, which is concerned with understanding the needs of the client (user) and determining the systems requirements which satisfy these needs, given any identified constraints and exclusions [Carroll and Swatman 1997], is a crucial phase in the software development process [Greenspan et al 1994].

So why is the RE phase so important to IS specialists and users? As Carroll and Swatman [1997:2] state, any “inconsistencies, omissions and errors in the requirements specification have significant impact upon the ability of the developed systems to meet customers’ needs.” The implication is that the client is less likely to accept and use the system that has been developed [Hocking 1996] when there are problems with either the communication or agreement of the requirements [Urquhart 1997]. When the system being developed does

not meet the users' needs, that is the requirements are not satisfied, in project management terms the system has failed to deliver [McLeod and Smith 1996]. Park et al [2000] attribute this to failure of the organisation to meet its goals. Further, most errors found later in the systems development process can be retraced to the requirements specification, which either contains errors in the requirements or misinterpretation of the requirements [Liou and Chen 1994].

The significance is that early detection of errors or misinterpretations decreases the cost of their rectification later in the process [Park et al 2000] and improves the quality of the system being developed [Darke and Shanks 1997]. As Thanasankit [1999] has shown, these costs can be substantial to an organisation.

RE has been defined as “the disciplined application of scientific principles and techniques for developing, communicating, and managing requirements” [Christel and Kang 1992:3]. This definition of RE is supported by Loucopoulos and Karakostas [1995], where RE is defined as:

“...the systematic process of developing requirements through an iterative co-operative process of analysing the problem, documenting the resulting observations in a variety of representation formats, and checking the accuracy of the understanding gained.” Loucopoulos and Karakostas [1995:13]

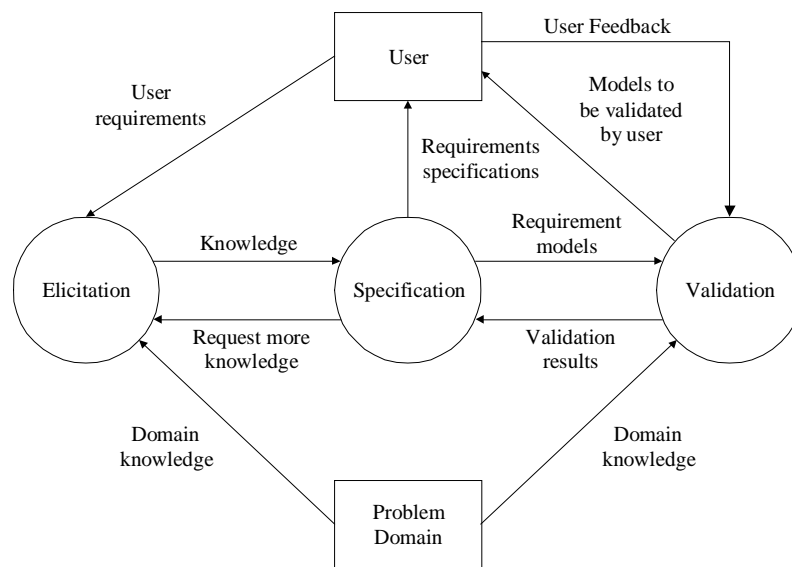


Figure 1: Requirements engineering process (Loucopoulos and Karakostas 1995: 21)

Figure 1 represents the requirements engineering process as defined by Loucopoulos and Karakostas [1995]. RE therefore covers “all the activities of discovering, documenting, and maintaining a set of requirements for building a computer-based information system” [Thanasankit 1999]. During RE, the requirements engineer (or systems analyst) needs to be mindful of the objectives/outcomes of the RE phase and implement appropriate processes or techniques which will help to avoid failure of the IS [Macauley 1996].

Hocking [1996] suggests that the terms used in requirements engineering create perceptions about the nature of requirements. Terms such as “analysis” and “elicitation of information” suggest that requirements engineering “involves the extraction of information from a static situation in which the users are passive subjects of the proposed changes” [Hocking 1996:320]. However, Hocking [1996] argues that in reality, the requirements are dynamic, fluid and are actually affected by the elicitation process. Carroll and Swatman [1997] support this argument by suggesting that the term “developing requirements” acknowledges that there is no definitive set of requirements to be determined, discovered or uncovered during requirements engineering. Hocking [1996] agrees that requirements are developed through interaction and negotiation. This interaction and negotiation occurs “between the developer’s domain and, specifically, through the interaction between the developer and the stakeholders of the new system as they learn together about the needs and constraints which may be satisfied by a range of possible sets of solutions” [Carroll and Swatman 1997:4]. Systems development represents innovation in the context of the organisation implementing the

system. Innovation therefore, may be accompanied by the emergence of unexpected functionality and/or features which may also include new ways to develop systems requirements. According to Land and Somogyi [1986] there is an interaction between formal systems and their environment, and this may explain why different management approaches, tools and techniques are needed for different system types and environmental conditions. The appropriate choices of tools, techniques and approaches may help to improve the elicitation of requirements and the chances of success of the systems development.

Failure of many IS development projects is due not just to the inadequate requirements [Boehm 1981] in general, but more specifically to the social, political and cultural factors associated with the project [Goguen and Linde 1993]. Within the social context, it is necessary for IS specialists to understand communication and cooperation, as well as social complexity during RE [Thanasankit 1999]. RE research has traditionally been positivist in its approach, largely focusing on the methods used for gathering, elicitation and validation of requirements. Many researchers conclude that the more formal the methods used, the more likely that the requirements will be clearly defined and understood.

Land [1998] developed a contingency based approach to requirements elicitation and systems development. He suggested that the way requirements may be elicited is “closely related to a number of contingency factors” [Land 1998:3] and that the methods used in systems development may range from highly formal to experimental, under “different but defined circumstances” [Land 1998:3]. However, as Thanasankit [1999] argues, organisations need to go further and consider the emotions and culture of users and IS specialists. It has been shown that different cultures will perform tasks not only because they are responsible for the task, but because they wish to maintain surface harmony and trust between the group [Thanasankit 1999] and this often inhibits formal approvals of requirements specifications, which in turn causes delays and potential failure of the project. In these cases, the imposition of formal, often western philosophies and methods, have a negative impact on the requirements gathering process [Thanasankit 1999].

4. REQUIREMENTS ENGINEERING IN VIRTUAL SOFTWARE DEVELOPMENT

There may occur a dilemma for project managers who are responsible for the RE phase during virtual software development. When systems analysts use more formalised methods for gathering requirements, as these methods are deemed to assist in the process of virtual communications, there may occur a negative impact on the social and cultural process of gathering users' requirements. The most appropriate choices of management approaches, tools and techniques as recommended by Land [1998] may not be available in the virtual domain.

There may arise tension between the two forces and therein lies the interest and motivation for this research. Virtual work and virtual teams have been shown by previous research [Carmel 1999; Karolak 1998; Meadows 1996] to benefit from a more structured approach to the working environment. Therefore it would be logical to deduce that the RE phase of systems development in a virtual environment would also benefit from a more structured approach.

However, western ideologies created RE foundations [Odedra 1993] and many of these processes were formalised and structured to suit western philosophies. Jirotko and Goguen [1994] argue that RE should be developed in an environment which suits both the social and technical concerns of the requirements. These structured methods may not be suitable for members of a virtual team who are likely to be situated in regions and cultures where social processes are deemed more significant in the requirements gathering process, rather than utilising structured methods [Thanasankit 1999].

From the reviews above, many virtual teams include members who are from different cultural and social backgrounds. They will come into the team with different experiences in the formal techniques of software development. This will affect the way they communicate the requirements of the system and the extent to which formal methods are used. RE in western cultures will be different from eastern cultures.

Figure 2 below shows a framework representing the tension which may occur between the two forces of social and cultural aspects of RE and formal software development methods used in RE.

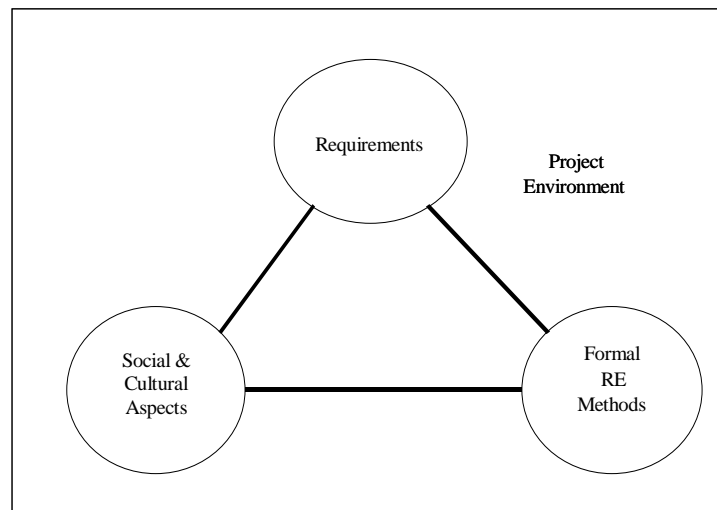


Figure 2: A framework of requirements engineering in virtual software development (adapted: [McLeod and Smith 1996:6])

Figure 2 indicates that the project manager who controls the project environment will always be balancing these variables to produce the requirements for the IS development. It is impossible to move either of the sides of the triangle without impacting on the requirements. For example, if highly formal methods are chosen at the expense of social and cultural considerations the requirements will be affected, and vice versa. The onus will be on the project manager of the virtual team to create a balance between social processes and structured methods in order to gather adequately the users' needs and keep the project on track.

5. RESEARCH METHODOLOGY

Three Thai systems developers from TJM Software House* were interviewed in Bangkok during 1998 and 1999. The interviewees were selected based on their responsibilities in gathering requirements from clients, who engaged in interviewing users, and who were observing users' activities, and gathering documents to construct requirements specification for development of IS. The systems developers were selected based on interaction with their clients, whose organisations were located outside of Bangkok and where virtual contact was part of the RE process.

The principal method for collecting data was by in-depth interviews with Thai systems analysts. The questions were open-ended and system analysts had freedom to describe their experiences and problems beyond the questions' boundaries.

Each interview was formalised, as requests were made to the system analyst's superior for permission. Each interview was recorded on tape in Thai, transcribed into Thai and then translated into English. Reporting the details of the case in Thai would be the more accurate. However, where necessary, appropriate English meanings have been used. The conclusions reported in the following analysis of that case study data represent the authors' interpretation of the evidence. In a much larger paper the richness of discourses and dialogue involved would be reported. However the conclusions drawn do sufficiently represent the data and support the interpretation of those elements of Hofstede's research that are appropriate.

The case study is applied to the conceptualisations outlined above accepting that it is only one case study, albeit in some detail, and that it represents only one cultural sphere of influence. It must be recognised that culture-inclusive research will only bear fruit in this and other areas of information systems when there is a

* pseudonym

large body of knowledge which will enable more justified reductionist outcomes to be both made and justified. Before we as researchers can engaged in any realistic conclusions about the impact of culture we have to address the discontinuities, compromises, omissions and exceptions noted across a number of case studies in numerous cultures. In order to understand the relations and processes of culture in information use and analysis, we must grasp the way that culture is embedded in a particular society and socio-economic system generating the information being used.

6. TJM SOFTWARE HOUSE CASE STUDY*

TJM is software house operated in Thailand and owned by Thai. TJM's clients come from both private and public sectors. This case study involves one of TJM's clients situated in a province of Thailand. TJM was responsible to work with the client to develop an accounting information system. The issue of distance meant that a virtual relationship was an integral part of the RE process.

6.1 The Influence of High Power Distance

Hofstede [1997] argues that Thai culture is one with high power distance. The high power distance culture in Thailand tends to respect the leader as the father figure of the organisation. Rohitratana [1998: 190] suggests that "due to paternalism and dependence", the concept of a flat structure in an organisation, which entails speedy decision making, cannot take place effectively. This occurs because it is the obligation of those at the top to operate as 'fathers' and make decisions. Thais perceive the role of 'leader' as controller rather than colleague. This may be called *superior-inferior*, concept, which is dominant in Thailand.

During systems development in Thailand, TJM reported that most of their clients have two committees to oversee the development of new IS. The first committee in this case, was the Development Committee, which included members such as the Heads of Department whose departments or units were in the scope of system development boundary. This committee was the first point of contact for interaction with the systems developers. The Development Committee provided the systems developers with requirements and identified problems of the current systems. The Steering Committee comprised of the President of the organisation, the Chief Information Officer and the Chief Finance Officer. Their role was to ensure that the development was on time, on budget and they made decisions concerning any additional costs or changes in scope. In essence each of these committees was 'virtually' separate from each other and from the client.

After elicitation, systems developers constructed requirements specification documents for the client for validation. The RE process was highly iterative as shown in Figure 3 below.

After each validation, the Development Committee sent the requirements specification to the Steering Committee for final approval and then passed the approval back to the developers for design and build stage. However, even though the Development Committee had full power for making decisions, it preferred to pass the requirements specification documents to the Steering Committee for approval. Usually the Steering Committee reported back with further requirements and feedback, which the systems developers needed to investigate.

One can observe that high power distance in Thai culture impacts on the structure of IS development by involving two committees and a separated client. The tension noted previously in Figure 2 was obvious in this virtual team. The structure was also reflected in the role of management in Thai organisations. As Thanasankit [1999: 90] stated, "decision-making in Thailand is usually confined to high level management". This is a common for Thai subordinates to pass decision-making to their superiors, which in this case, is the Steering Committee. This process delayed the time for systems developers to gain feedback or approval to progress to the next stage of systems development.

Organisational structure in most Thai organisations reflects a superior-inferior power relationship. This specific trait of Thai culture is important. It enables establishment of behavioural patterns by both systems developers and the clients. It facilitates the tensions between client and requirements agent. The clients

(management) perceive the systems developers from TJM Software House as subordinates and vice versa. Therefore, systems developers needed to follow their clients' need to add/change requirements, even when the project is in the build stage [Thanasankit 1999]. High power distance in Thailand is important for systems developers and their clients to establish social ranking for interaction.

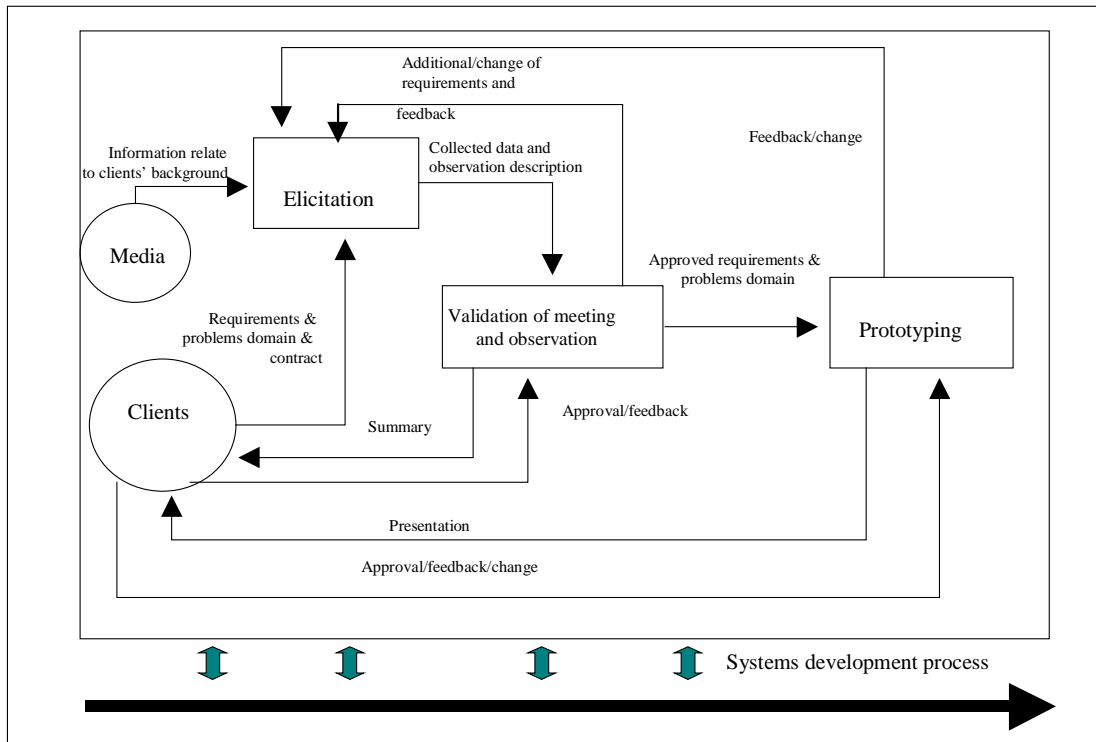


Figure 3: TJM requirements engineering process.

In the virtual environment, the TJM systems developers reported that it was hard to interact with the clients using Fax, email or telephone. They reported that it was important to interact face-to-face with their clients. Face-to-face interaction enables the systems developers to show respect and gain trust of the clients, while electronic communication media decreases the rich communication and social interaction.

6.2 The Influence of Collective Society in Thailand

Thai society constructs its reality as group or social interests, rather than as individual interests. Hofstede [1997] argues that collective societies usually support structures where people are born and live in extended families. Relationships between subordinates and superiors are perceived in moral terms, like family links. Relationship-oriented behaviour happens more commonly than work-oriented behaviour in Thai society and its organisations. The characteristics of *surface harmony* are important in Thai culture as they encourages smooth, kind, pleasant, conflict-free, non-assertive, polite and humble [Rohirattana 1998] relationships.

TJM system developers tried to avoid conflict with their clients to preserve good relations. Showing friendliness was important during RE process. The systems developers reported that Thais work to create and preserve relationships, therefore the work was more relationship-oriented rather than work-oriented. For TJM to show friendliness and promote good relations between them and clients, the use of electronic communications was not suitable during RE. Face-to-face communication was preferred by both the systems developers and the clients. This resulted in the need for travel to the client's site to elicit requirements. The virtual environment creates tensions to the extent that a recognition of existing social practice is essential to resolve that tension.

Travelling to the clients achieved feelings of “belongingness” and working together toward one goal for the client and the systems developers. In this case, achieving belongingness for the development team promoted increased cooperation from the clients during RE.

6.3 Some Challenges for Virtual Teams during Requirements Engineering

This paper highlights two powerful cultural traits on the virtual RE process: high power distance and the nature of collectivist societies, using the Thai case study. The case study has highlighted the social and cultural tensions that emerge from undertaking requirements gathering in a virtual domain. From this case study there are some important challenges noted for virtual team interaction with clients:

- From TJM Software House, it is clear that Thais prefer to communicate by using interviews and face-to-face interaction, even after using virtual processes. Electronic communication has been shown to decrease rich communication [Jarvenpaa and Leidner 1996]. This rich communication is not just about passing requirements from clients to systems developers, but reflects the behaviour of systems developers, the use and importance of body language during communication, a substantial tension in any virtual context. It is important for developers to understand the social interaction during the development of information systems for selecting methods and tools, which are most appropriate for eliciting requirements from clients [Land and Somogyi 1986].
- Trust is a major element for successful virtual teams [Carmel 1999]. In Thailand, trust can be achieved only by face-to-face and rich communication. Talking with the systems developers, visiting the software house and general conversations are part of system development interaction between clients and systems developers in Thailand. Virtual teams can achieve communication between clients and systems developers, however the use of electronic communications limits social interaction which are important for building trust. This creates further tension in the RE process.
- Many researchers [Thanasankit 1999; Carroll and Swatman, 1997; Thanasankit and Corbitt, 1999; Jirotkra and Goguen 1994] have shown that social interaction during RE influences the success of IS. Systems developers in Thailand are perceived by their clients as their subordinates. Therefore, working away from the clients’ sites may not be an option during RE. The virtual team studied noted that to achieve “belongingness” to the development group is an important cultural element especially in a collectivist society such as Thailand. Working closely together and having day-to-day interaction is important to achieve trust and strengthen close relationships. Employing electronic communication can only achieve minimal impact and social interaction. Achieving belongingness is, we would suggest, much more difficult in a virtual environment as RE can be seen as a social process which operates in a turbulent environment [Land 1998]. This turbulent environment represents the constant changes of the organisational environment and it can be argued that culture may also impact on the use of requirements elicitation methods [Land 1998; Thanasankit and Corbitt 1999].
- Formal methods may impose structure that is not conducive to social interaction or decision making. While formal methods are encouraged in the virtual environment to ensure project milestones are met, the use of such methods may cause the opposite effect during the RE processes in virtual teams from Thai backgrounds. Even through to build stage of this system development, the requirements were being reviewed and changed by the Steering Committee. In this case the formal methods and structure imposed an upward hierarchy of decision making which led to delays in sign offs and approvals. Using more formal methods created a tension in the RE process.

Virtual teams and client culture pose an important dilemma for successful development of IS, especially in Asian countries, where there are many diverse cultures tightly integrated within daily life. When cultural background is different between systems developers and their clients, the use of methodologies, electronic communications and interaction may influence the quality of requirements, which then influences the success of IS as a whole. There is a significant tension created which will impact the effectiveness of the RE process.

7. CONCLUSION

RE is a crucial stage in software development regardless of whether the development is local or global. During virtual software development previous research has recommended that more formal methods of requirements gathering be employed to decrease the risk of misunderstanding or misinterpretation of the requirements. However, RE is a social process and formal/structured methods may impact on the social and cultural differences between virtual teams members.

Project managers therefore face the task of creating a project environment that is conducive to communication through electronic means and which takes into account the differences in cultural and social aspects of virtual team members as they communicate their requirements. A balance is required to satisfy the formal structured methods of RE which have been shown in the past to improve software development in project management terms of quality, cost and time, and the need to provide a project environment which encourages open communication and supports cultural differences in virtual software development. Then, not only will the system be built right, but the right system will be built. Further research is required to determine which RE processes and which project environment characteristics are more appropriate in helping to achieve this balance.

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