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ABSTRACT

LEADER DELEGATION AND TRUST IN GLOBAL SOFTWARE TEAMS

by
Suling Zhang

Virtual teams are an important work structure in global software development. The distributed team structure enables access to a diverse set of expertise which is often not available in one location, to a cheaper labor force, and to a potentially accelerated development process that uses a twenty-four hour work structure.

Many software teams are partially distributed, that is, part of the team is co-located. Such partially distributed global software teams are an important work structure in software development projects. However, little is known about what affects or improves team members' motivation and job satisfaction in the partially distributed environment. This study investigates the effects of leader delegation to sub-teams and trust between sub-teams on global software team members' motivation and job satisfaction. It proposes a research framework based on specific hypotheses regarding these effects. A survey instrument was created and a pilot study conducted on student project teams in two U.S. universities. In addition, a study combining interviews and a survey distribution using industry software development teams was also conducted. The studies found that team competence predicts leader delegation to a sub-team in global software projects. Leader delegation related to teamwork process improves team members' motivation and satisfaction with the leader. However, leader delegation may also generate negative consequences for the sub-teams, such as anxiety and pressure. Cultural distance and geographical distance impair trust development between members

across sub-teams. Temporal distance causes conflicts related to excessive overtime and meeting scheduling. Trust in sub-teams is critical to improving motivation in a global software project. In addition, this study explores the impacts of language differences and software engineering profession culture on global software team members' interactions. Suggestions are proposed for how to shape delegation strategies in partially distributed global software projects and how to improve team members' trust in each other and their motivation. This work provides important findings for organizations interested in developing leadership skills for global software teams and retaining IT professionals at distributed sites.

LEADER DELEGATION AND TRUST IN GLOBAL SOFTWARE TEAMS

**by
Suling Zhang**

**A Dissertation
Submitted to the Faculty of
New Jersey Institute of Technology
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy in Information Systems**

Department of Information Systems

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CHAPTER 1

INTRODUCTION

1.1 Background

1.1.1 Global Software Teams

Virtual teams are becoming an important work structure in today's organizational environment. Globalization, redefinition of markets, structural reconfigurations that emphasize horizontal and network linkages, and the growing influence of information-related technologies have accelerated the need for organizations to coordinate activities that span geographical, as well as organizational, boundaries. In particular, the shift from production to service-related businesses has spawned a new generation of knowledge workers not bound to a single physical work location (Millard & Kyriakidou, 2004).

Global virtual teams are a common response of organizations to the challenge to compete effectively across time zones, physical boundaries and organizational contexts. The exponential growth of information technologies has facilitated the proliferation of virtual teams. A recent survey of workforce trends conducted by MCI WorldCom (2001) indicates that 61% of employees in companies that have at least 500 employees have worked or do work in virtual teams. Virtual teams are defined as "geographically and/or organizationally dispersed coworkers that are assembled using a combination of telecommunications and information technologies to accomplish an organizational task" (Townsend, deMarie, & Hendrickson, 1998, p. 18).

In the software development industry, the global virtual team is becoming an increasingly popular approach to software development due to the growing amount of work being offshored from high-cost countries such as the U.S. and U.K. to lower-cost economies such as India, China, and Russia. Global software teams provide access to lower cost labor as well as to a range of disciplines and technical specialties (Curtis et al. 1988). Unlike traditional virtual teams in which all team members are distributed to decompose a large and complicated project, global software development projects often consist of several co-located sub-teams, each working on a particular part of the project. Members of each sub-team are often co-located at one site, and they mainly use electronic media to interact and collaborate with sub-teams at other sites.

Global software teams provide a variety of organizational benefits such as access to otherwise unavailable expertise and lower cost human capital, bridging temporal and geographical distances, allowing flexibility in work arrangements, enhancing cross-functional interaction, etc. (Duarte & Snyder, 2001, Townsend et al. 1998).

Global software team usage in industry is still young and raises many unanswered questions, which research on virtual teams is just beginning to address (Martins et al. 2004; Powell et al. 2004). However, because of the importance of virtual teams to organizations, a considerable body of empirical literature has accumulated. Virtual group and team research has examined a range of issues including effectiveness relative to social-psychological inputs (Furst et al. 1999), critical success factors in cross-organizational ad hoc virtual teams (Lipnack et al. 1999), project management and success (Paré et al. 1999), knowledge transfer (Griffith et al. 2003), team dynamics, communication, and outcomes (Maznevski et al. 2000), technology choices, specifically

the team's continued adherence to a particular communication medium (Huysman et al. 2003), trust (Jarvenpaa et al. 1999; Piccoli et al. 2003), learning in cross-functional virtual teams (Robey et al. 2000), socialization in virtual groups (Ahuja et al. 2003), and leadership effectiveness (Kayworth et al. 2002). In the extant literature, team leadership has been identified as one of the critical success factors for virtual teams. While an understanding of virtual team (VT) leadership processes is lacking, the VT leader role is considered likely to be different from that of a traditional team leader (Avolio, Kahai, & Dodge, 2000) and more research is needed to find commonalities in effective leadership behavior for different virtual teams and groups (Zigurs, 2003).

In a related area, partially distributed team (PDT) research shows that lack of trust can be a serious problem when an in-group vs. out-group division is formed in partially distributed teams (Bos et al. 2004; Huang & Ocker, 2006). However, few studies have examined the leadership and trust issues in partially distributed software teams. This dissertation study aims to bridge this research gap by studying one specific leadership component: leader delegation in global software teams and trust between sub-teams in partially distributed global software projects. Specifically, this study explores how team competence predicts leader delegation behaviors in global software projects and the effects of leader delegation. Given the geographical and cultural distances between project management and sub-teams in global software projects, it is hard for the management to judge the true competence level of a remote sub-team. The effects of delegation may also be compounded by the distances between the management and the remote sub-team members. It is important to examine these issues to understand the optimum leader delegation strategies for running effective global software teams. This study will also

examine how trust between sub-teams in global software projects is affected by the four major types of distances spanned by global software projects: geographical, temporal, organizational and cultural. This study also strives to find how improving communication between sub-teams may overcome the negative influences of team distances and enhance trust between sub-teams in global software projects. Finally, this study aims to find out how leader delegation and trust can improve team members' subjective responses such as his/her satisfaction with project leadership and his/her motivation for working in the project. This question is important for finding out how to improve team members' subjective experience in global software projects and consequently how to retain valuable human resources and to improve their performance.

To study the abovementioned issues, this dissertation created a survey instrument and conducted a survey and interviews in a Fortune 100 IT service company. Both quantitative and qualitative data are collected and analyzed to provide statistically rigorous conclusions explained by rich contextual information.

The organization of this document is as follows: In Chapter 1, the background and objectives of this study are presented and the research questions, research methods and significance of this study are introduced. In Chapter 2, literature relevant to virtual team leader delegation, global software team management and trust studies is reviewed. In addition, the key research hypotheses are discussed, and a theoretical correlation model that incorporates these hypotheses is presented. Chapter 3 discusses the approach taken for this research including the constructs used in the survey instrument, the data collection method and analysis plan. Chapter 4 presents the pilot study and its findings. Chapter 5 presents the study results from surveying and interviewing real-world software teams. In

Chapter 6 the study results are discussed and the contributions and limitations of the study are presented.

The next sections in this chapter will introduce more global software team research background related to the theme of this dissertation study and then raise the specific research questions that this study aims to answer.

1.1.2 Global Software Team Challenges

Despite their benefits, global software teams pose major challenges, especially to team leadership and trust development. While leadership appears to be a major determinant of virtual team success (Cascio & Shurygailo, 2003), managing and leading global virtual software teams is not easy given the distances between sub-teams and the complexities of the global virtual team environment. There are several important challenges stemming from distances between team members.

First, geographical distance: Global virtual teams are often formed to access cheaper labor, or expertise that is not available in a single location (Townsend et al. 1998). Thus, in many cases, global virtual teams span large geographical distances, even continents. Geographical distance brings forth new issues; for example, the co-located members may form an in-group, excluding the isolates or the out-group members; conflicts and lack of trust might arise between sub-teams (Bos et al, 2004).

Second, time zone distance: Global software teams can work in different time zones. This might give rise to difficulties in team collaboration and trust building (Jarvenpaa & Leidner 1999; Manznevski & Chubda, 2000) and result in the need for strong virtual team leadership to fuse the team into a cohesive unit.

Third, lack of face-to-face communication: Global software teams rely heavily on communication technologies instead of face-to-face communication. Over the years, a number of communication technologies have been introduced into the virtual teams in businesses, ranging from common email tools to more complex and interactive communication technologies such as videoconferencing, groupware and distributed project management software (Geber, 1995). These communication technologies allow team members to communicate and share information regardless of their location in space and time (Bell & Kozlowski, 2002). Compared to face-to-face communication, the computer-mediated technologies are considered to convey fewer personal cues, such as warmth, trust and emotional state (Daft and Lengel, 1986). Therefore, it is believed that computer-mediated communication creates an emotional distance between team members and increases the difficulties in both coordination and communication. As an example, constructive criticism from a team leader might be judged more harshly than intended (Hagen, 1999).

Fourth, organizational distance between team members: Global software teams are often formed in the search for the best expertise, or people with the right experience (Lipnack & Stamps, 1997). These individuals might be independent consultants or experts, members of other organizations, or employees of the same organization but in different divisions or departments. Organizationally diverse virtual teams are employed in a number of organizations such as Intel and Microsoft (Lipnack & Stamps, 1997) and deal with complex assignments that depend on specific individuals to perform highly specialized tasks. Organizational diversity imposes another layer of challenge on virtual

team leadership. For example, it creates the need for a high level of trust at the team member level and also at the team leader level (Bradley & Vozikis, 2004).

Fifth, cultural distance: As global software teams span greater physical and organizational distances, they are also more likely to cross cultural boundaries. Team members have different languages, traditions, expectations, work habits, communications patterns, etc. Culturally diverse teams are common in multinational IT organizations, for example, Hewlett-Packard has virtual teams which are distributed worldwide and function around the clock (Lipnack & Stamps, 1997). Cultural diversity also creates difficulties for global software team leadership. Developing a shared mental model of team goals and expected team processes is difficult because team members do not share a common set of processes for sharing ideas, common views of how to respond to authority, or even basic knowledge of how to interact as a team (Maynard & Gilson, 2004). Misinterpretations are also likely to emerge in culturally diverse virtual teams due to a lack of familiarity with the expected patterns of social behavior held by teammates (Kayworth & Leidner, 2002). Misunderstandings and negative stereotypes of other cultures may cause trust problems between global software team members (Espinaso et al. 2006).

The importance of global software team leadership, and the unique challenges global virtual teams face, call for meaningful research into global software team leadership. However, to date, there have been only limited empirical studies investigating global software team leadership, and it is acknowledged that very little is known about what constitutes effective leadership for virtual teams (Cascio & Shurygailo, 2003). In their extensive review of 230 group support system (GSS) experiment studies, Fjermestad and Hiltz (1999) reported that leadership is a key variable in small-group decision-making

but that it has been virtually ignored in the information systems literature. Previous investigations of virtual team leadership are either descriptive case studies (e.g. Kayworth & Leidner 2002; Pauleen, 2003) or experiments that use student groups performing artificial tasks under unrealistic time limits (e.g. Kahai et al. 2004; Hoyt et al. 2003). These limited studies suggest that the participative, directive, transformational, transactional, and instrumental behaviors of leaders make a difference to the performance of electronic teams. Various contextual factors, including the nature of the task (e.g., task structure, task interdependence), operating conditions (e.g., rewards and facilitation), and/or features of the technology (e.g., anonymity), interact with leadership styles to influence group process and outcomes (Kahai, Fjermestad, Zhang & Avolio, 2006). However, the generalizability of these findings is very limited as the studies employed student groups performing artificial / unrealistic tasks.

Global software teams are also faced with the challenge of developing and maintaining trust, which is made difficult by the global boundaries the teams cross (Espinaso et al. 2006). However, past studies have limited generalizability for the same reason mentioned above---they have mostly been done with student teams performing artificial tasks (e.g., Jarvenpaa & Leinder, 1999; Kayworth & Leidner, 2002). In addition, the findings about leadership and trust from studies of general virtual teams may not be applicable to global software team management, as distributed teams with dissimilar structures will differ on team processes as well as outcomes (Dube & Lare, 2004). To understand what constitutes effective leadership and trust development in global software teams requires studies that examine ongoing global software teams performing meaningful, complex tasks in real organizations.

1.2 Objective and Research Question

As explained in the preceding paragraphs, global software team management and trust development pose major challenges to virtual team leaders and are important yet under-researched topics. *This dissertation study focuses on two aspects of these topics. First, leader delegation: Under what circumstances should a global software team leader delegate and how does delegation influence team outcomes? Second, trust: How does the global virtual team setting affect trust between team members and how does trust affect team outcomes?*

In traditional leadership studies, delegation is widely acknowledged to be an essential element of effective management (Yukl, 2002), and effective delegation offers a number of potential benefits, both to the manager and the subordinates. However, to the author's knowledge, only a few studies have been conducted to investigate delegation as a distinct component of global virtual team leadership. In the limited number of conceptual works and empirical studies in which delegation is not the direct focus, delegation has been a controversial issue. Some researchers argue for the benefits of delegation. Eveland & Bikson, 1988; Jarvenpaa et al. 1998; Jarvenpaa & Leidner, 1999 report that an effective leader of a virtual team needs to be more flexible to accommodate the complexities and volatility of the virtual team environment, and to be willing to let others take the lead when necessary. Furthermore, they suggest that virtual team leadership should focus on facilitating and empowering team members to take action on their own. In contrast, Pare & Dube, (1999) argue that, due to the distributed nature of virtual teams, management by observation is simply not possible, and that much more discipline and control is required in a virtual setting. In addition, team effectiveness in virtual environments may be hindered

by excessive autonomy coupled with exclusive reliance on electronic communication and lack of face-to-face interaction.

These conflicting views on the effect of delegation on virtual teams suggest that further studies should be conducted on the effects of leader delegation. Follower competence is generally believed to predict the effects of delegation (e.g. Hersey & Blanchard, 1988; Janz, Colquitt & Noe, 1997; Leana, 1986; Yukl, 2002). The general conclusion is that managers will delegate more to competent followers than to less competent followers. Therefore, it is proposed that global software team competency---the capability of a team to perform the team tasks---is an important explanatory variable in studying team leader delegation.

The first research question of this dissertation study is: under what circumstances does a virtual team leader delegate to the team?

The second research question relates to the effects of leader delegation on global software team outcomes: how do different delegation strategies influence intermediate outcomes such as team member motivation and team member satisfaction with the team leader? Team member motivation means how motivated a team member is to perform team tasks. Team member satisfaction with the leader means how satisfied a team member is with the team leadership. As a team may have more than one leader, in this study satisfaction with leadership relates to one's perception about general team management and leadership, rather than one's perception about any individual leader.

The third research question is: How do global software team settings, including team distances, communication quality and sub-team competence affect the trust a global team member has toward remote sub-teams? As mentioned earlier, global software teams

span geographical distance, time zone distance, organizational distance and cultural distance. These distances may cause communication difficulties, reduce shared context, introduce mis-interpretations, and result in diminished trust. This study also aims to study how improved communication between sub-teams and the competence level of sub-teams may affect the trust between sub-teams, in the hope of finding ways to overcome the negative influence of team distance on trust development.

The fourth research question of this study is: *How does trust toward the remote sub-team influence global software team member motivation?* Improving motivation is important for retaining talent and reducing employee turnover rate (Thatcher et al. 2003). Besides traditional factors such as payment and work environment conditions, trust as an important emotional process may impact one's motivation. Trust has been identified as important to team development and performance in traditional virtual team research (Jarvenpaa et al. 1998). Trust may be also critical to global software projects. However, to the author's knowledge, no studies have examined the relationship between trust toward remote sub-teams and team member motivation in global software teams.

The next chapter describes the research hypotheses and the research model.

CHAPTER 2

HYPOTHESES AND RESEARCH MODEL

2.1 Introduction

This chapter describes the theoretical background of the study. First, Section 2 presents a framework for virtual team leader delegation which differentiates four dimensions of leader delegation. Then Section 3 explains the research hypotheses related to global software team leader delegation. Section 4 explains the research hypotheses related to trust between sub-team members. Finally, the research framework integrating all research hypotheses is proposed.

2.2 Leader Delegation

2.2.1 Review of Existing Delegation Studies

Delegation refers to the process of distributing control or power to one's subordinates, usually through the allocation of responsibility for tasks normally reserved as leader functions (Bass 1990, Yukl & Fu, 1999). There is a rich body of studies in traditional leadership research that has investigated delegation, mostly as a feature of leadership style or as a combination of related leader behaviors. However, little empirical research has focused on delegation as a distinct management practice (Leana, 1987). Therefore, it is hard to interpret the effect size of delegation as a distinct leadership component in the aforementioned leadership studies.

The majority of the existing studies on leader delegation focused on the underlying causes of delegation either via moderating or predicting variables. Follower's competence

has been commonly found to predict a leader's delegation behavior. For example, Leana (1986, 1987) conducted a study to examine predictors and consequences of delegation. The participants were 44 supervisors and 198 claims adjusters employed in 19 branch offices of a large insurance company. Delegation was operationally defined as the dollar level of authority exercised by adjusters to settle claims. Results from the study indicated that supervisors' perceptions of subordinates' competence, the volume of supervisors' workloads, and the importance of decisions were significant predictors of delegation. In addition, it was found that subordinates' job competence and the congruence between supervisors' and subordinates' goals moderated the effects of delegation on subordinates' job performance. Another example is the study conducted by Yukl & Fu in 1999. They surveyed managers and subordinates in two organizations and interviewed managers individually or in focus groups. The degree of delegation and consultation with individual subordinates was determined in part by characteristics of the subordinates and the manager-subordinate relationship. More delegation occurred when a subordinate was competent, shared the leader's task objectives, had worked longer for the manager, was also a supervisor, and had a favorable exchange relationship with the manager. They also found that the managers acknowledged that developing subordinates and empowering them to do their work were important reasons for delegation, but many managers were reluctant to give up control over important decisions or to assign an important task to an inexperienced subordinate.

Some contextual variables have been found to moderate the effects of delegation. For example, in a survey of employees and managers from 25 work groups in a large technology firm, Langfred (2000) found a moderating effect of within-group task

interdependence on the relationship between the group decision-making autonomy and group effectiveness. The decision-making authority of the group was found to have a positive influence on work group effectiveness when task interdependence was high and a negative effect when task interdependence was low. For groups with low task interdependence (i.e., group members individually perform tasks relatively independent of one another), the granting of autonomy to the group has been found to create a dysfunctional performance loss (Pearce & Ravlin, 1987). Group members need to spend time interacting and coordinating with other group members on group decision making and planning, and by so doing will incur process losses as they spend less time on individual tasks. In a survey of 231 knowledge workers from 27 work teams, Janz and Noe (1997) also found a moderating effect of task interdependence on delegation. In particular, the positive relationship between team autonomy and team job motivation was *reduced* as teams worked under more interdependent conditions. This interaction effect also varied across the types of autonomy (e.g., planning-related, product-related, and people-related) the team was given. Janz and Noe also found that group maturity (e.g., team goal clarity, team coordination level and team unity) moderates the effects of decision-making autonomy on team outcomes.

Therefore, leader delegation may not always produce positive effects. Milewski and Lewis (1996) found that delegating work involves several costs and benefits. A leader should carefully weigh the tradeoffs between costs and benefits of delegation and make decisions accordingly. The costs of delegation include 1) assessment of a delegatee's competence, 2) monitoring delegatee's work and progress, 3) communication of desired outcomes and strategies, 4) anxiety related to loss of control, and 5) short-term

productivity loss due to learning and increased communication (Milewski and Lewis, 1996; Moore, 1982). The benefits include 1) the leader's better time management associated with a lessened workload (Milewski and Lewis, 1996), 2) increased morale associated with the delegatee's ability to make decisions independently and thus, a greater sense of efficacy, control and self-worth (Keller, 1994), 3) the delegated subordinates' performance improvement in the long run (Moore, 1982), and 4) subordinates' acceptance of goals due to their involvement in goal setting (Erez, 1985).

The above findings come from studies involving co-located leaders and followers or co-located teams. However, a virtual global software team is also a type of organizational team. It has many of the features and characteristics of traditional face-to-face teams such as roles, tasks, mission, and goals (Zaccaro & Bader, 2003). These commonalities suggest that the findings of traditional leadership research are relevant to virtual team leader delegation research. The existing delegation studies identified follower job-performing competence as very important in predicting leader delegation and moderating the costs of delegation. In this study, team competence is therefore included as an explanatory variable. The findings of previous delegation studies on the costs and benefits of delegation will also help us to analyze the effects of leader delegation in virtual teams, which will be discussed in section 3 when research hypotheses are presented.

2.2.2 What to Delegate?

A major limitation of previous delegation and leadership studies is that an overwhelming majority of them did not differentiate what a leader delegates. Only the global delegative style of the leader was assessed. This limitation seriously undermines the

practical value of these studies, as their findings do not tell the managers and leaders where they can and cannot delegate. Leadership is a multi-faceted process, particularly so in virtual teams, given the technological, cultural and organizational complexities of a virtual team environment. Therefore, it is important to differentiate between the leadership and managerial functions originally assigned to leaders that can be delegated to followers. To that end, studies that describe leadership and managerial functions are reviewed in this section, and a model of leader delegation aspects is generated.

For classical management theorists like Davis (1942) and Urwick (1952), the functions of the manager-leader in a formal organization were orderly planning, organizing and controlling. To address the overlapping needs of the organization, team and individuals, Coffin (1944) modified the classical functions as follows: formulation (planning), execution (organizing), and supervision (persuading).

MacKenzie (1969) proposed a well-known leader-manager model that illustrated the great variety of activities that a typical manager performs. He proposed that the central management functions relate to management of people, ideas and things, which form the three basic components of every organization with which managers must work. Three functions (the analysis of problems, decision-making and communications) are important at all times and in all aspects of the jobs held by managers, and therefore permeate the entire work process. To carry out these functions, the leader-manager needs to execute these leader activities: planning, organizing, staffing, directing and controlling. The following table summarizes these categories of leadership activities.

Table 2.1 Major Leader-Manager Functions
(Adapted from MacKenzie, 1969)

Activity	Definition or Explanation
Planning	Predetermining a course of action for accomplishing organizational objectives
Organizing	Arranging the relationships among work units for accomplishment of objectives and the granting of responsibility and authority to obtain those objectives
Staffing	Selecting and training people for positions in the organization
Directing	Creating an atmosphere that will assist and motivate people to achieve desired end results
Controlling	Establishing, measuring, and evaluating performance of activities toward planned objectives

A factor analysis reported by Dunnette (1986) of 65 managerial activities yielded seven factors: monitoring the business environment, planning and allocating resources, managing individual performances, instructing subordinates, managing the performance of groups, representing groups and coordinating groups.

Janz et al. (1997) identified four distinct facets in which a leader could give the team autonomy: planning (e.g., scheduling the team's work), product (e.g., suggesting new products or services), people (e.g., recruiting and hiring members) and process-related (e.g., specifying the development method a team should use).

Hertel et al. (2005) reviewed a collection of empirical works on the management of virtual teams and summarized the management functions of virtual team leaders at various phases of the team. They proposed that virtual team leaders are generally engaged in the following activities:

Personnel selection: selecting virtual team members based on their professional/technical KSA (knowledge, skills, abilities) and expertise with the purpose of combining expertise from different locations;

Task design: designing tasks that fit with the distributed nature of virtual teams, determining the interdependences of the sub-tasks and assigning sub-tasks to different locations;

Team initiation: Holding kick-off meetings or workshops;

Performance management: monitoring the motivation and work progress of the team, regulating team communications and building “common ground” among team members;

Training and team development: identifying a team’s training needs, evaluating training effects, sending team members for training;

Disbanding and re-integration: disbanding the team in a careful and constructive way; re-integrating the team if new projects are initiated.

The studies reviewed above categorize leader functions in different ways and use different labels for these leader functions. Integrating these different categorizations, Table 2.2 summarizes four major leader function aspects which can be delegated to virtual team members. These four areas are the overlapping important leader-manager functions identified in the above studies. The first aspect of leader delegation is composed of *planning-related* team management and leadership activities that a virtual team leader can possibly delegate to the team. The second aspect is composed of *people-related* team management and leadership activities that a virtual team leader can delegate, such as team staffing and team member training. The third aspect is *process-related* team management and leadership activities (or teamwork process management). The fourth is *control-related* team management and leadership activities. This aspect relates to the leader’s functions and activities that aim to control the work progress and quality of a virtual team.

To keep the categorization parsimonious, the key activities in each delegation aspect listed in Table 2.1 may incorporate more than one of the leader functions identified in the above studies. For example, “determining operating procedures and work instructions” incorporates two virtual leader functions in MacKenzie’s model: standardize methods, decide how to achieve goals. Some of the leader-manager activities are not included because they either cannot be assigned to the team through leader delegation, or are already tasks that are done by team members, e.g., suggesting new products or services.

Specifically, the following items were not included:

Designing tasks: Teams were often formed to cope with certain tasks in a limited period of time. Except in cases of some research and development teams, global software project leaders are not typically responsible for designing tasks for the team.

Holding kickoff meetings: Kickoff meetings are considered a team activity, not a leader function that can be reassigned. For many distributed teams, a face-to-face kick-off meeting is not practical.

Disbanding the team: this is not usually delegated by leaders to the team.

Communicating to the team to encourage purposeful actions toward desired objectives such as motivating team members, resolving conflicts and managing change: unlike in MacKenzie’s model, these items are not included as a separate category in Table 2.1 because these abstract action items can not be separated from other leader functions such as appraising work progress or determining corrective actions when a problem occurs.

Table 2.2 Four-dimensional Leader Delegation Framework

Delegation Aspects	Key Activities
Planning-related	Scheduling the team's work Setting the team's long-term goals Setting the team's short-term objectives Setting the team budget
People-related	Selecting team members Removing members from the team Determining team members' training needs
Process-related	Assigning work to team members Selecting the tools they will use in their work Determining team's operating procedures and work instructions, e.g., which analysis method to use? Determining communication and coordination protocols and practices, e.g., which media to use for data sharing
Control-related	Determining quality assurance procedures Evaluating the progress of the team's work Evaluating team product quality Determining corrective actions when performance objectives are not met

2.2.3 Degree of Delegation

To study leader delegation, researchers also need to examine variations in the delegation process. First of all, delegation does not mean that a leader abdicates his or her responsibilities. For instance, delegation may be followed up with support and encouragement and with periodic requests for progress, as well as with praise and reward (Bass, 1990). Delegation also should not be confused with laissez-faire leadership. A

leader who delegates still remains responsible for follow-up to see whether delegation has been accepted and whether the delegated activities have been carried out (Bass, 1990).

Second, delegation may occur in different degrees and the dichotomy of delegation vs. non-delegation is over-simplistic. Shriesheim and Neider (1988) distinguished among three type of delegation: advisory, informational, and extreme. In advisory delegation, subordinates share problems with their supervisor, asking their supervisor for his or her opinions regarding solutions; however the subordinates make the final decision themselves. With informational delegation, the subordinates ask a supervisor for information, and then make decisions themselves. Extreme delegation occurs when subordinates make decisions by themselves without any input from their supervisor. Other researchers have used similar categorizations of the degrees of delegation, some of them more fine-grained. For example, Tannenbaum and Schmidt (1958) proposed the following structure: the leader decides and announces the decision; the leader “sells the decision”; the leader presents the ideas and invites questions; the leader presents tentative decisions that are subject to modification; the leader presents problems, gets suggestions and makes decisions; the leader defines limits and asks for consensual decisions; the leader permits followers to function within limits. Hersey and Blanchard (1988)’s situational leadership theory proposes that depending on specific situations, a leader may “tell”, “sell”, “participate” or “delegate”. Reviewing empirical studies regarding virtual team management, Hertel et al. (2005) argued that a virtual team leader may closely control the team he or she leads through electronic monitoring, grant the team a limited degree of autonomy and lead the team by setting team goals and giving feedback, or allow a team to self-manage.

This study distinguishes the degree to which a virtual team leader delegates and measures delegation by a set of 7-point Likert scale questions instead of simple Yes/No questions. The measurement of delegation will be discussed in Chapter 3.

2.3 Research Hypotheses Regarding Leader Delegation

In previous studies, the important factors that characterize virtual team context include not only geographical dispersion but also many other factors such as use of communication technology, organizational distance, temporary nature of team, etc. Therefore, virtual team leadership studies encompass a wide variety of teams. However, to date, only sporadic studies have examined virtual team leader delegation. The following paragraphs will explore the costs and benefits of virtual team leader delegation and analyze when global software team leaders delegate and how leader delegation affects team outcomes. In the analysis, research hypotheses will be proposed.

2.3.1 Occurrence of Virtual Team Leader Delegation

A series of virtual team leadership studies investigated the effects of transformational/transactional leadership styles on different team outcomes including team potency, leadership satisfaction, team participation and team performance. The effects of transformational/transactional leadership styles on these intermediate outcomes were mixed. However, one pattern emerging from these studies was that transactional leadership generated more positive effects in the virtual team context than was found in traditional leadership literature (Zhang, et al. 2005). It is suspected that in the virtual team context the reduced delegation might be the reason for the improved effects of transactional

leadership. Hoyt and Blascovich (2003) found that transformational leadership was associated with higher levels of qualitative performance, while transactional leadership was associated with higher levels of quantitative performance. This finding can be explained with existing delegation literature. Delegation can cause short term productivity loss as a delegatee will need time to learn the delegated responsibility. The leader also needs to spend more time coordinating and monitoring the delegated tasks (Milewski and Lewis, 1996).

The issue of productivity loss is very important when global software team leaders weigh the benefits and costs of delegation. A software team is often formed for completing certain tasks in a limited time period. The short-term nature of the project requires avoidance of any productivity loss. In a longitudinal study using 18 student information system development (ISD) teams, Nicholson et al. (2002) confirmed this point. The researchers attempted to identify the characteristics/behaviors of effective ISD project team leaders/managers. Their exploratory analysis reveals that face-to-face (ftf) and virtual ISD team members value different ingredients of leadership in different phases of the ISD project. One key ingredient for virtual team leadership is that the leader has to be practical and manage time efficiently. Global virtual teams involved in ISD are temporary structures that are very focused on the development of the information system application and have tremendous time constraints. The role of a virtual project team leader is hence to remain practical in terms of the goals set and the deliverables promised, and to manage the time allocated to each task efficiently. Therefore, to avoid productivity loss, global software leaders will delegate more to competent teams than to incompetent teams. A competent virtual software team has the knowledge, attitude and expertise

required to perform the team tasks and is more likely to plan well and manage their work efficiently (Faraj & Sambamurthy, 2006). A competent team can quickly apply their expertise to the delegated task and reduce possible productivity loss to a minimum. In contrast, delegation to incompetent teams means that leaders have to spend additional time giving feedback and monitoring the execution of delegated tasks to ensure that performance standards are met. Otherwise managerial anxiety over loss of control can be overwhelming. However, in the distributed global team environment, close monitoring and timely feedback is difficult as “management by walking around” can not be used as a strategy (Pare & Dube, 1999). Due to increased temporal distances, possible increased cultural distances and the lean nature of computer-mediated communication in virtual teams (Bell & Kozlowski, 2002), leaders will need to spend much more time and effort in coordinating, monitoring and coaching team followers in the delegated tasks.

Besides the need to manage time efficiently, the matrix organizational structure of global software teams is often another reason why team leaders delegate more to competent team members. Developing subordinates’ skills and confidence is the biggest reason why leaders delegate or consult their followers, especially when followers’ skill sets are still to be developed (Yukl & Fu, 1997). The potential growth of the followers is likely to be the major benefit leaders may obtain from delegation to an incompetent team. However, virtual teams are often designed to cross geographical and organizational boundaries to allow dispersed organizations to maximize their expertise without having to physically relocate individuals. The required expertise for a given task or project may be dispersed at multiple locations throughout the organization; however, a global software team may facilitate the ‘pooling’ of this talent to provide focused attention to a particular

problem without having to physically relocate individuals (Kayworth & Leidner, 2000). Therefore, global software teams are often dispersed in cities or even countries and, very commonly, the team followers do not report to the team leader in a direct organizational line. Due to the typically short-term nature of the team and the complexity of the reporting relationship, global software team managers are more likely to be evaluated on their success in achieving project goals, rather than on their development of the team followers. In delegating to incompetent followers, global software team managers---unlike line managers who may treat the costs of delegation as an investment to be redeemed later---are faced with the cost of sacrificing team performance, which determines the manager's own promotion and career growth. As managing a matrix structure is already challenging for virtual team leaders (Oertig & Buergi, 2006), the costs associated with delegating to an incompetent team would tend to deter virtual team leaders from this management strategy. Based on the above arguments, the following hypothesis is proposed:

Hypothesis 1: Leader delegation will be positively correlated with global software team competence.

2.3.2 Effects of Global Software Team Leader Delegation

Hertel et al. (2005) found that improving virtual team members' motivation is an important task for virtual team leaders. Improving global software team members' motivation helps to retain talent and reduce turnover rates (Thatcher et al, 2003). Estimates show that up to 20 percent of information technology (IT) workers turn over each year (Whitaker, 1999). Turnover creates direct recruiting and training costs for organizations. Turnover also creates indirect costs due to disruptions in organizational processes. To

replace an IT worker, an organization may spend from one to seven times the employee's annual salary (Igbaria & Guimaras, 1993). Higher turnover rates in offshoring sites could result in lowered performance as new employees need more training to get familiar with organizational practices and culture and are not able to collaborate up to speed with remote teams. Due to high rates of turnover and associated costs, employers have shifted from perceiving IT workers as a replaceable commodity to seeing them as a valued asset. Therefore, improving global software team members' motivation is an important task.

Existing studies show that leader delegation improves team members' motivation. There are two categories of motivation. Recognition of one's ability can improve one's intrinsic motivation. Intrinsic motivation arises from a sense of personal accomplishment that comes from performing tasks and work activities autonomously (Deci & Ryan 1980). Extrinsic motivation originates from factors outside the team and external to team members, such as opportunities for rewards and positive evaluations, recognition from external leaders, feedback received from organizational stakeholders and outside customers, and peer pressure or team norms (Deci & Ryan, 1980). These forms of extrinsic motivation are frequently encountered in teams that often meet face-to-face. However, global virtual teams have physical, temporal, and psychological separation (Lipnack & Stamps, 2000; Townsend et al. 1998), are less embedded in immediate contexts, and have members who are less connected to each other and their team leaders. Also, the diversity in expertise areas makes it harder for the team's achievement to be appreciated by the leader or the external stakeholders. Thus, many of the factors that typically function as extrinsic motivators in face-to-face teams are likely to be less powerful sources of motivation for teams that seldom meet face-to-face (Kirkman et al. 2004). Delegation to team members

can significantly improve their intrinsic motivation. Delegation will improve the team's sense of self-worth and motivate the team to work harder. Previous research showed that team members are more likely to accept team goals and work toward these goals when the decision about team goals is made by the group (Erez & Arad, 1986; Bass 1990). Hackman and Oldham (1976) identified task variety, task identity, task significance, *autonomy*, and feedback from the task as key task characteristics that generate internal motivation. Therefore, delegation to global software team members would make the team more motivated to achieve the goals or follow the action plans, which they accept. Kirkman et al. (2004) confirmed the motivating effects of delegation to competent virtual teams. They investigated the relationship between team empowerment and virtual team performance and the moderating role of face-to-face interaction using 35 sales and service virtual teams in a high-technology organization. They found that team members are more intrinsically motivated when they believe they are empowered and given a meaningful task that could impact the organization.

In addition to intrinsic motivation, increased flexibility is another factor that delegation can contribute to global software team member motivation. Most global software teams are knowledge teams, which are formed to solve customer problems or to develop new products (Kirkman et al. 2004). The complex, knowledge-based tasks many virtual teams perform require behaviors such as planning and executing, managing team performance, improving team processes, and influencing organization-level direction and resource allocations (Mohrman, Cohen, & Mohrman, 1995). In conducting these activities, teams have to make sense of their tasks, improvise their work processes, and adjust how they make progress toward agreed upon goals. This requires that team members are given

flexible decision making freedom. Such flexibility is especially important to sub-teams remote from the global software team manager. The reluctance of central management to delegate to sub-teams is not rare in software engineering projects and may produce negative consequences. One consequence is that due to lack of understanding about the activities and cultures in the sub-team, the central management may not manage the sub-team as effectively as a local manager or self-managed sub-team. The following quotes from Meadow's (1996b p.113) study demonstrate this point:

“A common mistake of on-site managers is not letting the off-site manager manage the off-site people. The off-site manager knows the situation minute-to-minute and is from the same culture, able to understand all the nuances of what the team members will and will not say outright”

In contrast, delegation will increase the autonomy of the sub-teams and reduce the need for cross-site collaboration (Treinen & Miller-Frost, 2006) and thus reduce the complexities and difficulties the remote sub-team members might experience in virtual interaction. Being delegated, the sub-teams will feel a sense of being trusted by their leader and will enjoy the autonomy in their day-to-day work. They will be able to structure tasks in ways that are intrinsically motivating (Wrzesniewski & Dutton 2001).

Based on the above arguments, the following hypothesis is proposed:

Hypothesis 2: Leader delegation to global software teams will be positively correlated with said team's motivation.

Existing studies also demonstrate that delegation influences global software team members' satisfaction with the team leader. Delegation allows the team members to utilize their capability to adapt to immediate opportunities and changes without waiting for

decisions to be made by the distant leader. IS research also indicates that IT workers who perceive higher levels of autonomy report lower levels of overload (Moore, 2000) and derive greater satisfaction from their jobs (Guimaraes & Igbaria, 1992).

Also delegation allows participating in or controlling the team management decision-making, which is an important form of power-sharing in organizations (Heller, 2003). Imbalanced power sharing is a serious source of within-team conflicts when certain in-group members participate in team decision-making while the remote teams are excluded (Huang & Ocker, 2006). Sharing power with all sub-teams in a global software team would result in the remote team members feeling that they are being treated fairly by the organization, thus reducing the potential for conflict. Treinen and Miller-Frost (2006) found that mutual responsibility/goals are an important part of this power-sharing and that no sub-team should have secondary responsibilities in a global software project. Kirkman et al. (2004) also found that the more impact a virtual team can make, the more empowered and motivated the team members feel. In addition, there often exists competition between sites for higher organizational power and more organizational resources. More participation improves an offshore team's position and power (Holmstrom et al. 2006). Therefore, leader delegation will improve the team members' satisfaction level with team leadership.

Faraj and Sambamurthy's (2006) study of 65 software development teams found that empowering leadership has an important positive impact on team performance under conditions of high task uncertainty or high team expertise. In the software teams they studied, when team members have significant levels of professional experience with software development, they are more likely to possess relevant expertise and valuable

experience on how to manage their project activities. In contrast, when teams have low professional experience, the global software team leader should provide needed directions and guidance to the team members about delegated management functions and monitor their progress accordingly.

Based on the above arguments, the following hypothesis is presented:

Hypothesis 3: Delegation to a global software team will be positively correlated with the team members' satisfaction with team management

Team performance, as with individual performance, is a function of ability and motivation (Janz et al. 1997). Significant improvement in global software team performance is expected from team members motivated by leader delegation. In addition, when the team members are satisfied with the team leader delegation, the team leader will be more able to influence the members to work towards team goals and therefore to improve team performance. This has been confirmed in empirical studies (e.g. Zeffane, 1994). Therefore, delegation is an important leadership strategy that global software team leaders could use to improve team effectiveness.

2.4 Research Hypotheses Regarding Trust

Trust is another important process variable that has been commonly associated with the effectiveness of traditional and distributed teams. Trust can be defined as one party having confidence in another and a willingness to be vulnerable based on positive expectations about the actions of another (Jarvenpaa et al. 1998; Mayer et al. 1995). Trust is a key element to build successful interactions and to overcome selfish interests. It plays an important role in the construction and stability of interpersonal relationships. Trust

represents a means of coping with complexity and uncertainty in global software team contexts where there are high levels of interdependence and interaction between the different actors. It helps to create a climate of cooperation and understanding both on the individual and the collective level. However, distance is an impediment to building relationships of trust. “Trust needs touch” (Handy, 1995). While co-located sub-team members can build trust through formal and informal face-to-face meetings, trust takes time to develop between sub-teams which are distant from each other.

Trust requires certain conditions to be met, such as physical proximity, mutual information exchange (Handy, 1995), time, a shared social context, common values and similar cultures (Meyerson and al., 1996). But in the global software team context, these conditions are not always met. Trust in virtual teams has indeed been regarded as paradoxical so far. On the one hand, one of the fundamental factors that is believed to be important in determining the success or failure of virtual teams is trust. This is because trust functions as the glue that holds and links virtual teams together (Jarvenpaa & Leinder, 1999). On the other hand, the absence of physical proximity and a shared social context, and the limited lifespan of virtual teams, hinder the development of trust (Handy, 1995; Hummels and Roosendaal, 2001; Townsend and al., 1998). The multiple boundaries a global software team crosses introduce a series of distances between the sub-teams within a global software team, including geographical distance, time zone distance, organizational distance and cultural distance. These distances cripple the development of trusting relationships between sub-teams, as explained in the following section (2.4.1). Improving communication between sub-teams could enhance the degree to which one trusts the remote sub-team he/she works with in a global software project, as is to be explained in

Section 2.4.2. Section 2.4.3 discusses the relationship between sub-team competence and the level of trust one has toward the sub-team.

2.4.1 Effects of Team Distances

Geographical distance: Global software teams span countries, even continents, so it is common that sub-teams with a global software project are separated by hundreds or thousands of miles. Geographical distance may make it difficult to develop trust between sub-teams (O'Hara-Devereaux & Johansen, 1994; Handy, 1995; Lee & Kim, 1999).

First, in line with literature on physical proximity (Allen, 1984), people communicated less frequently and extensively the more they worked from different locations. In a co-located work environment, co-workers have a variety of convenient channels for spontaneous communication, such as hallway talk, chat by the coffee machine, etc. In contrast, people separated by distance have to rely on communication methods, which takes more efforts or costs to initiate. Kraut and his colleagues (1990) studied the relationship between physical proximity and the development of collaborative relationships among scientists in a large industrial R&D laboratory. They found that distance increases the costs of communications. Apart from monetary expenses for phone calls or travel, they include “the burden of having only intentional, structured interactions via a restricted modality within an already existing relationship” (Kraut et al. 1990, p. 162). Due to the costs of communication across distant sub-teams, interactions may be reduced. When the project proceeds without sufficient interaction, sub-teams start working from their own assumptions concerning expectations from remote counterparts. Since these are not anchored in solid exchanges, activities remain uncoordinated without both sides being

aware of this problem. Local processes of a sub-team may rely on assumptions that do not match expectations at counterpart sites. Therefore, trust between sub-teams may be crippled due to reduced communication, which is associated with geographical distance.

Second, because of the reduced communication between distant sub-teams, awareness of the distant sub-team is reduced. In studying nine global software projects, Herbsleb & Bass (2005) found that it is very difficult to judge the quality and skill of technical staff at remote sites due to the distances between sites and the consequent communication difficulties. Previous research views trust as a multidimensional and developmental concept that has three levels. Deterrence-based trust is the lowest level of trust and is based on whether an individual keeps his or her word. Knowledge-based trust is the next highest level and develops when team members know one another sufficiently well that their behavior is predictable. Identification-based trust, the highest level, is where team members have a shared understanding and fully appreciate each other's preferences (Lander et al. 2004; Lewicki & Bunder, 1996). Lack of knowledge about the remote team will hinder the development of higher-level trust, so that trust between the sub-teams remains at the low level of vulnerable deterrence-based trust. This is also why Cramton & Webber (1999) found that geographic distance contributed to the perception that people are less trustworthy and dependable.

Third, distance introduces in-group/out-group effects and the "we vs. they" mentality between sub-teams (Bos et al. 2004; Bos et al, 2005; Huang & Ocker, 2006; Ocker et al. 2007). In-group bias occurs when in-group members denigrate and negatively stereotype out-group members (Flippen 1999). Information and task-oriented work contributed by out-group members is not given the same consideration as that contributed

by in-group members (Mackie et al. 1990). Co-located members within a sub-team work together on tasks and refer to the other distant team members as “them”. This structure serves to inhibit the flow of information between sub-teams, with members at one location unaware of discussions and decisions made at the other location. Therefore, geographical distance is an important structural characteristic of partially distributed global software teams, which may influence the team interaction processes such as conflict and trust (Huang & Ocker, 2005). Once tensions between an in-group and out-group begin to develop, individuals may exaggerate the differences between one’s co-located group and the distant group, or may be more inclined to selectively distribute information and collaborate with in-group members, which in turn will deepen the split and have serious consequences for the work relationships and work performances of virtual teams (Bos et al. 2004; Cramton, 2001; Cramton, 2002).

Fourth, due to geographical distance and the costs of getting the dispersed sub-teams together, face-to-face interactions are greatly reduced in global software teams. Meadows (1996) found that face-to-face interactions are important to promote rapport and reciprocal insight in expectations and collaboration modes, which are important predictors of trust development. Communications between the teams have to largely rely on electronic media instead of face-to-face interactions. Hinds and Bailey (2000) suggest that electronic media reduce the salience of communications, and lead to task-centered interactions. The lack of personal exchanges prevents rapport and personal friendship being developed between sub-teams and hinders long-term trusting relationship development. In addition, empirical work shows that people who collaborate remotely do not share information evenly across sites (Cramton, 2001). This is because people do not

realize that their remote counterparts do not have access to the same information. And communication by electronic media requires more effort than local exchanges (Kraut et al. 1990). Such information flow problems further the in-group/out-group effects and may result in conflicts between sub-teams (Huang & Ocker, 2005).

Time zone distances: Time zone differences have several effects. First, the more time zones a global software team crosses, the less the time when the team members are at work at the same time. The lack of overlap time further exacerbates problems caused by geographical distance such as reduced interaction, reduced awareness of the remote site, etc., as mentioned above. For example, with no or little overlap time, members from distant sub-teams have to use asynchronous communication media. Immediate feedback or cues from synchronous communication tools such as video conferencing are reduced. As a consequence, the salience and nuance of communications suffer (Cramton, 1997; Vaughan, 1997). This worsens the communication difficulties the sub-teams have and further impairs relationship building between the sub-teams. Therefore, time zone distance would hurt trust between sub-teams in global software teams.

Time zone distance also brings up new challenges which could result in conflicts and lower trust between sub-teams within global software project. For example, during the overlap, the participants at various sites are at different points in their work rhythms. Video conferences between the United States and France saw sleepy morning stragglers at the U.S. site and alert afternoon workers at the French site (Olsen & Olsen, 2006). Another issue is that any synchronous communication, such as a phone call, audio conference or video conference, poses inconvenience and usually imposition to one of the two parties. Those not near the center of power at headquarters are the ones who are regularly

inconvenienced (Carmel, 1999). Conflicts arise and the inconvenienced party will not trust their remote colleagues to act in their interest. Over the long run, this imposition will take a toll on the distant managers and developers who are forced to alter their life (Carmel, 1999). This also impairs the long-term relationship between the sub-teams.

Organizational distance: The global nature of a software project also introduces organizational distances between the sub-teams, that is different sub-team members may belong to different function units or even different organizations. Previous research shows that differences in organizational affiliations can: reduce shared understanding of context, inhibit a group's ability to develop a shared sense of identity, and affect communication and performance effectiveness (Zack and McKenney, 1995). These effects are due to differences in corporate culture. Corporate culture covers many facets of organizational life such as management style, rewards and communication style used by employees. When sub-team members bring different values and ideologies from their corporate culture background to a project, the differences will introduce conflicts and misunderstandings between the sub-team members. Even within the same organization, at multiple sites the organizational culture may have adapted to local conditions and rules. When members from different sites connect for a project, differences in management structure and approach may surface. Also the functional units at each site may have evolved to using different norms and practices, e.g., expense approvals may require routing through a different department at one site and not at the other. Functional cultural differences have been found to be one of the key differences between information systems development and packaged software development (Carmel, 1999). When different functional cultures are

found to be governing the activities of sub-teams, they become obstacles to effective cross-functional teamwork (O'Hara-Devereaux et al. 1994).

Lau and Murnighan (1998) argue that functional diversity can be an obstacle which reduces informal communication, group cohesiveness, and social integration. This obstacle will have a tendency to create artificial subgroups within a team and introduce in-group/out-group effects into the team. Social identity theorists (Tajfel & Turner, 1986) suggest that individuals will become more biased toward their in-group members. Strong emotional subgroup attachments may then become potential sources for interpersonal or relationship conflict (Jehn, 1995) with members of other sub-groups. Therefore, functional distance may impair trust between the sub-teams within a global software project.

Cultural distance: when sub-teams are located in different countries, the national cultural differences between the sub-teams may also hurt trust between the sub-teams. There have been several theories or frameworks which identify key dimensions of cultural differences. Hofstede's five-dimensional classification is one of most commonly used. His theory is particularly relevant to this study as he collected data from a single controlled group of an IT company: IBM. He proposed that national cultures may differ in the following dimensions: revering hierarchy, individualism vs. collectivism, taking care of business, risk avoidance, and long term orientation. Differences in these dimensions may be reflected in conflicts between sub-teams in a global software project. For example, software teams frequently rely on group decision making techniques, most with roots in individualistic cultures. While individualists may be comfortable with a technique that inherently relies on conflicts, that is not the case for someone with a "collectivist" orientation because it would require him to be rude and to disrupt an

interpersonal relationship (Carmel, 1999). In addition to introducing disagreement or conflicts over work methods or norms, cultural differences also increase information processing needs (Dougherty, 1992). Dissimilar ‘common’ knowledge translates into diverse repertoires of behaviors that are not self-explanatory across communities. Complementary efforts become necessary to anticipate and enable reinterpretation of actions. Cultural differences imply that people lack insight into their counterpart’s cultural background and language (nuances). They will therefore need relatively rich media or preceding face-to-face contact to contextualize exchanges. However, in global software teams, rich media such video conferences or face-to-face contact may not be easily accessed due to time-zone or geographical distances. Therefore, in global software teams, cultural biases are argued to cause misinterpretations of messages and introduce conflicts (Kayworth & Leidner, 2002). Cogburn & Levinson (2003) conducted a study on students in global learning networks. They found that the two teams that experienced the least success in building a learning community reported in their evaluation essays that American–South African differences in communication and academic styles contributed to the low participation rates of South African team members. This low participation rate, in turn, generated a relationship of low trust between the Americans and their teammates in South Africa. Their findings proved that cultural differences in communication, work ethic, and academic styles contributed to trust problems between Americans and South Africans and, to a lesser extent, between Americans and other international students.

In addition, there are cultural differences between software professionals in different countries. For example, a 1996 study compared Singaporean and US firms’ usage of formal software development methods such as diagramming methods and found that

Singaporean firms make more use of such methods (Hunter & Palvia, 1996). These professional cultural differences may further exacerbate the negative effects of cultural differences on trust between sub-teams in different nations.

Of all the cultural differences, language is particularly important. Even when all software engineers use a common business language, English, various problems emerged. Non-native speakers usually had difficulties in reading between the lines and understanding subtle differences in what is being communicated. They may read manuals slowly, often missing ideas and nuances. They cannot scan specifications as quickly (Carmel, 1999). Comprehension of spoken English varies and depends a great deal on accent, speed and use of slang. As a result, language barriers caused reduced project participation of non-native speakers, less frequent communications, longer time for communications, and misunderstandings, which may eventually hurt teamwork performance and their work relationship with others.

Based on the above arguments, the following hypothesis is proposed:

Hypothesis 4: Team distances including geographical distance, time zone distance, cultural distance and organizational distance between sub-teams will be negatively correlated with the trust between members of different sub-teams.

2.4.2 Effects of Communication Quality on Trust

The preceding section argues that team distances such as geographical distance and cultural distance imposed challenges on communication between distant sub-teams and may cause misunderstandings between the teams, thus making trust-development difficult. However, it may be possible to overcome these challenges. One solution is to improve the

communication quality between the sub-teams. For example, frequent informal and unplanned communication has been shown to be related to shared identity and shared context (Hinds & Mortensen, 2005). Frequent spontaneous communication has a direct moderating effect on the conflict-distribution relationship, mitigating the effect of distribution on both interpersonal and task conflict (Hinds & Mortensen, 2005). Finally, frequent bursts of interaction are linked to high trust in virtual teams (Jarvenpaa et al. 1998). With the exponential growth of communication technologies, frequent low-cost communication could take place with tools such as instant messaging, voice over IP, etc. Also high quality communication such as frequent responsive communication and the ability to convey complex abstract concepts is important to demonstrate one's capability to the remote team, clear misunderstandings, and build trusting relationships (Huang & Ocker 2006). Multiple studies have demonstrated the importance of communication quality to trust development. For example, Levina (2006) also found that frequent cross-boundary communication improves the relationship and trust between members separated by geographical and organizational boundaries. Lee & Kim (1999) found that accurate effective communication was an antecedent of trust in an IT outsourcing relationship and helped build long-term outsourcing partnership. Cogburn & Levinson's (2003) cross-case comparative data on global learning network communication patterns reinforces Javenpaa's finding that high-trust teams engage in frequent communication characterized by behaviors such as providing feedback, clarifying and developing a consensus on tasks, and notifying teammates of upcoming absences.

Previous research has identified multiple ways to improve communication in global teams such as giving timely feedback, crafting straightforward messages, avoiding slang, using a formal documentation system, etc. (Carmel 1999; Espinaso et al. 2006).

Based on the above discussion, the following hypothesis is proposed:

Hypothesis 5: *Communication quality between subteams will be positively correlated with the trust between subteam members.*

2.4.3 Effects of Sub-team Competence on Trust

The competence of a sub-team determines how much members of other sub-teams will trust this team. Technical capability is frequently mentioned as an important factor in building and maintaining trust toward offshore partners in global software projects (Nguyen et al. 2006). Trust was built over time, based on long-term consistent performance and behavior that created confidence. When a virtual team is first formed, team members have to assume the other members are reliable. This kind of trust is called swift trust which is fragile (Jarvenpaa & Leidner, 1999). A successful team requires trust beyond the level of swift trust. Knowledge-based trust is a higher-level trust (Lander et al. 2004). Work expertise and performance enable the others to gain knowledge about your reliability. Especially in global software projects, where distance prevents people from finding out details about remote team members' work processes, technical expertise is very important for team members to turn out the desired work product and win the trust of other remote team members. In interviewing global software project leaders, Oertig and Buergi (2006) found that newcomers to the project win trust by their knowledge of the tasks. It took time for newcomers to the company to gain the trust of their colleagues. The project

leaders linked trust in people's expertise primarily with their developing knowledge of the company as well as knowledge of the tasks.

Based on the above argument, the following hypothesis is proposed:

Hypothesis 6: *Competence of a global software subteam will be positively correlated with the trust it receives from its distant subteam members.*

2.4.4 Effects of Trust on Team Member Motivation

Trust is important for global IS project success because it can reduce transaction costs (Cummings and Bromiley, 1996) and can facilitate information exchange (Earley, 1986). Trust lowers the transaction costs of relationships because individuals engage less in self-protective actions (Kramer and Tyler, 1996). If one could trust other sub-teams, one could be confident in their commitment and capabilities to collaborate on the project and be confident that other sub-teams would not slow down the project or take a free ride. Also, trust reduces the costs of controlling and monitoring efforts in distributed teams (Kanawattanachai & Yoo 2002). In addition, trust is critical in preventing geographical distance from leading to psychological distance within a global team and makes working in global project more enjoyable (Snow et al. 1996). Lee & Kim (1999) found that in the long run, trust leads to stable offshoring partnerships, which benefits both parties in the relationship. Therefore, trust between sub-teams would improve one's motivation when working on the global software project.

Hypothesis 7: *Trust toward other sub-teams will be positively correlated with a global software team members' motivation.*

2.5 Research Model

Based on the variable definitions and the propositions presented in the preceding three sections, the following conceptual model is presented in Figure 2.1. Inside the boxes are the variables. The arrows represent relationships between variables, which are described in the previously presented propositions. The numbers represent these propositions.

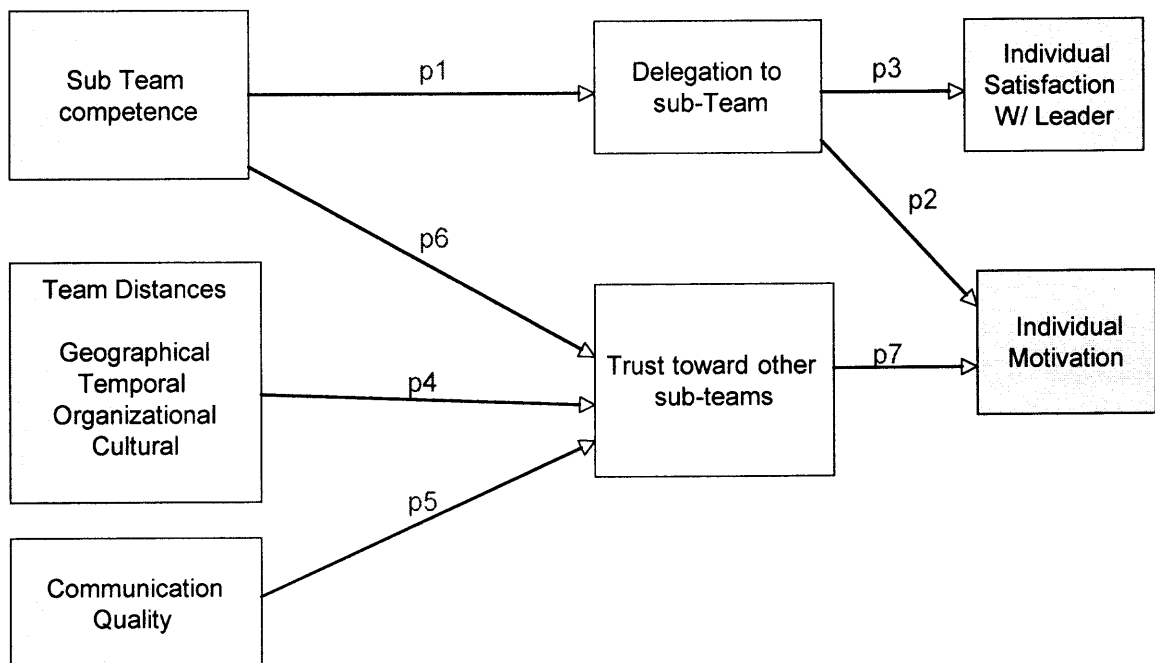


Figure 2.1 Research Model

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This study will use a multi-method approach to examine leader delegation in virtual teams by conducting both a survey and open-ended interviews with virtual team leaders and followers.

The quantitative survey method and the qualitative open-ended interview method are different both in terms of the type of research questions they are best applied to and the data analysis methods used. They are most often associated with deductive and inductive approaches, respectively.

Deductive research begins with a known theory and tests it, usually by attempting to provide evidence for or against a pre-specified hypothesis. Inductive research begins by making observations, usually in order to develop a new hypothesis or contribute to a new theory. Deductive research begins with pre-specified objectives focused on testing preconceived outcomes. Inductive (qualitative) research begins with open-ended observation and analysis, most often looking for patterns and processes that explain "how and why" questions. When applying quantitative methods, numerical estimation and statistical inference from a generalizable sample are often used in relation to a larger "true" population of interest. In qualitative research, narrative description and constant comparison are used in order to understand the specific populations or situations being studied. As a result, quantitative research is most often seen as a method trying to demonstrate causal relationships, often in controlled environments. Conversely, qualitative

research is usually seen as a method seeking better understanding of some particular, natural phenomenon. Table 3.1 summarizes the kinds of distinctions often made concerning the use and value of both methods (Casebeer & Verhoef, 1997).

Table 3.1 Usual Distinctions between Quantitative Method and Qualitative Method
(adapted from table by Casebeer & Verhoef, 1997).

Concepts usually associated with quantitative method	Concepts usually associated with qualitative method
<i>Type of reasoning</i>	
Deduction	Induction
Objectivity	Subjectivity
Causation	Meaning
<i>Type of question</i>	
Pre-specified	Open-ended
Outcome-oriented	Process-oriented
<i>Type of analysis</i>	
Numerical estimation	Narrative description
Statistical inference	Continuous comparison

Despite their differences, the two methods can be used together usually with the qualitative research generating the hypotheses or theory that are tested with the quantitative research. It can also be used with a quantitative approach applied first followed by a qualitative approach that is focused on gaining a deeper understanding of the results from the quantitative study. In this latter fashion, a multi-method study can be rigorous in terms of statistical analysis but also have the richness of contextual information to explain why a pattern exists. Such a multi-method design is especially develop a multidimensional understanding by using different types of data and different analytic techniques to focus on the phenomenon (Sawyer, 2001).

In discussing the need for more multi-method research in information systems (IS) research, Mingers (2001) proposed a typology of five generic multi-method research designs: sequential, parallel, dominant, multi-methodology and multilevel. The pilot study of the dissertation study uses the parallel design with a survey as the dominant method. In a *parallel* multi-method design, the methods are carried out in parallel, with the results feeding into one another (Mingers, 2001). An example of this type of design cited by Mingers is Trauth and Jessop's (2000) analysis of group support systems (GSS) use in which two analyses were carried out separately on the same set of data, but the conclusions were then combined to generate a richer understanding (Mingers, 2001). In the pilot study, the interviews were conducted while the survey was being conducted. In the pilot test, the parallel approach was used with the purpose that the interviews could give feedback to the design of the survey instrument so that the survey instrument could be improved. In the future full-scale survey, the sequential multi-method research design will be used as the dominant method. A *sequential* design employs methods in sequence with the results from one analysis feeding into the later analysis. An example of this type of design is following up a statistical analysis of questionnaire data with in depth interviews in order to gain a better understanding of the results. For the full scale study, the survey instrument has been validated and the interviews can be conducted to provide contextual information to explain the results of survey data analysis.

3.2 Survey Research

The survey instrument was created by a panel of two Ph.D. students and three professors, who have extensive research and work experiences related to virtual teams. The

measurements of the variables are adapted from previously published studies or created by the research panel. Besides the variables in the research model, the survey will also collect the respondents' background information such as gender, age, native language, dominant cultural background, role in the team project, the duration of the team, etc.

The survey instrument measures six major variables of interest in the research model: leader delegation, team competence, team members' satisfaction with leader, team members' motivation, team distance and trust of remote sub-teams. As the teams in the pilot study are hybrid teams which were distributed with some of them meeting face-to-face, the pilot study also measures the percentage of computer-mediated communication (CMC) in team communication to evaluate how virtual a team really is. Therefore, the survey instrument also measures the number of times a team met face-to-face, and the percentage of CMC. The data analysis used these variables as control variables in validating the relationships predicted in the research model. However, due to survey length constraints, only portions of the delegation research model about were tested. Therefore, although the next section introduces the measurement of all constructs in the model, in the pilot study survey, only questions related to team competence, leader delegation, satisfaction with one's leader and team motivation are included.

3.2.1 Measurements

The survey questions used in the full scale study are included in Appendix A. The following text presents detailed discussions of each construct.

Delegation: Leader delegation is measured by fourteen Likert-scale items in the pilot study. Thirteen items measure the thirteen leadership and management functions in

Sub-team competence: This variable refers to the capability of a team in the global software project to perform the team task. Two competence measurements were used in the pilot study. In the survey with student software teams which was conducted first, six Likert-scale questions were used, which are adapted from the situational leadership measurement of follower ability (Hersey & Blanchard, 1988) and Hardin et al's instrument of virtual team efficacy (2006). The six questions are as follows:

The team has the necessary job expertise and knowledge.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team has past experience relevant to the team job.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team is qualified for its job

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team can work on its own without much external help.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team can effectively communicate even in a distributed environment

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

Coordination with remote team members is not a problem.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

This approach to measuring team competence asks the respondent general questions about how competent the team is. Given the generality of the questions, the

student teams may report themselves to be more competent than they actually were. Therefore, in the second survey, with the report-writing teams, a new measurement of virtual team competence was adopted. This measurement decomposes a virtual team's competence into several skills or capabilities that are important to performing the team task. For example, the respondent is asked to "evaluate the team's PowerPoint development skills" instead of being asked "whether the team has the skills needed for the team task". Thus respondents are forced to ground their evaluation of the team's competence on specific skills and are less likely to give a biased general evaluation. Another question asks the respondent to evaluate the team's competence level excluding himself. In answering this question, the respondent does not need to evaluate himself so he is less likely to report false data. Responses to this question can be correlated with responses on other specific team competence items and thus can be used to evaluate how reliable the other responses are in evaluating team competence. In the pilot study, the course instructor listed seven skills and capabilities important to the team task which are used to develop this new measurement of team competence. The new items are as follows:

How do you evaluate your team on the following items?

Very weak							Very strong
1	2	3	4	5	6	7	

- a). PowerPoint slides development
- b). problem-solving skills
- c). critical analysis
- d). report-writing
- e). communication skills
- f). collaboration skills
- g). presentation skills
- h). the overall competency of the team to perform project tasks (excluding yourself)

In the full-scale dissertation survey, the following items suggested by three software project managers who have intimate knowledge of software project requirements and practices are used:

How do you evaluate your team on the following items?

Very weak							Very strong
1	2	3	4	5	6	7	

Ability to collaborate with other teams
Team members' ability to collaborate among themselves
Technical expertise needed for this project
Knowledge of organizational practices
Knowledge of systems for information sharing and collaboration
Problem-solving skills
The overall competency of the team to perform team tasks (exclude yourself in this reply)

Team members' motivation: In the pilot study, four questions measuring this construct are borrowed from situational leadership theory (Hersey & Blanchard, 1988). The original questions measure individual level motivation on a 1-7 Likert scale. They have been adapted to measure the team-level construct. Questions include the following:

The team is motivated to take on additional responsibilities if needed to finish the project.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team works to a high standard.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team is committed to its goals.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

The team members work hard to fulfill their responsibilities and obligations to the team.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

Hackman and Oldman's (1976) measurement of motivation is used in the full-scale study as the pilot study found very skewed data and high response bias with the original measurement. The following are the new questions measuring motivation:

I feel bad and unhappy when I discover that I have performed poorly on this project.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

My opinion of myself goes up when I do my project work well.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

I feel a great sense of personal satisfaction when I have done a good job on this project.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

Team member's satisfaction with the team leader: Three Likert-scale items were created by the study panel to measure this variable. The items are as follows:

I am very dissatisfied with the way this project is managed.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

I am very happy with the way my local team is managed.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

I would be very happy to work on future projects that are managed similarly to this project.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

Team distances:

- a. *Geographical Distance*: will be measured by miles between sub-team sites or between project leader and a sub-team.
- b. *Cultural Distance*: will be measured by two indices, national culture and native language. Therefore, there are three levels of cultural distance: (0: same national culture, same language; 1. Different national culture, same native language; 2. Different national culture, different native language)
- c. *Temporal Distance*: will be measured by hours between time zones
- d. *Organizational Distance*: will be measured in a similar fashion to cultural distance by placing each team member in relation to his or her leader into categories with 1 being the closest distance category and 3 being the furthest organizational distance. 1- team member and team leader are in the same department in the same company; 2 – different departments in the same company, 3 – different companies.

Communication quality: This construct is measured by three items on a 1-7 Likert scale which are created by the research panel:

I can convey complex work ideas to members of the remote team.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

In general, members of the remote team always understand me when I communicate.

Strongly Disagree							Strongly Agree
1	2	3	4	5	6	7	

My work communication with the remote team could be better.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

Trust: This construct borrows from Jarvenpaa and Leidner's study (1998) and includes four items on a 1-7 Likert scale:

If I had my way, I would not let the other team members have any influence over issues that are important to the project.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

I would be comfortable giving the other team members complete responsibility for the completion of this project.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

I really wish I had a good way to oversee the work of the other team members on the project.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

I would be comfortable giving the other team members a task or problem that was critical to the project, even if I could not monitor them.

Strongly Disagree						Strongly Agree
1	2	3	4	5	6	7

Number of times the team met face-to-face: This variable is measured by one question: How often does the team meet face-to-face?
Once every _____ days

Percentage of CMC: This variable is measured by one question: What percentage of the time does the team spend weekly on computer-mediated communication? _____%

3.2.2 Survey Instrument Validity and Reliability

3.2.2.1 Reflective Constructs

The constructs of trust, satisfaction with leader, communication quality and motivation are reflective constructs. In reflective constructs, measurement indicators are selected from a universe of questions and are interchangeable. The change in construct is reflected in changes in the indicators.

Measurement validity refers to the extent to which the measurement actually measures the concept it is intended to measure. In this study, considerable care was taken to improve the validity of reflective constructs. First, the measurements in the survey are grounded in the leadership and team literatures, and existing measurements that previous researchers have shown to be reliable and valid are borrowed where appropriate. Second, when established measurements were not available a panel of two Ph.D. students and three professors with extensive research and work experiences on virtual teams created the measurements. Third, three Ph.D. students and three industry employees who have worked in virtual teams took the survey and were interviewed to improve the face validity and also the content validity of the survey.

The survey seeks self-report on the constructs that form the research model. The respondent might be tempted to report data that is more socially desirable or that makes him or her or his or her team look better. To overcome this problem, detailed information was given to survey respondents that described how the confidentiality and privacy of their data was to be protected. The survey does not ask for any information that can identify any individual. Also, the respondents are assured that only a summary report of the information

captured would be released to their organization or published. These measures reduce the possibility of getting biased self-report data.

The reliability of a reflective measurement model refers to whether the measurement yields consistent results. Several steps were taken too improve the reliability. First, all the constructs in the research model are measured by multiple items. Second, in the data analysis of the pilot study, Cronbach's Alphas were calculated to evaluate whether a set of items measure a latent construct. The Alphas of constructs in this survey were all above 0.70 except the measurement of trust, which will be discussed in detail in the next chapter. Third, the order of the questions in the survey is randomized so that the items measuring one construct are not placed near to each other. Fourth, one item in the satisfaction measurement and two in the trust measurement are inverted, for example, "I am *dissatisfied* with the way the team leader led the team". The inversed item can be triangulated with other items to test if the results are consistent. However, in the pretest of the questionnaire, it was found that some respondents did not notice that some of the questions were inversed. Therefore, only three items are inversed in this survey.

In the full-scale survey, global software team workers from the U.S., Ireland, India and China will take the questionnaire. An information systems Ph.D. student from India examined the questionnaire and made minor changes to make the questionnaire culturally appropriate for the Indian respondents.

However, to improve the survey response rate, the survey was limited by the 10-minute constraint. This constraint has some costs: one control variable, project importance, is measured by only one item, and the other control variable, task interdependence, is measured by two items. However, since the importance of the project

is a straightforward concept, there is less need for multiple items. The two items measuring task interdependence are borrowed from an existing instrument which has been shown to be reliable and valid. Therefore, this limitation should have only a very minor influence on the reliability of the survey.

3.2.2.2 Formative Constructs

The other five constructs--Competence (team competence), PlanDele (planning related delegation), PeopleDele (people related delegation), ProcessDele (process related delegation) and ControlDele (control related delegation)--in this dissertation survey are formative. In a formative construct model, the indicators influence the construct. These are often called 'causal' indicators and the construct is often termed as variable (MacKenzie et al. 2005). This means that the measures cause the construct and that the construct is derived by its measurement. An example of a formative construct is Socio-Economic Status (SES) which is caused by three measures: education, income, and occupational prestige (Heise 1972). In this study, competence is a combination of team members' expertise in eight distinct aspects. Each type of delegation, such as planning related delegation, is a combination of project management's delegation in several management areas.

One would not require a simultaneous increase in all of the indicators for any individual, and thus, a high correlation between the individual indicators is not expected, required or a cause for concern (MacKenzie et al. 2005). Therefore, formative constructs cannot be validated using methods which rely on covariance or correlation between indicators such as confirmatory factor analysis and Cronbach's Alpha. There has been very limited research on how the reliability and validity of formative constructs should be

analyzed. Rossiter (2002) suggests that only the content validity of a formative construct needs to be examined. The content validity of delegation constructs is assured because the measures are selected based on extensive literature review which ensures that no important indicators are neglected. The measures of competence are collected from two managers in Company A who have intimate knowledge about Company A's work practices. Also the face validity and content validity of delegation constructs and competence are checked by a research panel of two IS Ph.D. students and two I.S. professors and are double-checked in pretests with another five Ph.D. students and three I.S. managers.

Recent research suggests that the multicollinearity of the formative construct indicators should be examined (Helm, 2005). As the formative construct model is based on a multiple regression, collinearity between the indicators would make it hard to separate distinct influences of the individual indicators on the latent variable. The variance inflation factor (VIF) should not exceed ten (Kleinbaum et al. 1998). Regression tests with the full-scale survey data showed that the highest VIF values of the competence construct, PlanDele construct, PeopleDele construct, ProcessDele construct and ControlDele construct are respectively 4.41, 1.97, 1.81, 2.21 and 3.53. Therefore, multicollinearity should not pose a problem as the VIF values are below the common cut-off threshold of ten.

3.2.3 Data Analysis Strategy of Survey Data

Basic statistical analyses will be conducted such as descriptive statistics, scale reliability test, factor analysis, etc. The Partial Least Squares (PLS) method will be used on the construct data obtained from the survey to test the research model. PLS is especially

useful for models in which there are multiple predictors and there exist intermediate factors that lead to correlations. Therefore, PLS is selected in this study. Also PLS is probably the least restrictive of the various multivariate extensions of the multiple linear regression models. This flexibility allows it to be used in situations where the use of traditional multivariate methods is severely limited, such as when there are fewer observations than predictor variables. Furthermore, partial least squares regression can be used as an exploratory analysis tool to select suitable predictor variables and to identify outliers before classical linear regression. In addition, this method is able to handle multiple dependent variables as well as multiple independent variables and robust in the face of noisy data (Malthouse et al. 1997).

However, in the pilot study, due to the small sample size, PLS cannot be used to test the entire research model at one time. Instead, multivariate regression is used to test each hypothesis. Details of the hypotheses test results will be discussed in next Chapter.

3.3 Semi-structured Interview

3.3.1 Interview Plan

Open-ended interviews will be conducted with the respondents to collect rich descriptive data about global software team dynamics, leader delegation processes, effects of delegation, and team members' experience interacting with remote sub-teams. The qualitative data collected from the interviews provide contextual information which may complement or explain the survey findings. An interview guide is created based on our research questions and consists of a list of questions to be asked. All the interview

questions are open-ended. During the interview process, depending on the situation, questions can be modified, added, or removed.

The following is the interview guide with each category of questions focusing on one component in the research model:

1. Opening Questions and Background Questions:

What do you do?

Do you work on multiple projects at the same time? Or only one? Tell me about your work in this project.

How many people do you work with? Where are they located? Have the members been meeting face-to-face before? Do you know all the persons personally (face-to-face)?

2. Leadership and Delegation

How are the decisions made in your team?

What if the team disagrees with the decision? Do you think the teams are treated differently in the project? How do you feel about the way decisions are made? Can you give an example?

Do you feel your team members have enough participation in the decision-making process? If you were the project manager, would you do anything different?

3. Team Competence

What does your team do in this project? How well do you think your team is doing in the project? How about the other teams? Do you think everybody contributes/ is able to contribute equally?

4. Communication and Trust

How do you communicate with people in different countries? What happens? How well do you think the other teams understand your English?

5. Motivation and Satisfaction

What are the things you like the best about this project? Can you give an example?

What are the things you do not like about this project?

Do you ever have to do something that is not assigned to you? Did you just volunteer and willingly carry the extra workload? Can you give an example? Do other people do this? Why do you think they do it?

Several categories of questions will be asked in the interviews. Most of the questions are designed to lead the interviewees to give more details or examples. Not all of the questions will be necessarily asked depending on the interviewee's responses. Also sub-questions may be generated in the interview processes to explore details. In the pilot study, nine members from three teams were interviewed face-to-face. In the full-scale study, 13 selected members who are currently working on global software project will be interviewed on the phone or face-to-face.

3.3.2 Interview Data Analysis

Interviews will be videotaped or recorded with the interviewee's permission. The interview data will then be analyzed using an explanation building approach. Explanation building is one of the common approaches to analyze qualitative data (George & Bennett, 2005). Each interview is considered one case. Interpretation or hypothesis is created from one case, and then built up with additional examples from other cases. This is an iterative

process repeated until all hypotheses are verified with supporting or opposing examples from all cases.

Two IS Ph.D. students, a master's student and two IS professors who are experienced in IS research will analyze the data. Each of them will build explanations separately then will compare and validate their findings together.

3.4 Comparison of the Analyses

The final step in the analysis will be to compare the results of the survey data analysis with those of the inductive analysis of interview data. A comparison of the results derived from the two data analyses can be used to corroborate findings or to reveal conflicting evidence, in which case the researcher can attempt to reconcile the conflict by probing more deeply into its source (Eisenhardt, 1989). In this study, comparison of the results of the inductive analysis with those of the deductive analysis can be used to provide additional insights into the relationships put forth in the research model, e.g., the effect of delegation on team member satisfaction and motivation, the effect of communication quality and distance on team member trust, etc.

CHAPTER 4

PILOT STUDY DATA ANALYSIS AND RESULTS

4.1 Study Design and Sample

A pilot study was conducted to validate the survey instrument and as a preliminary test of the research model. 82 students from 44 teams in two medium-sized U.S. universities took the survey.

Forty-eight students in 30 software-development student teams took the survey in the first round. There are 32 males and 16 females. Three of these students are graduate students and the other 45 are undergraduate students. The majority of the students, 65%, are in the age group 21-25; 25% are in the age group 26-30 and 10% of the students are over 35. Twelve of them have GPA from 2.0 to 3.0 and 36 of them have GPA from 3.0 to less than 4.0. The team size ranges from 3 to 5, with the team leader elected by the team members. In 16 teams, only one member took the survey; in 10 teams, two members took the survey; in 4 teams, three members took the survey. These teams were working on a semester-long software development class project. The survey was given near the end of the semester so the team members had worked on the team for about three months. The courses the teams took were face-to-face courses and the entire teams met face-to-face at least once a week. The team members are distributed and rely heavily on communication technology instead of face-to-face interaction for team collaboration and communication. However, they do not fit the traditional definition of virtual teams as teams that rarely meet face-to-face. Instead, these are hybrid virtual teams, which is a common structure in industry. The recent literature on virtual teams has broadened its conceptualization to

include teams that vary in the degree of “virtuality” they exhibit (Dube & Pare, 2004). Virtual teams range from highly to minimally virtual (Cohen & Gibson, 2003; Griffith & Neale, 2001; Griffith et al. 2003). For example, some teams that are referred to as co-located even though the team members actually communicate electronically between face-to-face meetings and even distributed teams meet face-to-face at times. The student teams represent diverse amounts of virtuality because the universities they come from are primarily commuter schools with students living quite far from each other. Some of the teams are entirely virtual and others meet regularly. Therefore, studying these hybrid teams would yield important insights on virtual teams.

In the second round, 34 students from 14 report-writing teams took the survey. All 34 students are graduate students. Two of them have GPA from 2.0 to 3.0 and 27 of them have GPA from 3.0 to less than 4.0; and five of them have 4.0 GPA. 40% of the students are in the age group 21-25, 25% are in the age group 26-30; 17.5% are in the age group 31-35; 17.5% are over 35. The team task was to analyze an industry case study, writing a team report and developing PowerPoint slides based on the case study results. The team sizes are 5 or 6 members with team leaders elected by team members. In 5 teams, only one member from each team took the survey; in one team, two members took the survey; in 4 teams, three members took the survey; in 4 teams, more than 4 members took the survey. The survey was given after the team finished their first case study project. Therefore, at the time the survey was taken, the team members had worked in the team for about one month. These 14 teams were taking an online management information system course. Only two of these teams reported meeting face-to-face once a week. All the other teams had never met face-to-face during the team project.

4.2 Data Collection

The survey respondents were briefed on the purpose of the study and the confidentiality and privacy of the survey data before the survey was given. They were sent an email which included the URL of the online survey. They filled in the survey online in private.

Nine members from three software-development teams were interviewed. The interviews took place in private meeting rooms. After securing permission, each interview was videotaped. The three members from the first team were interviewed together. This interview served as a practice interview to train the Ph.D. students who conducted further interviews and to improve the interview guide. It was found in group interview that the team members were reluctant to report difficulties or problems in the teamwork. The respondents gave short answers which were more positive than the actual teamwork situation. Therefore, this interview with the first team was not analyzed in this pilot study. The interviews with team members from the other two teams were conducted with each individual in private. The team leader and two followers from each team were interviewed.

4.3 Research Instrument

The survey instrument described in Chapter 3 and the interview guide were used in the pilot study. As mentioned in Chapter 3, only the part of the research model related to delegation was tested in the pilot study. In the first round of the survey, conducted with software development teams, team competence was measured by six items which ask the respondents to assess team competence in general. In the second round of the survey, conducted with report-writing teams, virtual team competence was measured by the eight

items which ask the respondent to assess the team's competence on each specific skill needed to perform the team task. In Chapter 3, there is detailed discussion about the differences between these two measurements. All other variables were measured by the same scales in the two rounds of the survey.

4.4 Data Analysis¹

4.4.1 Basic Statistics of Survey Data²

4.4.1.1 Constraints on Construct Measurement Analysis

Due to the small sample size, a factor analysis was not conducted. In the pilot study teams, team members were mostly assigned to teams by the course instructor and the student team projects did not have budget constraints. Thus the leaders of the student teams did not have the authority to delegate people-related or budget-related leadership functions. So it is not surprising that 60% of the respondents reported “not applicable” when asked how much the team leader allowed the team to: 1) decide discretionary expenditures, 2) select team members, 3) remove team members from the team, 4) determine team members' training needs. Keeping this “not applicable” data will further reduce the power of the statistical tests to be run. Answers to these questions were therefore removed from the data and the remaining 9 items measuring delegation were aggregated to form a

¹ Due to the small sample size in the pilot study, Alpha threshold level is set to be 0.1, that is findings with a significance level of 0.1 or less will be considered significant.

² For readability purposes, in this chapter acronyms are used to represent variables of interest in the data analysis.

Delegation – virtual team leader delegation

Competency – virtual team competence

Competency (1) - measured by original virtual team competence scale

Competency (2) – measured by the scale which consists of items assessing specific skills needed to perform team tasks

Motivation - team motivation

Satisfaction – team member's satisfaction with team leader

delegation measure. As the pilot is only a preliminary test of the research hypotheses, delegation was not entered into regression tests as multi-dimensional item. Instead it was treated as uni-dimensional to represent overall leader delegation to a team.

4.4.1.2 Scale Reliability

Cronbach's Alphas were calculated to test whether multiple items in a scale reliably achieved consistent scores on the concept being measured. Figure 4.1 shows that the Alphas of all constructs are above 0.7 except the Alphas of the task interdependence and the trust construct. There are only two items measuring task interdependence so 0.67 was treated as an acceptable level of reliability for using this construct in the model. The reason why the trust construct has low reliability is unknown especially since these measures were taken from previously validated questions. It may be that a construct such as this does not work for students. Further data analysis will not use "trust".

Construct	Cronbach Alpha
Delegation	0.933
Competency (1)	0.81
Motivation	0.881
Satisfaction	0.794
Interdependence	0.67
Trust	0.409

Figure 4.1 Cronbach's Alphas of the Scales.³

4.4.1.3 Descriptive Statistics

The following figure shows the summary distribution statistics for the software-development teams:

³ In Chapter 4 and 5, all tables containing data analysis results are figure output from statistics software.

	Mean	Standard Deviation
Importance-Project	5.72	1.17
Interdependence	2.78	0.36
GPA	5.71	1.18
Delegation	4.71	1.61
Motivation	5.47	1.41
Satisfaction	5.65	1.24
Competence	5.36	1.21

Figure 4.2 Summary Statistics of Software-development Teams.

Figure 4.3 shows the zero-order inter-correlations between the variables for the software-development teams.

	1	2	3	4	5	6
Importance_Team						
Interdependence	0.191					
GPA	0.194	.375(*)				
Delegation	.440(*)	0.301	0.139			
Competency	.476(*)	.587(**)	0.241	.508(**)		
Motivation	.611(**)	.494(**)	0.209	0.339	.840(**)	
Satisfaction	.509(*)	.464(*)	0.184	.435(*)	.776(**)	.639(**)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4.3 Zero-order Inter-correlations of Variables in Software Development Teams.

Figure 4.4 shows the descriptive statistics for the report-writing teams:

	Mean	Standard Deviation
Importance-Project	5.08	1
Interdependence	5.58	0.98
GPA	3	0.51
Delegation	5.41	0.85
Motivation	5.37	1.03
Satisfaction	5.46	1.14
Competence	5.89	0.81

Figure 4.4 Summary Statistics of Report-writing teams.

Figure 4.5 shows the zero-order inter-correlations between the variables for the report-writing teams

	1	2	3	4	5	6
Importance Team	1					
Interdependence	.587(*)					
GPA	0.147	-0.113				
Delegation	.646(*)	.769(**)	0.241			
Competency	0.478	.872(**)	-0.07	.706(*)		
Motivation	.596(*)	0.517	-0.071	.813(**)	0.46	
Satisfaction	0.594	.720(**)	-0.025	.654(*)	.739(**)	.735(**)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4.5 Zero-order Inter-correlations of Variables in Report-writing Teams.

4.4.2 Hypothesis 1 Test

4.4.2.1 Software Development Teams

Hypothesis 1 postulates that team competence predicts team leader delegation, such that the team leader will delegate more to competent teams than to incompetent teams. In the software development teams, this hypothesis is tested by regressing delegation on team competence. The regression results support the hypothesis ($p=0.007$). Figure 4.6 shows the summary statistics of the regression model.

Delegation Regressed on Competency	
Standardized Coefficient	0.508***
R Square	0.258
F-Overall	8.706***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4.6 H1 Regression Test Results in Software Development Teams.

To test whether the relationship between team competence and delegation arises because of the interaction of other control variables, stepwise regressions were conducted regressing competency, average GPA of the team, project importance to the team, and task interdependence on delegation. These control variables did not change the predicting effects of team competence on leader delegation. Therefore, detailed results are not shown here.

4.4.2.2 Report-writing Teams

For the report-writing teams, Hypothesis 1 is also tested by regressing delegation on team competency. The regression results support the hypothesis ($p=0.01$). The test results are shown in Figure 4.7.

Delegation Regressed on Competency	
Standardized Coefficient	0.706***
R Square	0.498
F-Overall	9.913***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4.7 H1 Regression Test Results in Report-writing Teams.

Again, stepwise regressions were conducted regressing competency and three control variables (project importance to the team, average GPA of the team, and task interdependence) on delegation. Including control variables in the equation did not significantly change the relation between team competence and leader delegation. Therefore detailed results are not shown here.

4.4.3 Hypotheses 2 and 3 Tests

4.4.3.1 Software Development Teams

Hypotheses 2 and 3 concern how leader delegation affects intermediate outcomes including team members' satisfaction with the team leader and team members' motivation.. *Hypothesis 2* proposes that delegation will improve team members' satisfaction with the leader. *Hypothesis 3* proposes that delegation will improve team member's motivation

The team outcome variables (team motivation and team's satisfaction with team leader) were regressed on team leader delegation, using team competence as a control

variable, to test hypotheses 2 and 3 as well as the effects of leader delegation on team flexibility. Figure 4.8 presents the summary data from all three regressions.

The regression results supported Hypothesis 2. The results show significant main effects of leader delegation, which means leader delegation improved the team's satisfaction.

Hypothesis 3 is not supported, as no significant effects of delegation on motivation were found. However, the main effects of team competence were found to be significant, that is, team motivation was largely (standardized coefficient = 0.75 for motivation and 0.65 for satisfaction) influenced by the competence level of the team ($p=0.001$).

	DV = Motivation Standardized Coefficient	DV = Satisfaction Standardized Coefficient
Delegation	0.537	1.502*
Competency	1.536***	1.708**
R²	0.75	0.651
F-Overall	21.993***	9.939***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4.8 Hypotheses 2, 3 Regression Test Results in Software-development Teams.

Another round of regression tests was conducted with team average GPA, project importance to the team, and task interdependence level as control variables. However, including these control variables in the test did not affect the relationships found above. As the second regression test did not produce significant changes, regression test results are not shown here.

4.4.3.2 Report-writing Teams

Hypotheses 2 and 3 were tested with data from report-writing teams using similar stepwise regression tests. Each of the team outcome variables (motivation and satisfaction with leader) was regressed on leader delegation and team competency. Figure 4.9 presents the results of these sets of regressions.

Hypothesis 2 was also supported in the report-writing teams. Team leader delegation significantly predicts team motivation ($p < 0.001$).

	DV = Motivation	DV = Satisfaction
	Standardized Coefficient	Standardized Coefficient
Delegation	0.782***	1.502*
Competency	0.126	1.708**
R Square	0.551	0.561
F-Overall	12.263***	11.502***

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4.9 Hypotheses 2, 3 Regression Test Results in Report-writing Teams.

Regression tests with the control variables of project importance to the team, team average GPA and task interdependence included were also conducted. The test results did not change the relationships discussed above. So the detailed results are not displayed here.

4.5 Interview Findings

4.5.1 Data Analysis Method

This pilot study is meant to test the research instrument and also to make a preliminary test as to whether the research hypotheses embedded in the survey are viable. In addition, interviews with six members from two software-development teams were also used to provide data supporting the research hypotheses. Therefore the interview data analysis did not strictly follow the inductive procedure explained in Chapter 3.

The interview data were analyzed in two steps. First, two Ph.D. students and two professors watched the videos of the interviews and discussed as a group what they found relevant to the research study. Each of them explained his/her findings to the group, and the group discussed the validity and implications of these findings. These group discussion results were recorded in writing. Second, one Ph.D. student, the author of this thesis, collated the group discussion results and wrote them into several concise statements. Then she watched the interview videos for a second time selecting quotes from the interviewees related to each statement and examining these quotes to judge how they supported or did not support the categories of findings that the group created. She improved or modified the statements accordingly. This two-step procedure roughly transcribes the interview data to create a coding schema, first by coding data and then iteratively improving the coding schema and making conclusions. This procedure draws on insights made by multiple researchers and should be adequately rigorous for a small-scale pilot study.

4.5.2 Data Analysis Results

The interview data analysis found that delegation is an important part of team leadership and could affect team outcomes in various ways. The following summarizes the detailed findings:

First, team leaders were aware of the importance of delegation, and delegation may happen for several reasons. One team leader learned from his previous military training that a leader should teach his subordinates to do his job and to be able to take over if the leader is not available. Both team leaders also emphasized that they delegated to the team because they believed the team had the capability to perform the task. Their belief in

the team's competence initially came both from knowledge of team members' past performance and from knowledge of a team member's professional experience. One team leader also stated that competent team members have egos and being too controlling might hurt such egos. One team leaders also delegated tasks to a less competent team member but explained this delegation as a way to give this team member a needed skill set and also self-confidence in order to make the person a productive member of the team.

Second, as the team develops, the leader's delegation style may change. In both teams that were interviewed, the leaders' style changed from being controlling to being more delegating as the team improved its competence. In one team, team members reported that in the very beginning of the project, the leader "tried to control everyone and everything in the project". While the leader was away, he would send emails to ask team members to conduct the work in a precisely specified way. However, as the team members demonstrated their capabilities and produced several deliverables ahead of deadlines, the leader "eased off". Near the end of the project, the team leader was very trusting and allowed the team members to self-lead. One of the most competent team members even led the team for two weeks when the leader was on vacation in a foreign country.

Third, delegation was accompanied by monitoring and coaching. After certain tasks or functions were delegated, the leaders monitored how the team performed and coached the team members when needed. One team leader, for example, suggested books for the team members to read and advised the team about the development tools available.

Fourth, delegation affects team motivation and satisfaction with the leader. In one case, when in the beginning a team member missed the first deadline and produced very low-quality deliverables, the team leader became very directive by setting detailed work

schedules for the team, making detailed work assignments to team members. and closely monitoring the work quality and progress of the team. Such non-delegation drove the team members to work harder and the team members appreciated the team leader getting the team up to speed. In another team, members had adequate professional experience and the skills needed to perform the project tasks; in the beginning the team leader was very controlling and the team members complained and even had head-on arguments with the leader. However, as the team leader learned about the competence of the team, he negotiated with team members when making decisions and the team members felt trusted and became more satisfied with the leader.

4.6 Discussion

The survey results provided preliminary support to that component of the research model relating to delegation.

In both software-development teams and report-writing teams, virtual team competence predicted leader delegation behaviors. The more competent the teams were, the more the leader delegated. The open-ended interviews also confirmed this finding.

In the software-development teams, delegation improved the team's satisfaction with the leader, but team competence did not moderate this relationship. In the report-writing teams, leader delegation improved both team motivation and team members' satisfaction with the leader. There are two main conclusions. First, in both types of the teams in the pilot study, delegation affected how satisfied a team was with the team leader. This is understandable as leader's behavior in his interaction with the team followers would directly affect the team members' perception of him. Second, delegation

exerted a stronger influence on the report-writing teams than the software-development teams. It is suspected that the different delegation effects found in the software teams and report writing teams may arise from the differences in the number of times the teams met face-to-face. In contrast to the software development teams, which met at least once a week, the report-writing teams barely met. Students in the report-writing teams took a summer online course and throughout the project, only two teams met face-to-face once. As collaboration and communication processes suffer from lack of face-to-face contact, the leader's role in team coordination and communication becomes more important. Therefore, leader delegation produced stronger effects in the report-writing teams. Unfortunately in the software-development teams, the measurements of the number of times a team met face-to-face and the percentage of CMC in team communication have very low reliability. The two variables were not used in data analysis so this study cannot tell exactly how the virtuality level of a team influenced the effects of leader delegation.

It is also suspected that the student leaders were not able to exert a strong influence over the software teams because their leadership functions are very limited given the pre-designed project tasks. Therefore, the effects of leader delegation were not as prominent and could not be detected as significant given the small sample size.

Though statistical analysis did not find all the delegation effects expected, interviews with three software development teams found delegation to be an important component in software team management. It was found that team leaders were aware that delegation was an important part of leading a software team and the leaders intentionally adjusted their delegation style as the teams developed. Highly competent team members could even take over or replace the leader when necessary.

In summary, the pilot study data analysis results provided initial support to some of the hypotheses and suggested that the hypotheses might be viable, although the sample size was small, the study run on teams that were not totally virtual and the teams themselves were students doing a student project which is not entirely representative of people in the work world with responsible work duties.

4.7 Lessons Learned about Research Methodology from the Pilot Study

There are several possible improvements in the survey instrument and data analysis procedure.

- 1. More specific questions on team competency measurement:** instead of using statements which generally assess the overall competence of a team, a new measurement of team competence was developed which decomposes the team competence into specific skills and capabilities which are important to the team task. Respondents are asked to assess each specific skill. With this new measure, it is expected that the respondents will provide more objective data about their team's competence since the questions will look like a request for a comparison of skill sets rather than an overall evaluation of competence. In the pilot study, the measure on team competence was skewed with all students rating their team as highly competent, even if course instructors gave different reports.. In the full-scale study, company managers were contacted. They provided a list of skills they believed were important to the software development team competence. These skills were used in the new questions.

2. Measurement of Trust: in the pilot study, the Cronbach's Alpha of the trust measurement was too low ($\alpha = 0.409$) to accept the measurement. This measurement is borrowed from the study of Jarvenpaa and Leinder (1999) and is one of the most commonly used measurements of virtual team trust. Previous studies proved that it is a very reliable measurement with Cronbach's Alphas of greater than 0.8 (Aubert & Kelsey, 2003; Jarvenpaa & Leinder, 1999). It is believed that the construct does not work well with students. Therefore, this measurement will still be used in the full-scale study. To increase reliability, all four items of measurement will be used. Three items from this measurement were used in the pilot study.

3. Triangulation of data: The pilot study relied on self-reporting of the team members. It is believed that any self-report bias is minimized due to the strict data privacy and confidentiality and the absence of any individual-identification information in the survey. To further reduce the possibility of self-reporting bias, the author is negotiating with the participating companies and course instructors to get the companies' or the course instructors' objective measurement of team performance, such as missed deadlines and project grades. More background information is asked about industry team members including their years of professional experience related to the team project and years of experience working for the current employer. This background information should indirectly show the team members' knowledge of the relevant domain and understanding of organizational practices and tools, and thus their competence related to team tasks. In data analysis, these data collected from multiple sources will be triangulated to judge whether the self-report data are reliable or not.

In addition to the above changes, the survey of the industry teams will collect more background information related to the project such as the longevity of the team, the stage of the project, team leader location, etc. All this background information will help us to better understand the context of leader delegation and team activity and may provide additional explanations of and context for the survey findings.

4.8 Limitations

There are four main limitations of the pilot study. The first is that only portions of the research model were tested. The second is the small sample size, which may make some important effects undetectable in regression tests. The third is the use of student teams as subjects, which limits the generalizability of the pilot study findings. The fourth is that all the variables in the pilot study were measured by self-reporting from team members. The self-report may be biased as team members may report more positive data than are actually justified. This study strictly protects data privacy and confidentiality and the survey asks for no information that could identify individuals. Therefore, it is expected that bias from self-reporting has been minimized. Still, the pilot study results should be viewed with caution. To overcome these limitations in the full-scale dissertation study, more industry teams are enlisted and objective third-party are collected to triangulate with self-report data. Details will be discussed in the next chapter.

4.9 Potential Contribution of the Pilot Study

This pilot study brings attention to an important gap in global software project leadership research: the delegation issue. It is expected to contribute to the literature on

global project leadership by providing additional insights into how project leaders delegate and how leader delegation affects virtual team outcomes. To date, there has been only limited research on how global project leaders share or delegate authority and responsibility to the team, and existing research has yielded conflicting findings. The preliminary results of the pilot study helped improve the design of the survey instrument and also shed light on the process and effects of leader delegation in student virtual teams. The pilot study results provided initial support to the viability of the research model, which could guide software project management researchers. The findings in this study will also help team practitioners to effectively manage virtual teams through delegation. Organizational project team leadership training may use the insights from this study to coach team leaders as to when and what they should delegate.

CHAPTER 5

FULL-SCALE SURVEY RESULTS

5.1 Study Site and Data Collection

In the full-scale study, surveys and interviews were conducted with software development teams in a Fortune-100 software development and service company, Company A. This company has more than 350,000 employees worldwide with more than \$90 billion in revenue in 2006. The survey was distributed to about 150 employees in the testing department of this company, located in four countries: Ireland, United States, India and China. The survey was hosted online by a third-party survey service provider. The contact managers in the participating company sent emails to the company employees, explaining the purpose of the study and the confidentiality and privacy of the survey data, and requesting them to take the survey available at the URL given in the email. Ninety-three employees completed the survey by early May of 2007. The survey response rate was 60% eliminating concerns about a biased respondent sample. During and after the survey, 13 employees from the four countries were interviewed. In the following sections, details about the survey respondents and the data analysis results will be presented. In next Chapter, details about the interview process and interview data analysis results will be discussed.

5.2 Survey Sample

Out of the 93 employees who took the survey, 28 are female and 65 male; 5 are under the age of 25; 55 are in the age group 26-30; 23 in the age group 31-35; 9 in the

age group 36-45; none in the age group 45-60, and 1 in the age group above 60. One respondent was a project manager; 36 were technical leaders of a project sub-team; 50 were project team members. On average, the survey respondents have worked in the company for 6 years; the sub-team size is about 15 people and each team has been in place for about two and a half years.

5.3 Survey Measurement Analysis

The two types of construct measurement models are reflective and formative. Reflective measures are caused by the latent construct, whereas formative measures cause the latent construct. In a reflective construct measurement model, the measures all represent the underlying construct and are expected to be correlated. Due to the high correlations between the indicators, the indicators are also interchangeable and dropping an indicator should not alter the conceptual meaning of the construct (Jarvis et al. 2003). A reflective construct measurement model can be validated using a standard statistical method such as Cronbach's Alpha, confirmatory factor analysis, etc. In this dissertation study design, the constructs of communication quality, motivation, satisfaction and trust are reflective constructs. The tests of these constructs were conducted using SmartPLS software. The measurement analysis results are listed in the following figures:

	AVE	Communality	Composite Reliability	Cronbachs Alpha
CommunicationQuality	0.50	0.50	0.75	0.50
Motivation	0.49	0.50	0.73	0.50
Satisfaction	0.74	0.74	0.89	0.82
Trust	0.59	0.59	0.81	0.65

Figure 5.1 Reflective Construct Measurement Analysis.

	CommunicationQuality	Motivation	Satisfaction	Trust
Com1	0.68	0.31	0.3	0.31
Com2	0.71	0.39	0.25	0.35
Com3	0.72	0.14	0.43	0.43
Mot1	0.02	0.55	0.01	0.19
Mot2	0.4	0.81	0.3	0.24
Mot3	0.25	0.79	0.16	0.22
Sat1	0.39	0.25	0.81	0.12
Sat2	0.47	0.19	0.9	0.26
Sat3	0.35	0.27	0.86	0.27
Trust1	0.35	0.25	0.25	0.78
Trust2	0.35	0.06	0.09	0.7
Trust3	0.51	0.35	0.23	0.82

Figure 5.2 Cross-loadings of Reflective Construct Indicators.

The Cronbach's Alpha for communication quality, motivation and trust are below 0.7. This may be because each of these constructs is measured by only three indicators. Also, the validity of Cronbach's Alpha has been questioned because it uses the same weight for all indicators (Brown, 2006; Chin, 1998). Therefore the composite reliability of these constructs was also analyzed and it is found that the composite reliability is above the threshold level of 0.7. Therefore, the measurements of these constructs are reliable.

Figure 5.1 shows that the indicators of communication quality, motivation, satisfaction with leader, and trust load high on the construct measured and low on the other constructs. This demonstrates the discriminate validity of these construct measurements. Also, Figure 5.1 shows that the convergent validity of these constructs is above the threshold level of 0.5 and the communality of these construct measurements is also above the threshold level of 0.5.

The other five constructs--Competence (team competence), PlanDele (planning related delegation), PeopleDele (people related delegation), ProcessDele (process related delegation) and ControlDele (control related delegation)--used in the survey are formative constructs. In the formative construct model, the indicators influence the construct; the

measures cause the construct and the construct is derived by its measurement. In this study, competence is a combination of team members' expertise in eight distinct aspects. Each type of delegation, such as planning related delegation, is a measure of the project management's delegation in a specific management area.

As indicated in Chapter 3, formative constructs cannot be expected to have high intercorrelations between its individual items and therefore need to be tested for their validity and reliability in a different fashion. The Variance Inflation Factor (VIF) was examined and found to not exceed the threshold value of 10. These constructs were therefore kept as viable measures.

5.4 Descriptives of Survey Data

Figure 5.3 shows the descriptive statistics for the survey results:

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
CommunicationQuality	91	.54	7.00	4.7425	1.21464
ControlDele	92	1.00	7.00	5.2682	1.32813
GeoDis	87	.00	17.70	10.2161	4.84439
Motivation	92	1.60	7.00	5.9200	.98689
PeopleDele	92	.16	8.00	4.7928	2.27699
PlanDele	92	-.82	7.15	4.9863	1.64575
ProcessDele	93	.98	7.88	5.5836	1.31148
Satisfaction	93	.60	7.00	4.5459	1.58791
TimeDis	87	.00	12.00	6.9368	3.87434
Trust	92	-.36	7.00	4.4162	1.43457
competence	92	1.53	8.12	5.8002	1.22545
Valid N (listwise)	82				

Figure 5.3 Descriptive Statistics of Survey Results

Figure 5.4 shows the correlation matrix of the constructs.

	1	2	3	4	5	6	7	8	9	10
CommunicationQuality										
ControlDele	.238*									
GeoDis	-.262*	0.075								
Motivation	.375**	0.168	-.269*							
PeopleDele	0.12	.618**	0.037	.240*						
PlanDele	0.066	.663**	-0.122	.262*	.646**					
ProcessDele	.242*	.801**	-0.08	.276**	.612**	.722**				
Satisfaction	.477**	.366**	-0.041	.271**	.264*	.325**	.413**			
TimeDis	-0.19	0.133	.935**	-.253*	0.058	-0.102	-0.022	-0.015		
Trust	.525**	0.048	-.357**	.289**	-0.013	0.04	0.004	.248*	-.284**	
competence	.220*	.759**	-0.116	.263*	.615**	.658**	.697**	.293**	-0.09	0.015

* P<0.05

** P < 0.01

Figure 5.4 Construct Correlation Matrix

5.5 Research Model Assessment

Partial Least Squares (PLS) was used for data analysis. The software package used was SmartPLS. PLS allows for incorporating formative as well as reflective measurement models and does not require the dependent variable distributions to be normal (Chin & Newsted, 1999). The PLS analysis did not include the following hypotheses:

1. Hypothesis 4c: Hypothesis P4c predicts that organizational distance negatively correlates to trust. The respondents who participated in this survey all came from the testing function of the same organization. Therefore, there is no variation of organizational distance in the data. Hypothesis P4c was not tested.

2. Hypothesis 4d: Hypothesis P4c predicts that cultural distance is negatively correlated to trust. As cultural distance is a categorical variable which may vary at three levels, cultural distance cannot be included in the PLS path analysis. However, using the trust construct scores from the PLS output, a T-test was conducted separately to test hypothesis P4c, which will be discussed later.

3. Hypothesis 6: Hypothesis P6 predicts that a remote sub-team's competence is positively correlated with how much members of the local team trust the remote sub-team. This survey asked respondents to self-evaluate the competence of the sub-team they belonged to. Therefore, to identify a remote sub-team's competence, data from individuals who were working in this sub-team need to be aggregated. However, different individuals referred to their sub-team and the project their sub-team belonged to in different ways. There was no reliable way to identify which individual belonged to which sub-team in which project. Thus, hypothesis P6 cannot be analyzed using survey data. However, in later sections, interview data about the relationship between team competence and trust will be discussed.

Figure 5.5 shows the PLS results related to the relationships predicted in the research model. T statistics from bootstrapping are also reported. A graphical presentation of the PLS results is attached in Appendix B.

Hypothesis	Path Coefficient	T Statistics	Support for Hypotheses
P1a: competence -> PeopleDele	0.61**	8.69	Y
P1b: competence -> PlanDele	0.66**	8.82	Y
P1c: competence -> ProcessDele	0.70**	10.72	Y
P1d: competence -> ControlDele	0.76***	12.23	Y
P2a: PlanDele -> Motivation	0.09	0.40	N
P2b: PeopleDele -> Motivation	0.15	0.81	N
P2c: ProcessDele -> Motivation	0.3334*	1.44	Y
P2d: ControlDele -> Motivation	-0.27	1.19	N
P3a: PlanDele -> Satisfaction	0.05	0.25	N
P3b: PeopleDele -> Satisfaction	-0.02	0.10	N
P3c: ProcessDele -> Satisfaction	0.31*	1.57	Y
P3d: ControlDele -> Satisfaction	0.10	0.42	N
P4a: GeoDis -> Trust	-0.43	1.16	N
P4b: TimeDis -> Trust	0.21	0.61	N
P5: CommunicationQuality -> Trust	0.46***	4.16	Y
P7: Trust -> Motivation	0.32***	2.89	Y

* P < 0.10; ** P < 0.05; *** P < 0.01

Figure 5.5 PLS Analysis Results.

Hypothesis set 1 predicts that the project management would delegate more to competent sub-teams. The PLS results supported these hypotheses. The path coefficients are all greater than 0.6, which suggests a strong relationship between competence and delegation. Comparing the four path coefficients, it is found that competence has the strongest influence over control related delegation. This is followed by process related delegation, then planning related delegation and finally people related delegation. This means that if a team is competent, the project management will readily trust them to self evaluate their work quality and progress and to develop their own quality assurance related procedures. They will also delegate planning and people related functions but are slightly less likely to delegate these tasks to sub-teams even if the teams are perceived to be competent. This may be because some of the planning work was completed before the teams were assembled. People related functions such as selecting or removing team members from a sub-team may be part of a standard way of assigning people to teams and thus, not possible to delegate. For example, Company A maintains a database about the expertise areas of the employees so the managers may be able to use the database to find talents needed in the project instead of consulting the sub-teams.

Hypothesis sets 2 and 3 predict that the more delegation a team gets, the more satisfied with the leader and the more motivated the team members are. The PLS analysis provided partial support for these hypotheses. It was found that only hypotheses P2c and P3c were supported. This means that autonomy in work processes such as tools, methodology, and communication patterns to will increase the team members' satisfaction with the project leadership and motivate them to work harder. The PLS analysis did not find that PlanDele, PeopleDele and ControlDele impact the team

members' satisfaction with the leader or their motivation.. Process related management functions relate to how one goes about his/her daily work, and thus have the greatest impact on the work being performed. Autonomy and flexibility in daily work are particularly important when the managers are remote, since one does not need to communicate and coordinate frequently with the remote managers. This, in turn, saves time and effort and allows one to structure his/her work in ways most suitable to his/her immediate work environment.

Hypothesis set 4 proposes that distance between sub-teams will negatively predict how much a team member trusts the remote sub-team. The PLS results do not support Hypothesis P4a nor do they support Hypothesis P4b. Both geographic and temporal distances were not found to be negatively correlated to team member trust.

Hypothesis 5 predicts that good communication quality will increase the trust one has towards a remote sub-team and that bad communication quality will reduce it. This hypothesis is supported and the path coefficient of 0.46 suggests a strong relationship. This means that despite the distance, global software team members can know each other better and develop more trusting relationships through better communications.

Hypothesis 7 predicts that the more one trusts the remote sub-team he/she works with, the more motivated one is and also the less one trust a remote sub-team, the less motivated he/she is. This hypothesis is supported by the PLS results.

As mentioned above, Hypothesis 4d regarding the relationship between cultural distance and trust cannot be tested using PLS, so it is tested separately. Only eight respondents answered the survey questions including trust, based on their interaction with remote team members who come from the same national culture. Forty reported trust

toward remote team members who come from different national cultures but speak the same native language; thirty reported trust towards their remote team members who come from different national cultures and also speak different native languages. As only 8 cases belong to the category of culture distance level 1 and the data were widely dispersed with a variance that was different from the other two categories, ANOVA tests comparing all three categories at the same time are not applicable. Instead, a T-test comparing category 2 (different national culture with same native language) and category 3 (different national culture with different native languages) was conducted. It was found that trust between team members in culture distance category 2 is significantly higher than trust between team members in culture distance category 3 (mean: 5.18 vs. 3.83; $p < 0.01$). Due to the small sample size and non-normality issue in category 1, trust between team members in culture distance category 1 cannot be compared with other categories in a rigorous statistical way. Therefore, it is concluded that Hypothesis 4d is partially supported. To gain more in-depth understanding about the impact of national culture on trust, the means of trust between team members in different countries are presented in Figure 5.6. For reasons such as small sample size in some categories, heterogeneous variance, and non-normal distribution, significance levels from F-tests cannot be reliably obtained so are not reported in this figure:

Culture Distance	Sample Size	Trust (Sample Mean)	Standard Dev.
Dublin vs. U.S.	31	5.40	0.20
India vs. China	2	4.54	0.81
India vs. U.S.	3	4.48	0.66
India vs. Dublin	7	4.35	0.43
same country	8	4.33	0.40
China vs. U.S.	25	3.86	0.23
China vs. Dublin	8	3.73	0.40
China vs. Canada	2	3.35	0.81
India vs. Australia	1	3.07	1.14

Figure 5.6 Trust between Team Members from Different National Cultures

Figure 5.6 shows that trust between Dublin team members and U.S. team members is very high (5.4 based on 1-7 scale; SD=0.20). The Dublin testing teams and the U.S. teams have been in place for the longest time and have the longest history of working with each other in Company A. These two sites also share 4 hours of overlap work hours, a relatively short geographical distance (approximately 2900 miles) and a common native language. It is believed these factors contribute to the high trust between these two sites.

Using the latent variable scores from PLS output, further regression tests were conducted to test the research hypotheses with control variables included such as team size, age, gender, and team duration. The regression results did not significantly alter the findings made above.

5.6 Interview Method

Thirteen Company A team members working on large globally distributed projects were interviewed. Seven of them were located in Ireland, one in India, three in China and two in the U.S. Two of them are senior managers. Except for three Chinese participants, the other participants have experience being manager or technical leader of a sub-team. As the interviewees come from different organizational levels or with different work experiences,

their opinions add to understanding the research questions in this study from different perspectives.

The interviews followed the interview guide introduced in Chapter 3 and were conducted in several ways. For the Irish participants, interviews were conducted face-to-face at the Irish site by one researcher, while another experimenter participated via telephone. For all other participants, interviews were conducted via telephone. During the interview, participants were encouraged to raise their own issues and describe their experiences even if not asked specifically. Each interview took approximately 45 minutes.

With the exception of the Chinese members, interviews were done by two researchers; one directly asked questions; the other took written notes and asked follow-up questions near the end of the interview. In addition, all interviews were audio-recorded with the interviewees' permission. Each recording was subsequently reviewed and analyzed by four or more researchers. A procedure of iterative "explanation-building" analysis was used whereby each researcher listened to an interview recording, took notes and formed a list of hypotheses related to the research questions of interest in this dissertation study. Next, the recording of a different interview was listened to, with special attention paid to confirming, or rejecting the initially listed hypotheses. As a result of this second interview, the hypothesis list was revised and a third interview was analyzed. This process continued until all the recordings were analyzed. Finally, all the researchers met and compared and integrated the hypothesis lists into a single list.

5.7 Interview Findings

In this section, interview findings pertaining to the research questions of this dissertation study are presented. For privacy reasons, pseudonyms are used in place of the interviewees' real names.

5.7.1 Team Competence and Leader Delegation

In Company A, project management judges whether a team is competent enough to take over decision-making responsibilities. When the management does not trust a team's capabilities, they are very reluctant to delegate authority to the sub-teams. One senior manager complained about a request for more decision-making power from incompetent Indian teams. She believed that this kind of request stemmed from inappropriate competition between different sites and was unjustified. She was quoted as follows:

"In the past, I had an India team and there was... quite strong competition.... I felt the team wanted to make decisions but weren't quite ready. They felt they wanted to prove themselves to be on par with the people in Dublin. There was certainly competition".

"They would have liked to be ahead of where they were. They felt that they would like to be stronger and play a stronger role".

However, it is difficult for managers to judge the competence level of remote team members. There is a lack of opportunities for the manager to easily find out the work situation of the remote teams. The remote team may be considered as incompetent even when their work progress was stalled for legitimate reasons. In the interview process, it

was found that one team consists of a sub-team at the U.S. site and also a sub-team at the Ireland site who report to a manager in the U.S. The Irish employees felt they had to work harder than their U.S. counterparts to prove their expertise to the manager. One interviewee commented:

“All Tom (the manager) knows about those people is some of their past history though some reports and reviews. He can only see how well they stick to the schedule because he doesn't see them everyday. Whereas if he could come here and ask why you did not finish work that day, he would see your broken leg, That explains everything. But he does not see that in Dublin, so he relies on how well they perform their tests and the numbers (of cases) they pull in... They are remote so in order for them to establish themselves, they work hard to stick to the schedule, maybe beating the schedule as much as possible.”

5.7.2 Effects of Leader Delegation

Several interviewees expressed a hope to be assigned more authority and to get more involved in the team decision-making process. They felt that being delegated authority and responsibility meant recognition and trust from management. Gaining recognition from headquarters was a significant source of motivation for teams that recently joined the company or teams that were far away from headquarters. For example, one Chinese interviewee was quoted as saying, *“We all work hard. My colleagues are prepared and ready (to take over more responsibility). I think the headquarters should trust us more”*. The Chinese team members were often willing to compromise their personal life and work extra hours to prove their competence. In the interview, one Irish

manager reported that members of the Beijing team he was leading worked 12 hours a day. There also exists competition between the sites in Company A. More delegated authority is felt to be a way to gain status in the organization. As mentioned above, there exists serious competition between the Irish and Indian teams. The Indian team members were found skipping over contact with the Dublin teams and interacting directly with U.S. central management. In addition, they felt that delegation would allow remote team members to structure their work more flexibly. One Chinese interviewee talked about her experience working with development teams and management in the U.S. She mentioned that one disadvantage of the cross-country work arrangement was the lack of knowledge on the U.S. side about the work environment and work practices of the Chinese team. She said “*the U.S. colleagues should know us better*”. She wished the project management would ask about the Chinese team’s opinions, so she could enjoy “*more flexibility in scheduling my work*.” It was also found that project managers usually did not come from the technical side. They were expected to consult with sub-team leaders and members regarding technical issues that needed resolution. However, this was not always done, in particular, when deciding on deadlines for the testing team. For example, schedules from testing came from the development team and were created by development managers who knew little about testing. As one Chinese interviewee put it, “*when we joined the project, the schedule had been predetermined by the developers. You know, they produce software code and modules to be tested. We (the testing team members) need to follow their schedule.I am OK with this.*”

While the interviews identified many benefits of leader delegation, some interviewees mentioned one undesirable consequence of being delegated more

decision-making responsibility. One Irish employee has a busy schedule in life and work. She does not want to add more responsibility to her already overwhelming workload. She is therefore happy that in her team “*the decisions are made between the project manager, the local manager and the technical leader*”. She explained that:

“You can be under a lot of pressure, you do not really want to have, say, more participation; I am aware it means a lot of, a lot of pressure; I am comfortable with what the managers decide to do”.

One Chinese interviewee gave another reason why getting decision-making authority may cause pressure. She said that “*I’d like to get involved in some management things but I am afraid of making wrong decisions*”.

Therefore, leader delegation was found to produce either a positive or negative impact on the team members in different situations depending on factors such as relationship between teams, team leader background, workload, etc.

5.7.3 Team Competence and Trust

When working with a new remote team for the first time, one often makes assumptions about whether the remote team is trustable or not. Jarvenpaa and Leinder (1999) found that virtual team members rely on “swift trust” at the beginning of the team project, assuming the remote team members are trustworthy. However, “swift trust” can easily be lost if expectations are not met. These findings are consistent with the results of our interviews. The interviews also showed that the competence of the remote sub-team influences whether the “swift trust” can develop into more stable trust or will, instead, disappear.

Company A has been expanding quickly in India and China and a large number of newly hired employees have started working on projects. When new teams join the project for the first time, the other teams often have to assume that they possess the necessary skills as they have no face-to-face meetings in which to assess these skills. As one Irish employee put it, *“we have to assume that they are working out things correctly. We are just so busy, we can't check everything.”* However, due to the fast expansion rate, newly hired employees may not receive enough training before they work on the project or and may not have intimate knowledge of the practices they are nominally trained to follow. One Irish manager was disappointed to find that one Indian team did not follow the procedures they were trained in Ireland to follow after they went back to India. In such situations, this sub-team's competence level did not meet the initial expectation of other project team members. The trust level can then be expected to drop. One American interviewee described his experience:

“I had issues getting them to do what I asked them to do. It's not working. I said I need XYZ. But they only gave me X or XY....I thought they had enough training. But six weeks later, I found they never had. OK. Then it's like, it explains a whole lot. That's why they do not have a clue what I am talking about.”

When a sub-team lacks proper training or experience, they are not trusted with tasks important to the project by the other project members. An Irish interviewee gave an example of working with inexperienced Indian and Chinese colleagues:

“They (Indian and Chinese sub-teams) were brought into the project to increase the size of the team. We have to develop their skills; we gave them easier more straightforward things to do; we will be left to do more challenging things.”

Therefore, a sub-team’s competence level is important to the maintenance of initial trust and predicts whether the other sub-teams trust them to handle complicated tasks independently.

5.7.4 Team Distance and Trust

Geographical distance between teams causes two issues: communication breakdowns and psychological distance, which may hurt the development of trusting relationships between sub-teams. Due to budget constraints, most of the team members did not have a chance to visit remote sites, and they have never met members of the remote sub-teams face-to-face. The lack of face-to-face contact limited the rich communication between sites and hindered trust development. One Irish manager commented on this issue: *“The limits on travel curtail face-to-face contact. In the past, we could sit down at business meetings and visit someone personally after the meeting. With Japanese and Chinese colleagues, you sat down with people and negotiated your relationship. Now, with the problem of no face-to-face contact, there is less personal relationships between people (on global projects).”*

Due to geographical distance, people work in different environments and cannot understand the context the remote colleagues’ experience. Misunderstandings may occur. One Irish member gave an example: *“Without face-to-face contact, you don’t know if*

someone is being impolite or in a rush when he wrote you a short message asking you to do something for him, like 'hi, can you do'".

One may perceive the remote sub-team as a distant group isolated from them even when the teams work on the same project. Such psychological distance is worsened when the cultural background of the sub-teams is also different. The psychological distance contributes to an “us” vs. “them” mentality. In the interviews, terms such as “those people” or “they” are often used to refer to a remote sub-team. Also it was found that some members are more comfortable seeking information or help from teams close to them. One Chinese member mentioned that she always asked for help from colleagues sharing the same office before reaching out to her U.S. team members in the project. Psychological distance is also reflected in how one approaches the remote team members. Another Chinese member said that even though his Japanese colleagues were always extremely polite and formal in communication, he still felt more comfortable asking for help from his Japanese colleagues rather than from his American colleagues. He said:

“It’s easier to communicate with the Taiwanese, Japanese and Korean colleagues. I feel we are all Asian. The culture difference between us is not very big. We can easily accept the grammar and the tone each other uses. ... With Asian colleagues, we can comfortably ask direct questions in a casual way. Don’t need to be very polite. But with the American colleagues, I would begin the email with some polite things like ‘sorry to bother you.’ I don’t know why, just feel I have to act that way.”

Based on the above discussion, geographical distance is detrimental to the development of trust between distant sub-teams.

Time zone difference may accelerate the global software project when the work of teams in different time zone forms the follow-the-sun pattern. When asked about the impact of time zone difference, one Irish member first answered as follows:

“I think it(time zone difference) affects us in a positive way. The fact that we are distributed in different time zones. When a blocking issue occurs, we reprioritize our work to make sure we work on the highest priority thing. If it’s a critical issue, when Westford people finish for the evening , we can work on this issue and have it ready the first thing in the morning and have it ready when they come up.”

However, she continued to explain that this smooth turnover of work from one site to another site is not always possible. One package of testing work usually cannot be finished in one work day and therefore cannot be turned over at the end of the work day to another site. Also as one Chinese employee explained, *“our work is interdependent. Often when we have a question, we have to stop and wait for the answer from the developers who are in another time zone. This waiting time can be as long as one day.”*

In addition to the abovementioned work delay issue, time zone difference results in reduced or zero overlap between times team members are at work. This causes significant difficulties in communication between sub-teams. Figure 4 shows, on a common GMT timeline, the common working hours of the four sites where the interviewees are located., It shows their standard eight-hour work day in blue (Milewski et al, 2007). As can be seen, there are often large gaps in temporal overlap across sites.

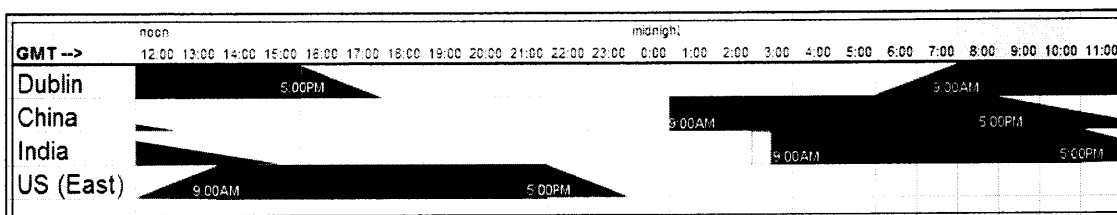


Figure 5.7 Common Work Hours
(adapted from Milewski et al. 2007)

To increase the time overlap between sites, one strategy is to increase one's working hours. Several interviewees commented on the long day required to be available for communication with remote teams. These long work days disrupt one's family and personal life. One American interviewee said his wife complained about the early meetings and the overtime. The adjustment may be minor or major for different sites. For example, a member from the U.S. said that in her project they met at 7:00AM because it was the most convenient time for everyone, but for her it just meant starting her day a little earlier. Ireland was coming in at 1:00PM but India was coming in at 7:00PM. She did not see any problem with that. However, one Indian member complained about meetings being held at times quite distant from their own "peak" times. He suggested teams should alternate who should work overtime to be involved in meetings. One member from the Chinese site also reported that his/her U.S. colleagues complained of the overtime needed for project-wide meetings. Two Chinese team members suggested that they do not mind the overtime, but even so the difficulties in scheduling a meeting time may cause conflicts between sites, and thus may hurt the relationship between the sub-teams.

Organizational distance was seldom mentioned in the interviews. All the interviewees have been working in global projects involving testing or development teams. They did not mention experiences working with another company or in a project

which involved only teams in one location. Therefore, there is no comparison of different types of organizational distance.

Cultural distance prevents the emergence of a shared context in global projects. The lack of shared context results in difficulties in understanding and appreciating the work practices of a remote sub-team in another culture, which is harmful to trust development. As one Irish manager put it, *“different cultures have different attitudes towards the way they work and how they work. If we don’t understand this kind of difference, it can be frustrating... For example, the U.S. people do not see these differences on our side either; this causes difficulties in our relationship.”*

Some cultures may favor certain attitudes that are considered unprofessional or untrustworthy by another culture. For example, one Irish team leader thought the Chinese team members were reluctant to admit problems. He described a situation where the Chinese team was unwilling to discuss the slow progress made on a project:

“Chinese people are very proud and the fact that ... we didn’t sort of discuss this with the team first of all and the manager of that team, they were ‘oh no. we don’t need any help, we’re fine’. That was a cultural thing we should have looked into.”

Another example is the “honor issue”. One U.S. technical leader found that the Indian team in the project hesitated to ask clients for information. They thought that asking questions is a sign of incompetence. However, due to this hesitation, they lost the trust of their American colleagues. The U.S. manager commented on this issue as follows:

“I cannot work on the problem if you do not give us what we need. I cannot evaluate until we get all the pieces. Maybe they are afraid to ask customers. They don’t want to come across as under-trained (before the clients); they want to come across as

knowing everything and being able to answer questions. So rather than asking a stupid question, they will not ask any question. This happens when we have new support people from India. I see that, somewhat, on a regular basis. ”

How to respond to these attitudes may vary across cultures. If remedial actions which are unacceptable to a culture are taken, these could further damage the already weak trust between the sites. For example, in response to Beijing team’s unwillingness to talk about slow progress, without consulting the local leader’s opinion the Irish manager sent two technical experts from Shanghai to Beijing to help the Beijing team work out the problem. This action “*made the Beijing team lead very angry*” and seriously hurt the relationship between the Irish side and the Beijing team.

Another negative influence of cultural distance is difficulties in communication. Without knowledge about the icons, ideologies and customs of another culture, it is hard to understand the subtle meaning behind sentences. While the Chinese team members fully understand and expect their Japanese colleagues to be formal and polite in communication, one Indian team leader made negative comments on his communication with Japanese colleagues: “*it takes time to understand what the other party is thinking. It’s hard to understand their background.*” Even though the Indian team members spoke fluent English, Irish members sometimes found it difficult to convey ideas accurately to them. As one Irish team member puts it, “*sometimes when you mean one thing, they think you are talking about another.* ”

The communication difficulties are further exacerbated if the teams speak different native languages. Japanese employees were often mentioned as hard to communicate with. One Chinese team member who just joined Company A mentioned that the language

barrier slowed down his communication with his U.S. colleagues. He mentioned that it took him time to phrase things in English and often his U.S. colleagues needed to redo his sentences to make sure they understood him correctly. The other interviewees said they did not feel language difference is a serious barrier in working with teams other than the Japanese team.

The managers in Company A were aware of the language differences and have taken measures to minimize the language barrier. For example, at the Beijing site, job applicants need to pass an English test. Language and culture training were also given to new recruits.

One interesting finding is that the software engineering culture may partly mitigate the influences of culture distance. For example, software engineers use English as a common work language. One Chinese member mentioned that terms in computer science and software engineering are translated in different ways in their language, so that it is easier for them to communicate with the original terms in English than using translated terms from Chinese. Besides, using a common business language, the software engineering profession also has practices or standards commonly accepted in the community. These become a shared context for members of a global project and become a basis for understanding and accepting other project team members' activities. For example, both U.S. members and Chinese members mentioned that the software developers had a large influence on the work schedules of the testing teams. For example, when developers decide to drop features in the software, testing teams suddenly had fewer items to test and a lower workload. This interdependency based on code modules

(features) between testing and development helped shape the relationship between the team members and reduce misunderstandings.

5.7.5 Communication Quality and Trust

Improved communication contributes to the development of trust, as it enables teams to better understand each other, reduces misunderstanding, and fosters a quality work relationship.

First, team members can select the right communication tools to overcome language barriers. Most of the interviewees mentioned that when communicating with remote teams, they can use email to better craft the wording and be more accurate, especially if the message involves complicated ideas. In telephone meetings, some team members may have difficulties following what is being said. One U.S. team member found that during a telephone meeting, key points can be taken down and sent to the meeting participants through instant messaging to make sure that everyone follows the meeting progress.

Second, more direct communication between team members will improve the information flow. One Irish manager noted information missing in the communication with the Indian team that caused difficulties working with them. He later discovered the reason for the problem: constrained by the Indian team hierarchy, Irish team members communicated only with the Indian team leader instead of directly with the Indian team members. The Indian team leader then relayed the information to his subordinates. The information flow would have been smoother and work problems could have been avoided if direct communication had been used.

Third, the exchange of social information can foster the development of personal relationships. Some team members put their picture in instant messaging or email. This helped the other members know them better. Also social interaction helped others to learn about the team members' life and personality. With more knowledge about someone, it is easier to anticipate their responses and to know whether they are trustworthy or not. One Irish team member commented: *"I can put face with a name, know one's personality. I will be more comfortable going online, say 'hi, can I ask you a question?' You would know how the other person reacts."* In addition, exchanging social information with remote team members online helps maintain their presence and draws one closer to the remote team. One U.S. member believed that after working at home for a few years, she still enjoys a good work relationship with her colleagues partly because she managed to maintain her presence by exchanging social information, e.g., events in her personal life, with her colleagues through instant messaging.

Fourth, if possible, face-to-face contact should always be made. Face-to-face contact, such as kick-off meetings, would quickly get people acquainted and give chances for them to negotiate a relationship. The preceding discussion mentioned the incident of the Irish manager who sent experts to help the Beijing team without asking for the opinion of the Beijing leader, which damaged the work relation and trust between the Irish team and the Beijing team. To solve the problem, the Irish manager flew over to Beijing and spent a few months with his Beijing colleagues. During his visit to Beijing, he joked and communicated more with the Beijing team members. The tension was gradually dissipated. Also, during the daily face-to-face interactions, he found that Beijing members were much

more confident talking face-to-face than they were on the phone. This helped him to better understand the Beijing team members and improved his trust in them.

5.7.6 Trust and Motivation

Several interviewees emphasized the importance of trust. Trust means that one could rely on the remote team without being afraid of them taking a free ride. Also trust reduces one's workload as one needs to spend less time checking the remote team's work. As one Irish manager put it, *"With trust, you don't have to double check to make sure they are not lying"*. When in one project the Irish managers did not trust the competence of the China sub-team, they were *"doing a lot of monitoring verifying the Beijing employees are around working out things correctly"*. When asked what motivated her to do her job, one U.S. member said her biggest motivation in working in her current global project is that all the sub-teams in the project were very competent and trustworthy. She said *"I think it's probably the people I work with. It's funny saying that. You know, I've never seen these people face-to-face"*. She agreed that knowing the people and trusting them motivated her. *"The team works well together, gets along, helps each other out technically."*

5.8 Comparing Survey Results with Interview Results

It is found that the interview results support the survey findings and supply detailed examples and context which helps to explain the reasons behind the survey findings.

First, the interview findings also supported hypothesis P1 that, sub-team competence predicts leader delegation to sub-teams in global software projects. Also, the

interview findings revealed that a remote team needs to work harder to demonstrate its competence than a team that is co-located with the project management.

Second, the interview findings supported the survey results about the mixed effects of leader delegation. The survey only proves the positive effects of process-related delegation predicted in hypotheses P2c and P3c but does not support the other hypotheses (P2a, P3a, P2b, P3b and P2d, P3d) about the positive effects of other types of delegation. The interview findings explain this from the perspective that delegation does not always improve team members' satisfaction and motivation. Delegating management functions, such as planning the schedule, selecting team members, etc., may add to the pressure of those who already have a heavy workload and of those who are inexperienced and not ready to assume extra responsibility. However, process-related management functions govern how team members conduct their daily work and interact with other team members, and delegation of this aspect allows team members to structure work flexibly and in ways that increase their motivation. In addition, it was found that in Company A decisions such as schedule planning, selecting team members or deciding quality assurance procedures are often predetermined before the project starts.

Third, the interview findings support hypotheses P4, that team distance may hurt trust between teams. Interviewees commented that time zone differences may cause conflicts about who should work overtime to be available for cross-site meetings. However, in the statistical analysis of survey data, no significant relationship between time zone distance and trust was found. This may be because the influence of time zone differences is not strong enough to be detected in statistical tests. In addition, the

interviews showed that the software engineering professional culture mitigates the influences of culture distance.

The survey data analysis found that trust between people from different cultures but with same native language is significantly higher than trust between people from different cultures with different native languages. This finding seems to emphasize the impact of language on trust development. However, in Company A, the language barrier is not serious as most of the employees have adequate proficiency in English. Further analysis finds that the trust level between the U.S. and Irish teams is very high because they have employees with a longer work history, have a longer history working together and understand each other's culture better. These teams were categorized into the class of different national culture but with same native languages. The trust level between these teams greatly boosts the average trust level of the teams in this category. Therefore, language difference may not necessarily have a major impact on trust development in Company A.

Fourth, the interview findings support hypothesis P5 which predicts that communication quality is positively correlated with trust between sub-teams. The interview data also suggest several methods that global software team members can use to improve communication quality.

Fifth, the interview findings support hypothesis P6, which predicts that team competence improves trust levels. The survey data could not be analyzed to verify this hypothesis.

Finally, the interview data supports hypothesis P7, that trust toward other sub-teams improves one's motivation working in global software projects.

CHAPTER 6

DISCUSSION, CONTRIBUTIONS AND LIMITATIONS

This chapter discusses the survey and interview findings and then explains the contributions and limitations of this dissertation study.

6.1 Discussion of Dissertation Study Results

This dissertation study results have validated the research model and provided support for the majority of the proposed model. Important conclusions and implication for global software project management were made. They are described in the following paragraphs.

First, global software project management delegates more to competent sub-teams. However, when the management is distant from team members, traditional walk-around management is not applicable, so it is hard for the management to judge a remote sub-team's competence level. To demonstrate the team's expertise, the remote sub-team needs to work harder than the team members who are co-located with the project managers. Remote sub-teams were found to work at levels that either achieved or exceeded assigned deadlines. For the software professional working in testing teams, the number of testing cases finished is an important index of their work progress and can be stored in databases for the managers to check. For global software project members who are in other software engineering functions, they may take other approaches to demonstrate their capabilities. For example, requirement engineering workers may need to be judged by indicators which are not as easily quantified. In this kind of situation,

managers should not only rely on the numerical numbers in reports and project databases but also on measures of quality. More effort and time would be needed to understand the remote team's work and their work quality and progress.

Second, leader delegation may increase team members' satisfaction with project management and their motivation for working in the project. As more and more software engineering work is offshored, there exists intensive competition between the offshore sites for recognition and resources from the company's headquarters (Holmstrom et al., 2006). Requests for being delegated more authority and responsibility becomes part of this competition. Therefore, delegation would greatly motivate remote teams to work harder as this delegation means recognition and trust from upper management. When delegation is made by management in company headquarters, the impact is even more prominent. Also delegation allows the remote sub-team members to structure their work flexibly and to accommodate local team contextual factors such as holidays, leaves, etc. Global software project managers should recognize that being distant from sub-teams, they may not be able to know the immediate work situation in remote sites or appreciate the influence of changes in local context in a timely fashion. Consulting local team members' opinions or granting them autonomy to make decisions is one way to improve the efficiency of management. When a software project is offshored and time-critical, delegation may be a good approach to take.

However, leader delegation may negatively influence team member's motivation and satisfaction with the leader. In global software projects, working overtime is a common practice that is needed to accommodate the time zone difference with the remote site in order to collaborate and communicate in real time. Some team members may

already have a hectic schedule and be struggling to balance their work and life. Delegating more responsibility to them may add to their workload and increase the pressure on them. For inexperienced team members, this may even create additional anxiety stemming from a fear of making wrong decisions. Therefore, leaders should carefully evaluate the advantages and disadvantages before and after delegation. Leaders also need to follow up on their delegation and provide team member mentoring or coaching if needed.

Third, in global software projects, delegation strategies are also influenced by other factors. For example, it is found that the developer team may have more control over how many features are to be tested and the schedule for producing the features. Therefore, in projects involving developer and testing teams, more planning related functions may be delegated to developer teams. However, testing teams may not complain about this setup even if it puts them at a work disadvantage. Another factor is that more software tools can be used to help managers manage their software projects. These tools may take over functions which might otherwise be delegated to sub-teams. For example, when a company maintains a database of employees' work history performance and expertise areas, the project manager can readily refer to this database instead of consulting local sub-team members' opinion when selecting members to work on a project. Another example is a database which logs the number of testing cases automatically telling management on a daily basis, the progress of a particular sub-team.

Fourth, this dissertation study found that among the four types of delegation, each in one management area, process-related delegation had the strongest impact over sub-team members' satisfaction with the leader and their motivation level. On the

contrary, delegation relating to planning, personnel management and control was found to have little impact. Process related management functions, specifically selecting tools to use in project work, setting team's operating procedure and work instructions, deciding on team's tools and procedures for communication and collaboration and assigning work to team members according to their expertise, all involve tasks associated with daily work and interaction with others. Therefore, delegation of these functions would significantly influence the autonomy and flexibility one might have in a team. In the global project context, waiting for remote project management to determine or adjust decisions in these areas would greatly impair one's ability to structure work in an efficient and motivating way. In contrast, most of the planning, personnel and control management decisions such as selecting members for the project and deciding on quality assurance procedures are likely to be made prior to the project's start. Or these decisions can be routine or made with the aid of software tools such as the test case progress database mentioned above. Therefore, the impact of planning, people management and control management delegation is not as significant as process-related delegation.

Fifth, in global software projects, a sub-team's competence level affects how much a local sub-team member trusts the remote sub-team. When one works with a sub-team that he/she has had no prior experience with, one assumes the sub-team is trustworthy. However, this initial swift trust can easily be damaged if the competence level of the sub-team does not meet expectations. While many software companies expand their offshore sites, this fast expansion rate results in a variety of competence problems: many new recruits join projects before they have obtained appropriate training. These new sub-teams are often assigned easy tasks to work on to gradually develop their

skills. However, without knowing the training process in the remote site, one might make wrong assumptions, and it may take time for non co-located team members to find out about the competence levels of the remote sub-teams. By then, trust may be damaged and hard to recover. Therefore, on the one hand, companies should make sure training capacity meets the requirements of site expansion; on the other hand, project management should inform the existing teams about the detailed background, especially the expertise and experience of newly joined team members.

The new teams need time to go through the process of building up their reputation and winning other's trust in the global software project. In Company A, Irish and U.S. teams have a long history of delivering quality work on time and therefore have earned the trust of the other teams. Global project management needs to recognize that new teams require proper training and time to build up their reputation for competent work with existing teams.

Sixth, geographical, temporal and cultural distances negatively influence trust-building between sub-teams in global software projects.

Geographical distance curtails face-to-face contact and reduces chances for people to sit down and negotiate relationships. Also the distance increases the psychological distance between the sites, which consequently prevents help-seeking behaviors and trust building interactions. This finding corroborates partially distributed team research findings (Bos et al., 2005; Ocker & Huang, 2006)

Software companies may expect to utilize time zone differences to accelerate work by using follow-the-sun work patterns. However, in testing projects, packages of test work usually cannot be finished in one day and therefore cannot be turned over to another site at

the end of the work day. Because of this, 24-hour work across sites is impossible. Moreover, the time zone differences mean little overlap of times when people are at work. This makes synchronous communication difficult. To be available for cross-site meetings, global software project members have to work overtime and this may disrupt their personal life. Also conflicts may arise about which site should suffer the pain of extending their work days to be available for meetings. Project managers are recommended to move the shared time window on a regular basis to favor each of the sites in turn in order to avoid employee dissatisfaction. Also companies can help improve the infrastructure issues in the residential aspect of some sites, such as providing bandwidth at employee residences or arranging for employee housing close to the wired office. If the right infrastructure is in place, employees can work at home and thereby experience less disruptions of their personal life. These solutions seem well beyond the typical corporate scope, but solving them is critical to the success of global work (Allen et al., 2007).

Cultural differences are reflected in various aspects in global software projects, for example how open teams are with problems and how that affects team's sense of honor impacts communication between sub-teams. Different cultures have different attitudes towards these issues and this leads to different behaviors. Some teams may view other teams' behaviors as unprofessional or even personally damaging, e.g., this sudden addition of a senior manager on the Beijing team that took place without consulting the leaders of the Beijing team. In response they may act in ways unacceptable to those teams, which could further impair the already weak relationships. To prevent this from happening, project management is recommended to hold culture sensitivity training sessions to educate teams about the importance of understanding other cultures.

Language differences may cause misunderstandings and slow down the communication process. Company A included an English test as part of the recruitment process and gave English language training to its newly hired personnel. These measures helped reduce language barriers. Other companies can take similar measures. As English is the common work language of the software engineering profession, common shared English terminologies help sub-teams to avoid translations to their native tongue and to maintain a stronger shared verbal context.

Seventh, improving communication between sub-teams can help overcome the negative influence of team distance and increase trust between them. It was found that appropriate communication tools, more direct communication between team members, more social interaction and face-to-face contact are important ways to improve communication quality. In cases in which trust was already damaged, more face-to-face communication can help one look into the causes of the trust problem and ease the tension between the sites. This study identified several suggestions as to selecting and using communication tools for global project use: 1) use email to craft precise messages to convey complicated ideas, 2) include more personal information such as personal pictures in email messages or instant messaging icons; 3) combine telephone meetings with instant messaging to transfer both audio and text messages so people with English as a second language find it easier to follow the conversation and participate in the meeting. Training in the cultural communication differences that might arise in a global software project is recommended as a way to improve communication between sites.

Finally, trust towards other sub-teams increases motivation of team members working on a global software project. Trust eliminates the fear of social loafing and

removes the workload that comes from the need to double check others' work, thus making team members more motivated to work hard on the project's tasks. This shows that trust is important to improving performance in global software teams. Project managers not only should be concerned with the productivity of team members but also should monitor the team members' emotional state to identify trust issues early and to take actions promptly if trust is seen to waver.

6.2 Contributions of this Study

For industry practitioners, this work indicates under what circumstances leader delegation is important and how various types of leader delegation affect team members' satisfaction with the leader and motivation. Practical guidance is also given as to how and when delegation might not be appropriate. This study provides a deeper understanding of inter-team dynamics in global software projects and adds to the knowledge of how various types of distances between sub-teams can affect trust. Additionally, this study identifies measures that can be taken and training that could be developed to overcome the difficulties caused by team distances. This work also found issues that are important for cross-site communication and gives practical suggestions as to how to improve cross-site communication in global software projects. Finally this study points out the importance of inter-sub-team trust to improving project members' motivation and gives guidance on how trust is developed in global software projects. Based on the above, this study has important practical implications.

For researchers, first, this study investigates very important yet under-researched areas: leader delegation in global software projects and trust and motivation issues in

partially distributed software teams. This study proposed a research model and developed research instrument to validate and verify major portions of the model. This model can serve as a starting point for further study in these areas. Also, this research raises several new issues for global software project management research, They are: 1) What management functions can software tools replace and how does this replacement affect leader delegation in software projects? 2) How well do the different types of software engineering tasks fit the follow-the-sun design, if at all? 3) How does the software engineering professional culture interact with national cultures?. 4) What is the impact of psychological distance on global software projects? These research questions are new yet important to software project management and warrant meaningful research. Finally, unlike many other virtual team studies, this research was conducted using real world software development teams. Overall, this study adds to the body of research on industry practitioners and can be used to verify other studies' relevant findings, in particular, those done with student teams.

6.3 Limitations of This Study

This study is not without its limitation. First, the survey length is constrained. More control variables could be included. Second, the survey relies on respondents' self-report and this may introduce response bias. In future studies, objective data from third parties such as evaluations from team managers can be used to cross-check survey data. Third, the measurement of culture is gross. More fine-grained measurement of culture has been developed by the researchers involved in this dissertation study to be used in future study. Fourth, the pilot study only tested portions of the research model. Fifth, the study was

conducted with a small sample from one company. In the future, studies with more varied types of teams from different contexts can be conducted to verify findings of this study. Currently another survey will be conducted with global software engineering teams from a leading IT service provider company in the coming few months. Findings from both studies will be compared and combined to yield more in-depth understanding of the research questions.

APPENDIX A SURVEY MEASUREMENTS

Part I – General Information

1. What is your sex?
☐ Female
☐ Male
2. What is your age?
☐ Less than 25
☐ 26-35
☐ 36-45
☐ 46-60
☐ Over 60
3. Where were you born? COUNTRY _____
4. Please indicate the location where you work? _____
5. How long have you worked for your current employer? _____ YEARS

In the questions which follow, we use the word *project team* to be a small collection of people that you know and work most closely with to do your current work. . Your *local team* is that part of the team that is in the same country you are located in. Your *remote team* is that part of the team that is in another country. The following questions ask about your *local team* and your *remote team*. If your team is split between more than two countries, choose the team in the country you work most closely with as your *remote team* and answer the questions only for that team.

6. What is the name of your *local team* (e.g., Dublin SVT Team)?
7. What is the name of the *remote team* you picked (e.g., China SVT Team)?
8. Where does your *remote team* work?
9. How many people are on your *local team*?

Part II: Constructs Measurement Questions:

(Motivation 1)

10. I feel bad and unhappy when I discover that I have performed poorly on this project.

Strongly Disagree				Neutral				Strongly Agree
1	2	3	4	5	6	7		

(Satisfaction with leader 1)

11. I would be very happy to work on future projects that are managed similar to this project.

Strongly Disagree				Neutral				Strongly Agree
1	2	3	4	5	6	7		

(Trust 1) *

12. If I had my way, I would not let *remote team* members have any influence over issues that are important to the project

Strongly				Neutral				Strongly
----------	--	--	--	---------	--	--	--	----------

Disagree							Agree
1	2	3	4	5	6	7	

(Communication quality 1) *

13. I can convey complex work ideas to members of the *remote team*.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Satisfaction with leader 2)

14. I am very dissatisfied with the way this project is managed.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Trust 2) *

15. I really wish I had a good way to oversee the work of the *remote team* members on this project.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Communication quality 2) *

16. In general, members of the *remote team* always understand me when I communicate.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Motivation 2)

17. My opinion of myself goes up when I do my project work well.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

* construct jointly shared with another NJIT dissertation using the same questionnaire (Egan, 2007)

(Trust 3)*

18. I would be comfortable giving members of my *remote team* tasks critical to this project.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Motivation 3)

19. I feel a great sense of personal satisfaction when I have done a good job on this project.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Communication quality 3) *

20. My work communication with the *remote team* could be better.

Strongly Disagree			Neutral			Strongly Agree
1	2	3	4	5	6	7

(Satisfaction with leader 3)

21. I am very happy with the way my *local team* is managed.

Strongly Disagree	Neutral					Strongly Agree
1	2	3	4	5	6	7

(Delegation 1)

22. In the current project you are working on, how much is your *local team* able to:

	Not at all						Completely	N/A
	1	2	3	4	5	6	7	
Set your team's goals?								
Decide your team's discretionary expenditures, e.g. travel?								
Schedule your team's work?								
Recruit members for your team?								
Dismiss members from your team?								
Determine team members' training needs?								

(Delegation 2)

23. In the current project you are working on, how much is your *local team* able to:

	Not at all						Completely	N/A
	1	2	3	4	5	6	7	
Select the tools your team will use in project work?								
Set your team's operating procedures and work instructions e.g. which methodology to use?								
Decide your team's tools and procedures for communication and collaboration, e.g. email?								
Assign work to team members according to their expertise?								

(Delegation 3)

24. In the current project you are working on, how much is your *local team* able to:

	Not at all						Completely	N/A
	1	2	3	4	5	6	7	
Set its own corrective actions when performance objectives are not met?								
Set the team's own procedures concerning quality assurance?								
Evaluate the quality of the team's work?								

(Team competence)

25. How would you rate your *local team* on the following items?

	Very weak						Very strong
	1	2	3	4	5	6	7
Ability to get work done in timely fashion							
Ability to collaborate with other teams							
Team members' ability to collaborate among themselves							
Technical expertise needed for this project							

Knowledge of organizational practices							
Knowledge of systems for information sharing and collaboration							
Problem-solving skills							
The overall competency of the team to perform team tasks (exclude yourself in this reply)							

APPENDIX B GRAPHICAL PRESENTATION OF PLS ANALYSIS RESULTS

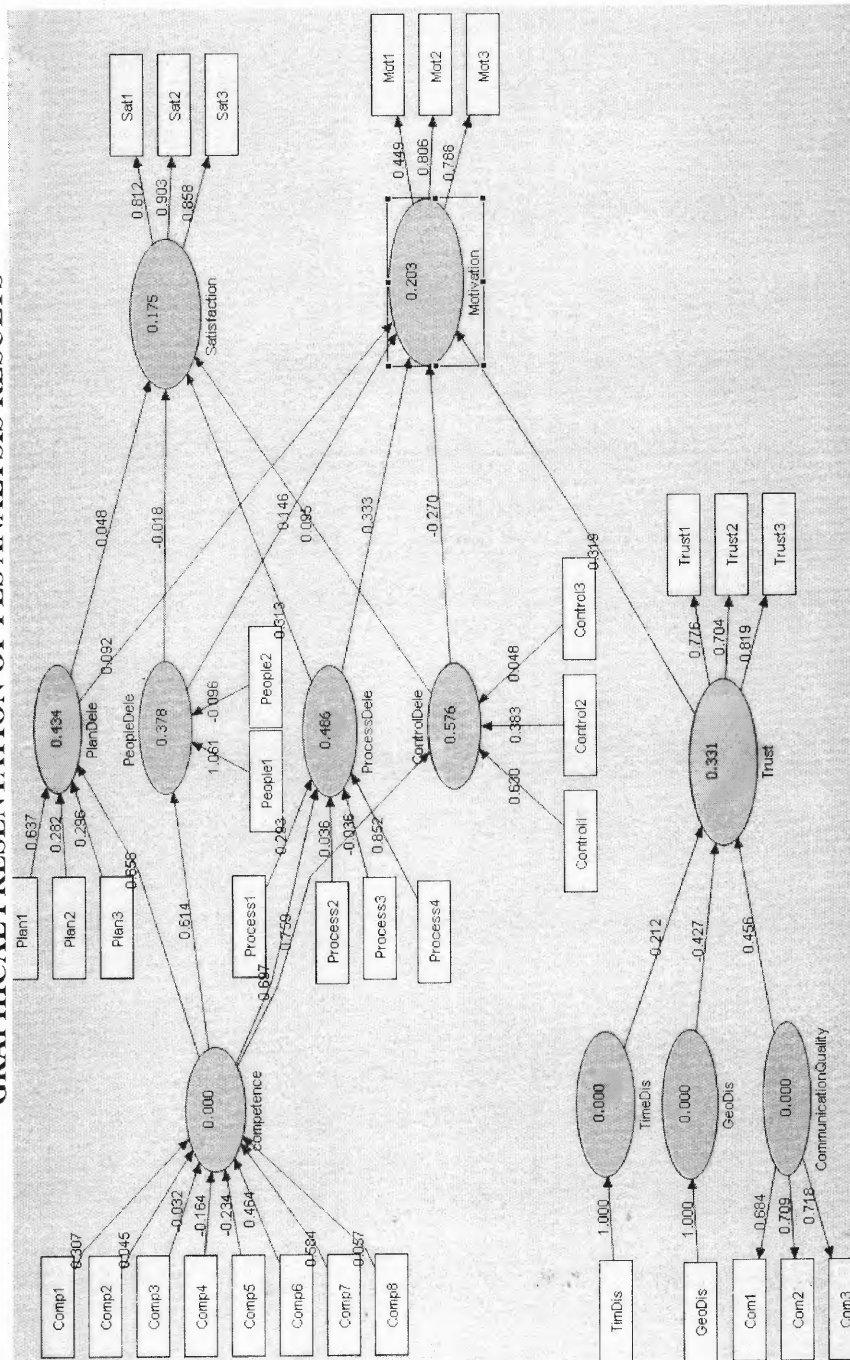


Figure B.1 PLS Analysis Graphic Output

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