ABSTRACT

LEADERSHIP IN PARTIALLY DISTRIBUTED TEAMS

by
Linda Plotnick

Inter-organizational collaboration is becoming more common. When organizations collaborate they often do so in partially distributed teams (PDTs). A PDT is a hybrid team that has at least one collocated subteam and at least two subteams that are geographically distributed and communicate primarily through electronic media. While PDTs share many characteristics with both traditionally collocated and fully distributed teams, they also have unique characteristics and issues.

This dissertation reports on a field study of PDTs conducted over two semesters with student participants. This research was conducted as part of a larger series of studies investigating PDTs. In these studies, participants were formed into PDTs of two collocated subteams each. The task was to produce requirements for an emergency response information system for a specified country. Study 1 varied leadership configuration but held distance constant. Study 2 varied both leadership configuration and distance.

Although distance was to be measured as cultural, geographic, and temporal distance, multicollinearity issues arose and cultural distance was dropped from the analysis. Distance was measured as time zone differences which, because the subteams in a team had east-west geographic distance, captured the geographic distance as well.

Data collection was through surveys and personal reflections. Personal reflections are open ended survey questions for which the subjects reflected on their

experiences the previous week in a PDT. This dissertation reports on qualitative and quantitative analyses of Study 1 data and quantitative analysis of Study 2 data. In addition to bivariate analyses of the survey data conducted separately for each study, multivariate analysis using Partial Least Squares (PLS) was performed on the combined Study 1 and Study 2 data.

Factor analysis resulted in the identification of three types of trust: Expertise Trust, Personal Trust, and Process Trust. Trust was measured in the first personal reflection (after one week) and in the post survey at the end of the four week project. Early trust has the dimensions of Expertise Trust, Personal Trust, and Process Trust while longer term trust is comprised of Personal Trust and Process Trust.

The results partially support the proposed research model. Strong support was found for the proposition that leadership roles identified by Quinn (1988) and examined in fully virtual and traditionally collocated teams are enacted in PDTs as well. Results suggest that leadership configuration influences leader role enactments. Trust was found to be important to team outcomes and influenced by media used and distance. Leadership role enactments were associated with perceptions of leader effectiveness, perceptions of performance, and satisfaction. Results suggest that leader effectiveness is associated with trust, perceptions of performance, and satisfaction. That is, trust, leadership configuration, distance, and leader role enactments all play important roles in PDTs.

The results add insights into leadership and trust in partially distributed teams, which can inform professionals as to issues, leadership configurations, and leadership behaviors (roles) that will promote successful outcomes.

LEADERSHIP IN PARTIALLY DISTRIBUTED TEAMS

by
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CHAPTER 1

INTRODUCTION

1.1 Objectives

This research examines issues of leadership in partially distributed teams (PDTs) engaged in software development for an emergency management information system (EMIS). Through a pilot and two field experiments with student subjects, the effects of leadership configuration and distance (cultural, geographic, and temporal) on leadership, trust, satisfaction, and team outcomes are examined. This dissertation reports on results of a subset of a larger series of studies investigating PDTs.

1.2 Background

Inter-organizational collaboration is becoming more common in a variety of domains including emergency planning and response. When organizations collaborate, or when distributed departments of an organization collaborate, they often do so in PDTs. A partially distributed team is a hybrid team that has at least one collocated subteam and at least two subteams that are geographically distributed and communicate primarily through electronic media (Huang and Ocker, 2006). While PDTs share many characteristics with both traditionally collocated and fully distributed virtual teams, they also have unique characteristics and issues.

Sidorova et al. (2008) note in their study of the trends in IS that "the IS discipline became *less technology focused and more business-process-focused* over time" (Sidorova, Evangelopoulos, Valacich and Ramakrishnan, 2008, p. 476). As such, it is not

surprising that "IT and Groups" has been identified as one of the five top core research areas of today (Sidorova et al., 2008). In fact, "Leadership in Virtual Teams" was found to be a top research theme in the category of IT and Groups. PDTs are a hybrid of virtual teams and collocated teams. Therefore, given the findings of Sidorova et al. (2008), it is important to the IS research community to study them. However, while leadership in traditional and fully distributed teams has been well-studied, there is much to be examined to understand leadership in PDTs.

Because of the unique characteristics of PDTs, one cannot assume that an understanding of leadership in traditionally collocated teams or fully virtual teams is valid for PDTs. There may be special problems for PDT leadership especially with regard to communication and effective functioning. A major issue for leadership in PDTs is how to configure leadership (e.g., a leader for the whole team, subteam leaders, etc.) to produce the best results. The effects of distance have been studied extensively in virtual teams (McDonough III, Kahn and Griffin, 1999, Espinosa and Carmel, 2003) but the results may not transfer seamlessly to PDTs because the structure of PDTs includes collocated members as well as dispersed members. Trust has been shown to be important to team outcomes such as satisfaction and performance (Jarvenpaa and Leidner, 1999, Coppola, Hiltz and Rotter, 2004). In a PDT the collocated members of a subgroup may have had prior experience working together and have built trust before teaming with distant subgroups and members. This can lead to difficulties in building team trust. Trust in virtual teams often develops as "swift trust" (Meyerson, Weick and Kramer, 1996) which is based upon other cues (such as reputation or role) than actual experience between trustor and trustee. In a PDT, then, the collocated members may have already

developed trust and subgroup identity and must develop "swift trust" with their distant teammates in order to maximize team effectiveness. This can lead to in-group/out-group effects ("us vs. them" thinking as opposed to "we" thinking). Thus, leaders in PDTs are likely to face many challenges such as overcoming strong in-group/out-group effects (Huang and Ocker, 2006) brought about by a distance faultline between subteams.

Leadership can be viewed through a variety of lenses (e.g., style, roles). This research examines leadership through the lens of leadership behaviors, or roles. It tests a model of the effects of leadership configuration and distance on team outcomes (performance, satisfaction with a leader, and satisfaction with a group) in PDTs.

1.3 Research Questions

The overarching research question this dissertation research addresses is, "Do leadership configuration and distance have impacts on outcomes in PDTs and, if so, through what processes do they have this impact? Eight research questions are asked and examined in the context of the overarching research question:

RQ1: What do leaders in PDTs do and how does leadership configuration affect what leaders do?

RQ2: Does leadership configuration have an impact on the development of swift trust and longer term trust in PDTs and what are the effects of trust?

RQ3: Does leadership configuration have an impact on perceived leadership effectiveness in PDTs and what are the effects of leadership effectiveness?

RQ4: Does distance (cultural, temporal, and geographic) impact trust, leader role enactments, and/or perceived leader effectiveness?

RQ5: What are the effects of ineffective, "bad" leadership in PDTs?

RQ6: Are there different patterns of enactment of leader roles in different leadership structures?

RQ7: Is there an effect on communications media used by leadership configuration and/or distance and are there relationships between the media used and trust and/or the media used and enactment of leader roles?

RQ8: Do teams with emergent leaders have greater or less satisfaction than those who retain their designated leadership structure?

1.4 Overview of Methodology

A pilot and two studies (Study 1 and Study 2) were conducted. In the pilot leadership configuration was held constant and distance was not measured as the goal of the pilot was to examine and improve procedures, measures, etc. In Study 1, conducted in the fall semester of 2007, leadership configuration was varied but distance was held constant. Lessons learned from the pilot and Study 1 were used to improve procedures in Study 2, conducted in the spring semester of 2008. For Study 2, both leadership configuration and distance were varied.

Data was collected from surveys (background and post) and personal reflections. Personal reflections are surveys with open ended questions for which the participants reflected on their experiences working in the PDT. Both quantitative and qualitative analyses were done for Study 1, and quantitative analysis was conducted for Study 2 and for the combined data set from the two studies.

For quantitative analysis, as a general rule, for each reflective construct that had more than two items measuring it, factor analysis (Principal Components) was performed. Scale reliability measures were taken (Cronbach's alpha and/or composite reliability) and in cases where reliability was not achieved, scale reduction was performed to achieve reliability. As is frequently done in the literature (Kutner, Nachtsheim, Neter and Li, 2005), when parametric test requirements of variable normality are not met, nonparametric tests (e.g., Spearman's r) are performed.

Although the design of the study is a nested one (participants are nested in subteams which are nested in teams), nested analysis will not be done in this dissertation research but will be addressed in future research. The data collected are mostly not normal and could not be made normal by transformations. Normality is a requirement for tests of nested design such as ANOVA and Hierarchical Linerar Modeling (HLM) (Dytham, 2003, Quinn and Keough, 2002). Although some statisticians claim that nonparametric tests can be extended to be used for nested effects in hierarchical design (Oron and Hoff, 2006), others claim that there are no acceptable nonparametric tests for nested designs (Quinn and Keough, 2002). Additionally, even if it was possible to use HLM, the software to do so costs around $500 and is not available at present to the researcher. Thus, there is no readily available solution to the problem of lack of normality and therefore for this dissertation research nested testing will not be done, which is, of course a limitation. However, investigations of ways to overcome this limitation will be ongoing and continue after this dissertation is complete.

For the qualitative analysis, coding was done of the personal reflections. Two coders were used to establish inter-coder reliability (Cohen's kappa). All of the personal

reflections of leaders were coded as well as a randomly selected set of team members' reflections.

Bivariate and univariate analyses were done separately for the pilot, Study 1, and Study 2. The hypotheses that were at least partially supported in the Study 1 and/or Study 2 analyses were then examined using multivariate analysis (PLS) of the combined semesters data set to arrive at parsimonious models.

1.5 Contributions of the Research

This dissertation research contributes to the field by increasing understanding of leaders and leader issues in partially distributed teams. The Quinn (1988) roles have been studied in both fully distributed virtual teams and collocated traditional teams. A search of the literature has not uncovered examinations of the roles in PDTs prior to this research. A scale to measure leader roles that has been previously validated for use with traditional collocated and fully distributed virtual teams (Denison, Hooijberg and Quinn, 1995) is modified and validated for use in PDTs as was a scale to measure perceived performance (Mortensen and Hinds, 2001). This research also identified different types of trust and found evidence that early trust is not the same as longer term trust adding to the literature on trust.

How to configure leadership is a challenging question faced when organizing PDTs. This research provides insights as to the effects of leadership configuration on team outcomes. The model hypothesized that leadership configuration and distance affect performance and satisfaction with leader outcomes through the processes of leader role enactment, perceived leader performance, and trust. The examination of the

intervening factors adds to the extant literature by exploring these important elements of PDTs.

Leadership in PDTs presents special challenges including bridging the divide between subteams. This research, through its findings, can provide guidance as to the issues that need to be addressed by leaders and means (e.g., communication media choices) to overcome these obstacles.

1.6 Organization of the Dissertation

This dissertation is organized into 13 chapters:

- Chapter 1 introduces the motivation for this research, the general research questions that are explored, and the outline for the dissertation.
- Chapter 2 explores and analyzes the literature on leadership in traditional and virtual teams.
- Chapter 3 explores and analyzes the literature on trust as it relates to the issues of this dissertation (e.g., swift trust).
- Chapter 4 explores and analyzes the literature on boundary issues as issues of cultural, geographic, and temporal distance are crucial to be understood for effective PDT functioning.
- Chapter 5 briefly describes the constructs measured and manipulated in this research.
- Chapter 6 presents the research questions, motivations for those questions, hypothesis and research model.

- Chapter 7 briefly describes a pilot study undertaken in spring 2007 and discusses the lessons learned.
- Chapter 8 describes the quantitative analysis of Study 1.
- Chapter 9 discusses the results of qualitative analysis of Study 1.
- Chapter 10 is a discussion of the quantitative analysis and results for Study 2 data.
- Chapter 11 describes the results of multivariate analysis of the combined Study 1 and Study 2 data.
- Chapter 12 is a summary and discussion of the findings of this research.
- Chapter 13 discusses limitations, contributions, and future research.

CHAPTER 2

REVIEW OF THE LITERATURE: LEADERSHIP

2.1 Introduction

Leadership in virtual teams presents unique challenges that are not present in traditional teams. The leader may have to develop presence through electronic media rather than face-to-face as she or he would in a traditionally collocated team. PDTs may present additional challenges as some subteams may have a leader physically present while others only interact with a leader through electronic communication. Leadership roles may be shared and leaders not designated as such may emerge as the team matures. This chapter discusses the special challenges of virtual team leadership, leadership styles and roles, emergent leadership, and the characteristics of effective virtual team leadership through a discussion of relevant literature from the traditional team, virtual team, and partially distributed teams.

Virtual teams may be self-managed or have a leader. In the case of PDTs, leadership may be centralized with one leader for the entire team and no subteam leader; hierarchical with a team leader and subteam leaders; decentralized with subteam leaders and no overall team leader; without designated leaders at all; or any combination of configurations. When there is no designated leader, leadership roles may be formally or informally shared amongst many team members or a leader may emerge. Even when there is a designated leader, leadership roles may be shared as a "divide and conquer" approach is taken for task processes. For example, in the case of a PDT with centralized leadership, the subteams may divide the tasks to work on in parallel and leadership roles to accomplish the subtasks may be taken by subteam members.

While the literature is replete with theory and empirical studies of leadership in general, little is known about leadership in virtual teams (Zigurs, 2002). This chapter reviews the current leadership literature to address issues in virtual and traditional teams that are relevant to the study of leadership in partially distributed teams. Discussed are studies of leadership in both virtual and traditional collocated teams, with emphasis on the roles or behaviors of team leaders and effective/ ineffective leadership.

2.2 Challenges of Virtual Team Leadership

This section is focused on the challenges virtual team leaders have. Studies by Zigurs (2002), Pare and Dube (1999), Bell and Kozlowski (2002), and Cascio and Shurygailo (2002) lend insight into the leader's challenges. Leadership has its challenges, but do the challenges for virtual team leadership (also called e-leadership) differ from those faced by leaders of collocated teams? Discovering that which is generic to virtual teams is difficult in part because virtual teams come in different configurations. Environmental contexts and leadership style will differ as well.

The issues facing virtual leaders are discussed by Zigurs (2002) as presence, process, and technology. When a leader is collocated with his or her team members, as in a traditionally collocated team, there are multiple cues that make the members aware of the leader's presence and position. In meetings, the leader might sit at the head of the table and the leader is likely to have a larger office with fancier trappings. Many of these cues are not available in a virtual team and so the leader must find other ways to project both presence and position. This new kind of presence is referred to as "telepresence" (Zigurs, 2002, p. 344).

The technology provides another challenge for leadership in virtual teams. For example, the richness of the media (Daft and Lengel, 1986) will influence the team process. It is through the technology that leadership is expressed in a virtual team. Therefore, Zigurs notes, "leaders have to make sense of technology in order to make the most capable use of it (Zigurs, 2002, p. 347)." Because of the difference in the means of communication, then, how roles are expressed in a virtual team will differ from the way they are expressed in a traditional collocated team.

Some of the adaptation of these roles will require redistribution of emphasis on different roles. For example, because of the lack of physical cues in virtual teams, relationship development roles may take on increased importance. If the virtual team leader is successful in creating telepresence, then, Zigurs asserts, the perception of dispersion will be reduced for the team (Zigurs, 2002). However, she also notes that in a virtual team, leadership isn't totally under the control of the leader but is "expressed through the interplay of team members and technology (Zigurs, 2002, pp. 348-349)." Therefore, for leadership to be successful, the team interaction must also be attended to. Inasmuch as a team is geographically distributed and/or distributed in time, a leader cannot be present to interact with all team members at all times. Therefore, leadership roles may need to be duplicated, eliminated, or substituted (Balthazard, Waldman, Howell and Atwater, 2004). That is, leadership roles may need to be shared, or may even be taken over by the communications software (Avolio and Kahai, 2003). Xhaulflair and Rorive conclude from their examination of three case studies that leadership became "blurred" as the extent of being virtual increased (Xhauflair and Rorive, 2003). The "blurring" of leadership may reflect a sharing of leadership roles.

Pare and Dube suggest that in addition to relationship building, coordination and control are key management issues for virtual teams (Pare and Dube, 1999). They note that the dispersion of team members means that project leaders cannot use traditional measures to control the work processes. Thus, one can infer that leadership roles will need to be adapted for the virtual team context (and therefore, for the PDT context as well).

Avolio and Kahai (2003) also assert that relationship development is a primary concern for virtual team leadership. They suggest that virtual team leaders must build trust rapidly; communicate often and clearly; and foster group identity by using "technology to deal with greater work force diversity (Avolio and Kahai, 2003, p. 333). Team cohesion, as noted by Balthazard et al. (2004) as a priority for virtual teams, can be fostered by the development of trust and the development of a group identity that minimizes the perceived distances between distributed team members.

Virtual teams can be configured in a variety of ways (e.g., inter- or intra-organizational). Bell and Kozlowski (Bell and Kozlowski, 2002) present a theoretical framework to understand virtual teams. They suggest that the challenges faced by virtual team leaders can, in part, result from the specific characteristics of temporal distribution, boundary spanning, lifecycle, and member roles. For example, teams that are distributed across time are more likely to be out of touch with the overall environment and therefore the leader must monitor the environment and keep the team informed (Bell and Kozlowski, 2002). Thus, the type of challenge faced by the leader depends upon team configuration, factors of distributedness, and member roles.

Cultural differences are a fundamental issue facing virtual leaders (Cascio and Shurygailo, 2002). Expectations of behavior are formed based upon shared cultural beliefs (Cascio and Shurygailo, 2002). Therefore, no matter the challenge there is also the fundamental issue of overcoming differences in points of view, expectations, and the like.

It is likely that there is no one issue that faces all leaders of all configurations of virtual teams but, rather, a collection of interacting challenges that are based upon culture, distributedness, configuration, and lifecycle of the team.

2.3 Leadership Roles Not Specific to Virtual Teams

One way of characterizing leadership is by leadership behaviors which then can be categorized into roles enacted. A leader might engage in some or all of the roles, and/or some of the roles can be enacted by team members. The gist is that, as a whole, these roles guide the team to achieve its goals. One can first examine leadership roles described in the literature for traditional teams that are also used in describing leadership behaviors in virtual teams.

2.3.1 The Competing Values Framework

Behavioral complexity theory suggests that leaders may engage in multiple leadership roles at once (Carte, Chidambaram and Becker, 2006). The Competing Values Framework uses this idea to identify leadership roles that may be enacted by team leaders. The leadership roles defined by Quinn (Quinn, 1988) in his Competing Values Framework are also examined by researchers (Kayworth and Leidner, 2001/2002, Carte et al., 2006) in studies of leadership in virtual teams. Quinn's Competing Values

Framework for Leadership Roles (Quinn, 1988) incorporates four models into one framework at the managerial level. The Rational Goal Model and Internal Process Model encompassing leader behaviors that use the left brain, or McGregor's Theory X perspective; while the Open Systems Model and Human Relationship Model encompass leader roles that use the right-brain or McGregor's Theory Y perspective (Quinn, 1988).

Each model can be visualized as the quadrant of a circle divided from the other quadrants by an axis of flexibility/control and an axis of internal/external focus and shorter/longer horizons (Quinn, 1988). The figure below, adapted from Quinn (1988), shows the roles together with the model in which they fit and how they relate to each other in the Competing Framework of Leadership Roles. Eight roles, two per quadrant, are identified: Innovator, broker, producer, director, coordinator, monitor, group facilitator, and mentor. The upper right quadrant represents the Open Systems Model and has the roles of innovator and broker; the lower right quadrant represents the Rational Goal Model and contains the roles of producer and director; the lower left quadrant represents the Internal Process Model with coordinator and mentor roles; and the upper left quadrant represents the Human Relations Model with group facilitator and mentor Roles. As can be seen from the diagram, leadership style can be inferred by where in which quadrant a role falls. Thus, the mentor role, characterized by showing consideration, is flexible with internal focus and tends towards being a concerned, supportive style.

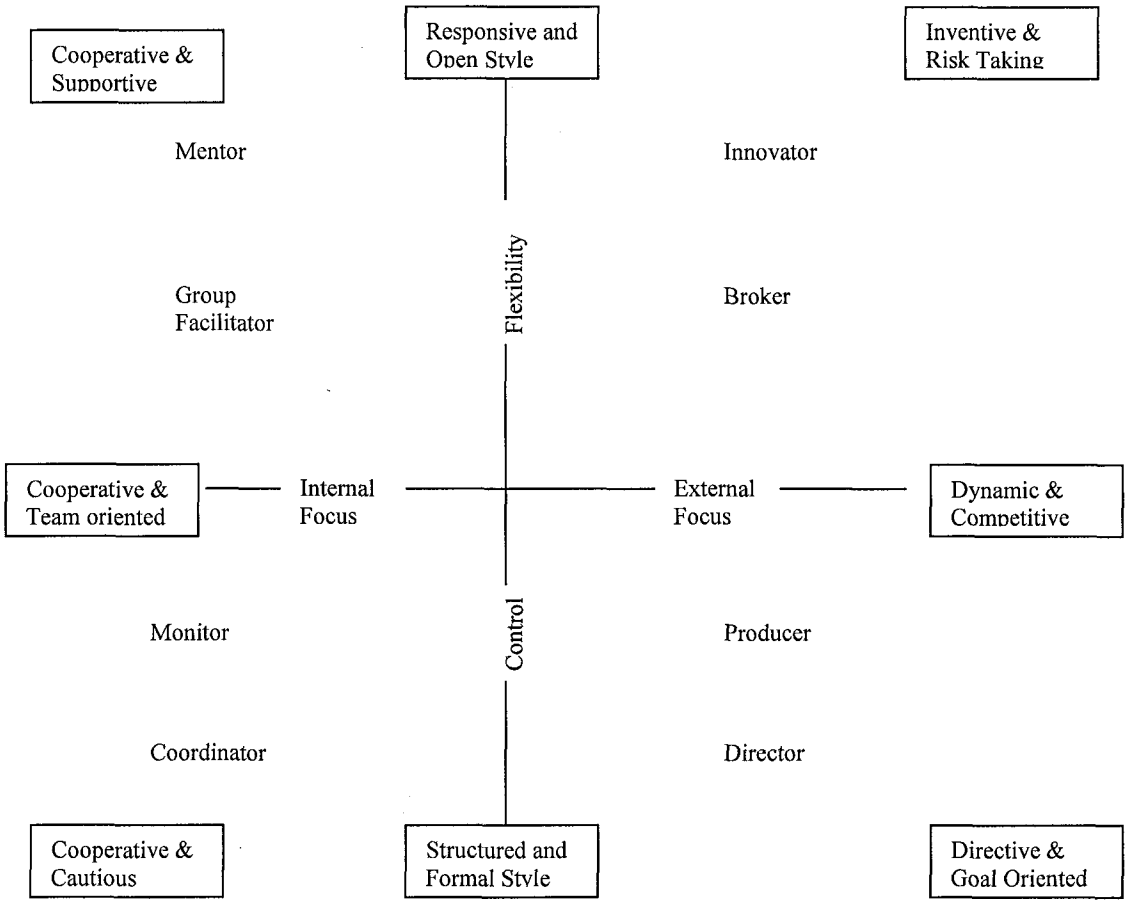

Figure 2.1 Competing values of leadership roles (adapted from Quinn, 1988, p. 86).

Although the above model takes a role perspective, one can observe that there is a relationship between the concepts of transformational/transactional leadership style and the categorization of leadership roles in the above model. That is, the roles in each quadrant share the same style as described by the transformational/transactional concept. For example, the mentor and facilitator roles (in the upper left quadrant of Quinn's model) share a quadrant and also may be observed to have characteristics of a transformational leadership style. Carte et al. (2006) make this explicit in their adaptation of Quinn's model, as will be discussed in the discussion of emergent leadership in this chapter.

2.3.2 Quadrant Model of Leadership Roles

Dennison, Hooijberg, and Quinn (Denison et al., 1995) report on an empirical study of the roles and framework identified by Quinn (Quinn, 1988) for leadership in traditional collocated teams. This, again, was not a study of the roles in virtual teams, however, the definitions for the roles were adopted by Carte (Carte et al., 2006) and Kayworth (Kayworth and Leidner, 2001/2002) in their studies of virtual team leadership, and so are relevant to this discussion.

One hundred seventy six managers from 84 companies in the public utilities industry were surveyed with a questionnaire that included measures of the eight roles specified by Quinn's Competing Values Framework (Quinn, 1988) and adapted by Denison et al (Denison et al., 1995). In addition, 670 subordinates of the subjects and 222 supervisors of the subjects also completed a questionnaire in which their perceptions of the effectiveness of their manager or subordinate were elicited (Denison et al., 1995). After Quinn, Denison et al. defined the eight roles as follows:

> ***Innovator Role:*** *The innovator is creative and envisions, encourages, and facilitates change.*
> ***Broker Role:*** *The broker is politically astute, acquires resources and maintains the unit's external legitimacy through the development, scanning, and maintenance of a network of external contacts.*
> ***Producer Role:*** *The producer is the task-oriented, work-focused role. The producer seeks closure, and motivates those behaviors that will result in the completion of the group's task.*
> ***Director Role:*** *The director engages in goal setting and role clarification, sets objectives, and establishes clear expectations.*
> ***Coordinator Role:*** *The coordinator maintains structure, does the scheduling, coordinating, and problem solving, and sees that rules and standards are met.*
> ***Monitor Role:*** *The monitor collects and distributes information, checks on performance, and provides a sense of continuity and stability.*
> ***Facilitator Role:*** *The facilitator encourages the expression of opinions, seeks consensus, and negotiates compromise.*

> ***Mentor Role:*** *The mentor is aware of individual needs, listens actively, is fair, supports legitimate requests and attempts to facilitate the development of individuals. (Denison et al., 1995, p. 527-528)*

Denison et al.'s hypotheses tested Quinn's model for both high- and low-effective managers or dimensionality, measurement, and whether the pattern of roles forms a circumplex model (Denison et al., 1995). A circumplex is defined by http://www.personalityresearch.org/interpersonal/circ.html as:

> *A circumplex can be viewed in three successively more restrictive and testable ways. First, a circumplex can be viewed as merely a useful pictorial representation of a particular domain. Second, a circumplex can be viewed as implying circular order, such that the variables that fall close together are more related than variables that fall further apart on the circle, with opposite variables being negatively related and variables at right angles being unrelated (orthogonal). Third, a circumplex can be viewed as implying exact circumplex structure, such that all variables are equally spaced around the circle (Wiggins & Trobst, 1997) ...*

It is the second way that the notion of a circumplex is used in this discussion. Effectiveness of managers was assessed by the supervisors' responses, and the roles the managers enacted were measured by the responses of the subordinates (Denison et al., 1995). Denison et al. found that the eight roles did scale in two dimensions, but, contrary to their hypothesis that the fit would be better for high-effective managers, they found that there was no significant difference for the high- and low-effective managers (Denison et al., 1995). Convergent/divergent validity was found and was better for high-effective managers (Denison et al., 1995). Most interesting to this discussion was Hypothesis 3 which states:

> *The interrelationships among the role clusters should take the form of a circumplex, as specified by the theoretical model. In addition, this circumplex pattern will be more apparent for high effectiveness managers than for low effectiveness managers. (Denison et al., 1995, p. 530)*

In its initial form, the hypothesis was rejected. However, what was supported was a "quadrant model" for high effective managers, wherein the roles are perceived as fitting within the proper quadrant when the constraints on the order of the roles in the quadrants are removed (Denison et al., 1995). Quinn's theoretical model specifies that moving from the lower left quadrant to the upper left quadrant in the circumplex should result in an order of roles of coordinator, monitor, facilitator, and then mentor (Quinn, 1988). However, the data from the Denison et al. study suggest that for high effectiveness managers, the order of the roles in each of the left-hand side quadrants are reversed (i.e. monitor, coordinator, mentor, then facilitator) (Denison et al., 1995). For the low effectiveness managers, the "quadrant model" was still not supported. The data suggested that for the low effectiveness managers, subordinates saw as central to leadership, albeit indistinct, the roles of director, producer, and coordinator (Denison et al., 1995).

Denison et al. conclude that high effectiveness managers are perceived by subordinates as having a greater behavioral complexity than do low effectiveness managers and exhibit the eight roles of Quinn's model more clearly, in a "limited form of the circumplex model that we labeled the quadrant model (Denison et al., 1995, p. 535)." Additionally, less effective managers, the authors conclude, may behave in more traditional ways that emphasize control and productivity (Denison et al., 1995).

Hooijberg and Choi (Hooijberg and Choi, 2000) used a quadrant model version of Quinn's framework in an examination of which roles are associated with leadership effectiveness. They used a 360-degree feedback approach in examining both which roles are associated with effectiveness as well as a comparison of those ratings made by a

manager's superiors and subordinates with the manager's self-rating (Hooijberg and Choi, 2000). The model used by Hooijberg and Choi identifies the quadrants as: *task leadership quadrant* (lower right – producer, director); *stability leadership quadrant* (lower left – coordinator, monitor); *people leadership quadrant* (upper left – facilitator, mentor); and *adaptive leadership quadrant* (upper right – innovator, broker) (Hooijberg and Choi, 2000). Each role is defined as follows:

> *As a **producer**, a manager is expected to motivate members to increase production and to accomplish stated goals.*
> *As a **director**, a manager is expected to clarify expectations, define problems, establish objectives, generate rules and policies.*
> *As a **coordinator**, a manager is expected to maintain the structure and flow of the system, coordinate the scheduling of staff efforts, handle crisis, and attend to technical and logistical issues.*
> *As a **monitor**, a manager is expected to know what is going on in the unit, to see if people comply with rules and regulations, and to see whether the unit is meeting its quotas.*
> *As a **facilitator**, a manager is expected to foster collective effort, build cohesion and teamwork and manage interpersonal conflict.*
> *As a **mentor**, a manager is expected to develop people through a caring, empathetic orientation. In this role, the manager is helpful, considerate, sensitive, open, approachable, and fair.*
> *As an **innovator**, a manager is expected to pay attention to changes in the environment and to identify and facilitate adaptation to those changes.*
> *As a **broker**, a manager is expected to meet with people from outside his or her unit to represent the unit and to negotiate and acquire resources for the unit. (Hooijberg and Choi, 2000, pp. 344-345)*

The horizontal axis is the axis that goes from the internal focus on the left, to an external focus on the right. The vertical axis is the continuum from flexibility at the top, to control at the bottom. Thus, the quadrant model is Quinn's model, as shown above, without ordering of the roles within any quadrant. Each quadrant has its own characteristics based upon the axes that define it. For example, the people leadership quadrant (mentor, facilitator) is characterized by flexibility and an internal focus.

Leadership effectiveness was measured as having four indices (overall managerial success, overall leadership effectiveness, meeting managerial performance standards, and how well she or he performed as a role model (Hooijberg and Choi, 2000)) and was determined by the results of surveys given to the managers, and the managers' subordinates, peers, and superiors. Again, the subjects were from the public utility industry, with 252 managers as subjects (Hooijberg and Choi, 2000). The leadership scale used was the Competing Values Framework questionnaire, which was reported by Denison et al. to be valid. However, the confirmatory factor analysis indicated that the roles of producer, director, and coordinator were highly correlated for all four groups of participants and therefore might be subsumed by a single factor that the researchers termed the goal achievement role (Hooijberg and Choi, 2000). Thus, the data were examined with both the eight original roles and using the six roles of innovator, broker, goal achievement, monitor, mentor, and facilitator (Hooijberg and Choi, 2000).

The results indicated that that the subordinates positively associated the roles of coordinator, mentor, facilitator, and broker with leadership effectiveness, but that the monitor role had a significantly negative association with the perceptions of effectiveness by the subordinates (Hooijberg and Choi, 2000). Interestingly, the goal achievement role had a significantly stronger association with perceptions of leadership effectiveness than any of the other roles.

In contrast, there was little support for the hypothesis that "A manager's peers will positively associate the producer, director, coordinator, monitor, and facilitator leadership roles with effectiveness (Hooijberg and Choi, 2000, p.346)." Only the

facilitator and innovator roles were significantly associated with the peers' perceptions of leadership effectiveness.

The third hypothesis, "A manager's superiors will positively associate the innovator, broker, producer, and director roles with effectiveness (Hooijberg and Choi, 2000, p. 346)," was also partially supported. The broker role was not positively associated with effectiveness as hypothesized and, contrary to the hypothesis, the coordinator role was (Hooijberg and Choi, 2000)

Finally it was found that managers' leadership effectiveness models were similar to their superiors' but dissimilar to their subordinates' models (Hooijberg and Choi, 2000).

It is interesting to note that although the researchers believed that the model could be represented by six roles, the roles subsumed by the goal achievement role were not all perceived the same way insofar as association with effectiveness by all groups. Although the survey was not directed towards virtual team leaders, per se, there are implications for virtual team leadership, in particular for partially distributed teams. For example, if the results are transferable to virtual teams, it may be critical for managers to educate members about what leadership roles would be efficacious for them to enact where the leadership roles need to be shared by team members. If the leadership is hierarchical, with a vertical leader and distributed designated leaders, then mentoring and training in the roles the central leader views as important to effectiveness should be more easily emphasized and understood. However, if the leadership roles are to be shared by members without explicit leadership designation, it may be necessary to explicitly define what roles need to be emphasized for effectiveness.

2.4 Leadership Roles in Virtual Teams

Carte, Chidambaram, and Becker (2006) examined virtual team leadership behaviors in the context of the eight roles identified by Quinn (1988) and examined by Denison et al. (1995) in a longitudinal study of 22 virtual teams comprised of undergraduate students from three US universities.

The model tested was the researchers' Lederplex model (Carte et al., 2006), adapted from Denison et al.'s quadrant model (Denison et al., 1995). It should be noted that although the order of the roles within the model is the same as in Quinn's Competing Value's Framework (Quinn, 1988), and not the order found in Denison et al.'s investigation (Denison et al., 1995), the Lederplex model is a quadrant model and so the order of roles within a quadrant is not significant.

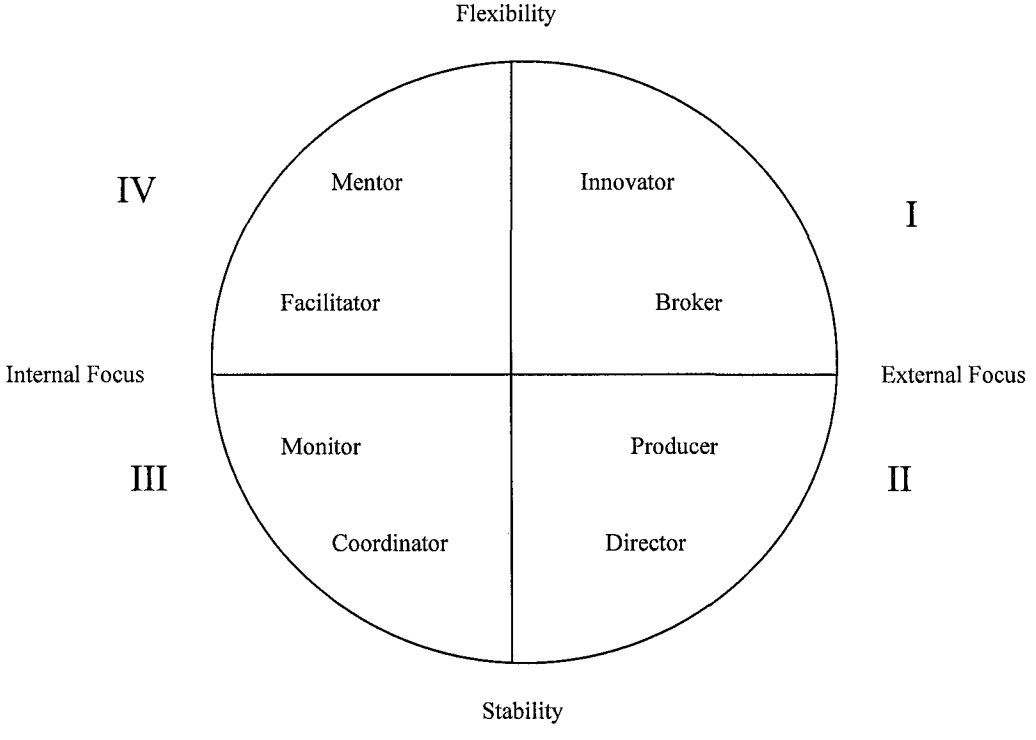

Figure 2.2 Leaderpex Model (adapted from Carte et al., 2006, p. 328).

In the model, Quadrant I (innovator role, broker role) has transformational leadership, defined as "focused on encouraging and facilitating change and maintaining external legitimacy ... (Carte et al., 2006, p. 328)." The transformational roles are seen as inspirational and motivating (Carte et al., 2006). Quadrants II and III (producer, director, coordinator, monitor) are seen as comprised of directive leadership roles (Carte et al., 2006). Directive roles are behaviors that engage in problem solving, decision making, and guidance (Carte et al., 2006). Quadrant IV (facilitator, mentor) contain the participative leadership roles (Carte et al., 2006). Quadrants II and III are presumed to contain the roles subsumed by the goal achievement role in Hooijberg and Choi (2000). Participative leadership includes those behaviors that increase member participation, including sharing of power and problem solving between members and leader (Carte et al., 2006). Carte et al. use Denison et al.'s definitions (Denison et al., 1995) of the roles. The results showed that more leadership behaviors were evident in communication exchanges for high-performing teams than for low-performing teams (Carte et al., 2006). This is consistent with Denison et al.'s findings for high- and low-performing teams (Denison et al., 1995). Carte et al. found that amongst the Directive leadership roles, there were more communications embodying producer and monitor role behaviors for high-performing teams, but not more director and coordinator role behaviors (Carte et al., 2006). The communication exchanges showed that there was more sharing of the monitor role and more concentration of producer role for high-performing teams (Carte et al., 2006). Overall, more messages were sent by high-performing teams than by low-performing teams (Carte et al., 2006). Finally, the analysis of communication exchanges showed that some role behaviors (shared monitor and concentrated producer roles)

enacted early in the team lifecycle were associated with team behaviors, but, when they were enacted only later in the lifecycle there was not a significant association with team performance (Carte et al., 2006).

While monitoring behavior was associated in this study with high-performing teams, in Hooijberg and Choi's study of non-virtual teams it was found to have a negative association with perceptions of effectiveness (Hooijberg and Choi, 2000). This suggests that monitoring behavior may be more important in virtual teams than in traditional teams, and warrants further investigation. Konradt and Hoch (Konradt and Hoch, 2007) found that control-related roles were the most important roles in the view of managers of virtual teams. This would be consistent with the notion that monitoring behavior is vital in virtual teams as, in Quinn's Competing Values Framework, the monitor role resides in the lower hemisphere which is the control-related hemisphere.

In their study, Wakefield, Leidner, and Garrison (2008) also found that the monitor role was positively associated with perceptions of leader performance in virtual teams. Wakefield et al. (2008) administered a survey to 159 virtual team members employed by a U.S. telecommunications firm or one of five Korean firms. Recall that the left hemisphere of the Quinn (1988) framework has the internally focused roles (coordinator, monitor, facilitator, and monitor). Using PLS (partial least squares) Wakefield et al. (2008) tested a model of the relationship of those role enactments and communications technology use with team conflict and perceptions of leader effectiveness. The model also tested the relationship of perceptions of leader effectiveness with perceptions of team performance. Three types of conflict were tested for: task, relational, and process conflict (Wakefield, Leidner and Garrison, 2008). Task

conflict is when there are disagreements about tasks, activities assignments, or work content; relational conflict occurs when there is interpersonal conflict (e.g., resulting from lack of understanding of cultural differences) that is not related to the task; and process conflict is when there is disagreement about the process and method to do the task (Wakefield et al., 2008).

The results suggested that greater use of communication technology, the less conflict. Task conflict was observed to be reduced by expressions of the monitor role, but not by the facilitator role. Other roles were not tested against task conflict. The results of examining leadership roles and process conflict resulted in positive associations with the coordinator role but not the facilitator role. The other internal roles were not tested against process trust. Finally, relational trust was found to be lower when there was a greater perception of the leader enacting the facilitator role, but, surprisingly not when the mentor role was perceived. The other roles were not tested against relational conflict. (Wakefield et al., 2008).

Supported was that the greater the degree the internal roles are perceived by the team members, the greater the perceptions of the leader's effectiveness. Also supported was the greater the perception of the leader's effectiveness, the greater the perceptions of team performance. (Wakefield et al., 2008).

The results of this study have implications for virtual team leaders. It is noteworthy that the internal roles proposed by Quinn (1988) do have an effect on conflict and perceptions of leader effectiveness, and through leader effectiveness, perceptions of team performance. Being aware of this can guide leaders as to which roles are critical for them to enact in a way salient to their members. Although this study was an examination

of members' perceptions in virtual teams, it is possible that some of the teams were partially distributed as the definition of virtual team did not preclude that situation. However, as with most studies, it does not distinguish between virtual teams and PDTs. This dissertation research teases out the effects on PDTs and distinguishes them from fully virtual or traditionally collocated teams.

Virtual team leadership was also investigated in an empirical study reported by Kayworth and Leidner in the winter of 2001-2002. Of particular relevance to this discussion was the measurement of leadership complexity. Likert scale items from Denison et al. (1995) were used to elicit which of the eight leadership roles identified by Quinn (1988) were exhibited by team leaders. Other results concerning the effectiveness of leaders are also related to the study of leader roles as they reveal the behaviors perceived as most effective. Although the number of teams (13) was too small to perform a quantitative evaluation of leader effectiveness as it relates to project quality, the data suggest that the highest quality papers were produced by teams with leaders assessed as being highly effective (Kayworth and Leidner, 2001/2002). Leaders assessed as most effective were perceived to be "understanding" which suggests that they engaged in mentoring role behaviors (Kayworth and Leidner, 2001/2002). Overall, the data suggest that effective leaders pay attention to both task-related activities and relational aspects of leadership (Kayworth and Leidner, 2001/2002). The researchers also report that those attributes of effective leaders in traditional teams were also found in the effective virtual team leaders. However, the authors suggest that the emphasis of particular roles may vary in virtual teams from those that need to be emphasized for effective traditional team leadership (Kayworth and Leidner, 2001/2002). For example,

communication may be more important in virtual teams than it is in traditional teams. The researchers conclude that mentoring is the primary characteristic of effective leaders in virtual teams and that although it is possible that ineffective leaders also possess the capacity for the understanding and empathy shown by effective leaders, the ineffective leaders may not be able to project them effectively (Kayworth and Leidner, 2001/2002). Not all leaders are designated. Members can enact leadership roles, emerging as de facto leaders. The next section addresses literature that focuses on this phenomenon.

2.5 Emergent Leadership in Virtual Teams

Virtual teams may be self-managed, often temporary, teams (Yoo and Alavi, 2004). In such cases, there may not be a designated leader and members may enact leadership roles, thus being emergent leaders. Yoo and Alavi (2004), in their report of an exploratory study of emergent leaders in virtual teams, define a virtual team as "a temporary, geographically dispersed team whose team members interact primarily through electronic media (Yoo and Alavi, 2004, p. 28)." However, it is plausible that emergent leadership can occur in any self-managed team, temporary or not. The question of interest is what behaviors both predict leadership and are enacted by emergent leaders in virtual teams?

Yoo and Alavi attempted to discover this in a 10-week exploratory study of the behaviors and roles enacted by emergent leaders in seven virtual teams (Yoo and Alavi, 2004). The subjects were senior US government agency executives placed into teams, without designated leaders, of eight to ten members each. The task was to develop a strategy to be used by a community to increase the home ownership rate. Teams only

met virtually. Although the participants knew each other, they had no experience working together in a team. Both qualitative and quantitative methods were used in analysis: partial correlation of message type, length, etc. was determined, and the contents and timing of 306 email messages were examined in a grounded theory approach to identify behavior patterns (Yoo and Alavi, 2004). The researchers developed a coding scheme to examine messages and coded messages as task-oriented, relationship-oriented, or technology-oriented (Yoo and Alavi, 2004).

The results indicated that emergent leaders sent longer and more messages, and that the number of logistics focused task-oriented messages sent was higher for emergent leaders than for non-leaders (Yoo and Alavi, 2004). There were no differences in the number of expertise-related, relationship-related, or technology-related messages between emergent leaders and non-leaders (Yoo and Alavi, 2004). Content analysis of the email messages revealed that emergent leaders enacted the roles of initiator, scheduler, and integrator (Yoo and Alavi, 2004). As initiators, emergent leaders sent out the first or second message, and sent out the first task-structuring messages which included team activity organization suggestions. In six of the seven teams, the emergent leader enacted the role of scheduler and "set up the temporal rhythm of the project by coordinating the scheduled conference calls for the team. ... these teams scheduled conference calls on a regular basis, and seemed to have used those calls as a major coordination mechanism (Yoo and Alavi, 2004, p. 41)." As integrators, several of the emergent leaders compiled the final document, integrating the other team members' work into the final deliverables. The emergent leaders did not provide most of the task-content expertise.

In the leadership literature, there is confirming evidence that leaders tend to communicate more. A study by Hiltz, Johnson, and Turoff (Hiltz, Johnson and Turoff, 1991) examined leadership in synchronous CMC (computer mediated communication). One of the independent variables was designated leadership (designated leader/no leader). However, the designated leaders were selected by the team members after the completion of a preliminary task. It is therefore possible that leaders designated in that manner may share characteristics with emergent leaders. Results indicated that those participants who entered more comments during the initial practice task tended to be selected as team leaders (Hiltz et al., 1991). Interestingly, there was "absolutely no correlation (Pearson's R of 0.01) between the quality of the leader's initial prediscussion solution to the problem and the likelihood of having been selected as leader (Hiltz et al., 1991, p. 96)." Thus, it is suggested that leadership, when emergent or team selected, will be assumed based upon skills of organization and communication more than domain expertise. Further exploration may reveal if this conjecture is true and what the implications for team management are.

Studies of emergent leadership often take a functional perspective. That is, it is the leadership behaviors that are studied, not the designation of leadership. Misiolek and Keckman also took this perspective in a study of emergent leadership in temporary virtual teams (Misiolek and Heckman, 2005). They studied the leadership behaviors and perceived leadership of 62 students divided into 13 temporary, distributed teams. Teams were assigned the monikor of being "weak leadership" or "strong leadership" teams depending upon whether or not emergent leader(s) could be consistently identified by team members. As has been seen in other research (e.g., Yoo and Alavi, 2004),

differences in communication patterns were found between emergent leaders and non-leaders. In strong leadership teams, leaders initiated more communication than non-leaders. However, in weak leadership teams participants who exhibited leadership behaviors did not initiate significantly more communication than non-leaders (Misiolek and Heckman, 2005). In strong leadership teams, leaders were also the initiators and recipients of more social communication than were the non-leaders; no difference was found in weak leadership teams. Similarly, in strong leadership teams the leaders were more often the recipients of task process communications while there was not a significant difference in weak leadership teams (Misiolek and Heckman, 2005). However, in both strong and weak leadership teams, leaders initiated significantly more process related communication than did non-leaders (Misiolek and Heckman, 2005).

Misiolek and Heckman (2005) did not find a significant difference in leadership index (i.e., strength of leadership perception) for performance. However, the researchers note that "no team is truly 'leaderless' (Misiolek and Heckman, 2005, p. 8). They note that the strong leadership teams could be considered to be "centralized" leadership teams, and the weak leadership teams could be described as "decentralized" (Misiolek and Heckman, 2005). In viewing it that way, it is not surprising that leaders were neither strongly perceived by members or that communication patterns did not differ in weak leadership teams, because if the team shares the leadership functions then it might be a team of leaders – possibly each enacting leadership in an area for which they are best suited.

One might ask, is it possible that emergent leadership can occur in teams with designated leaders as well? If the designated leader is not autocratic, then perhaps this

can happen. Since virtual team leaders cannot be present to micro-manage a team, shared leadership with emergent leaders may be needed to achieve effectiveness. While most of the literature focuses on what makes a leader "good" or effective, leadership can also be "bad." The next section describes research on "bad" leadership.

2.6 "Bad" Leadership

Although the leadership roles identified by Quinn (1988) have, in some situations, had a negative correlation with effective leadership (Hooijberg and Choi, 2000), the roles are "positive" ones intended to benefit the organization, team, and output. Since the 1970s the terms "leader" and "leadership" have had a positive bias and have been assumed to have the intention of motivating followers and engaging them in activities that are beneficial (Kellerman, 2004). Kellerman (2004) describes leadership as a continuum that ranges from malevolent to benevolent. She traces the bias towards leadership as a positive concept only to a 1978 book by James MacGregor Burns in which leadership was defined as a mobilization of resources to "arouse, engage, and satisfy the motives of followers (Kellerman, 2004, p. 8). Burns did not call malevolent leaders "leaders" but rather referred to them as "power wielders" (Kellerman, 2004).

However, history is unfortunately replete with leaders who fail to act in ways that benefit their followers. Some have been evil and destructive (e.g., Hitler), while others fail to lead in ways that benefit the stakeholders through their incompetence, even when their motives are appropriate. It is important to note that bad leaders need not be ineffective. Hitler was certainly, at least for most of his tenure, quite effective at achieving his goals, particularly that of annihilating the Jewish population in Europe

(Kellerman, 2004). Kellerman (2004) proposed a typology of bad leadership that categorizes such leadership into seven types: incompetent, rigid, intemperate, callous, corrupt, insular, and evil. A "bad" leader can exhibit any or all of the characteristics in the typology. Bad leadership, according to Kellerman (2004) requires that at least some followers either cooperate or at least do nothing to intervene to try to stop the bad leader. Kellerman (2004) further categorizes bad leadership into two overall categories: ineffective and unethical. Ineffective leadership is incompetent, rigid, and/or intemperate; unethical leadership is callous, corrupt, insular, and/or evil (Kellerman, 2004). Kellerman defines incompetent leadership as one in which "the leader and at least some of the followers lack the will or skill (or both) to sustain effective action. With regard to at least one important leadership challenge, they do not create positive change" (Kellerman, 2004, p. 40). Rigid leadership is leadership in which the leader and some followers are "stiff and unyielding. Although they may be competent, they are unable or unwilling to adapt to new ideas, new information, or changing times" (Kellerman, 2004, p. 41). Intemperate leaders lack self-control and are "aided and abetted by followers who are unwilling or unable effectively to intervene" (Kellerman, 2004, p. 42). Callous leaders, and at least some of their followers, are unkind and ignore the needs of their followers. Corrupt leaders, and at least some of their followers, "lie, cheat, or steal. To a degree that exceeds the norm, they put self-interest ahead of the public interest" (Kellerman, 2004, p. 44). Insular leaders, and at least some of their followers, fail to take into account the needs of anyone outside of the immediate group for which they are responsible. Evil leadership is one in which "the leader and at least some followers commit atrocities. They use pain as an instrument of power. The harm done to men,

women, and children is severe rather than slight. The harm can be physical, psychological, or both" (Kellerman, 2004, p. 46).

Kellerman's study of "bad leadership" is important because it broadens the understanding of leadership to account for leadership that is ineffective and/or ill-intentioned. It reflects the real-world situation in which not all leaders lead with the intention or ability to benefit their followers. Any study of leadership may benefit from looking at this "flip side" of leadership. When results of a study fail to show associations of leadership with good outcomes, it may be fruitful to use Kellerman's typology to understand why the leadership failed to produce positive outcomes.

2.7 Effective Leadership

The empirical and conceptual papers reviewed in this chapter have implications for effective leadership. Some of the literature is specifically geared towards prescriptive recommendations for effective virtual team leadership. These articles vary from the specific (e.g., Cascio and Shurygailo, 2002) to the more generic (e.g., Kayworth and Leidner, 2000).

The need for good communication is stressed by the recommendations. For example, Cascio and Shurygailo note that "Each employee is accountable for regular communications (Cascio and Shurygailo, 2002, p. 370)." This is consistent with the empirical findings discussed above that suggest that overcoming communication challenges is a key factor for virtual teams. Cascio and Shurygailo also recommend that for remote teams a face-to-face meeting be held initially so that members can meet each other and interact prior to working virtually together. This recommendation was also

made by Zigurs (2002) and is thought to build trust and team cohesion. Cascio and Shurygailo (2002) also recommend that important communications (e.g. a layoff) be delivered face-to-face even when the workers are geographically distributed. Thus, one can infer that the authors do believe that face-to-face communication has advantages over electronic communication and should be used when the communication is vital or to best take advantage of the benefits such communication can bring.

Cascio and Shurygailo (2002) also note that "E-leaders should be aware of, and take positive actions to avoid any 'us versus them' tendencies (p. 371)." This in-group/out-group effect is especially likely in PDTs (Huang and Ocker, 2006). Cascio and Shurygailo (2002) also propose that recognition of employees is most important when employees are remote and caution managers to acknowledge the employees' accomplishments and efforts frequently.

The overarching principle of Cascio and Shurygailo's recommendations, it can be inferred, is that extra effort needs to be made to establish and maintain clear and accessible communication in virtual teams. Such efforts will include defining process, availability, norms, and expectations.

Kayworth and Leidner (2000), citing the same data set as used in their 2001/2002 study discussed above (Kayworth and Leidner, 2001/2002), also make recommendations to achieve effective virtual teams. Communication is also in their results seen as key to virtual team success (Kayworth and Leidner, 2000). The recommendations made are related to developing and engaging in effective communication, overcoming cultural obstacles, effectively choosing and using technology, and, most germane to this chapter discussion, leading virtual teams. Qualitative study results indicated that virtual team

members perceived leadership of the teams to have significant influence on the perceived team performance (Kayworth and Leidner, 2000). The authors suggest that effective virtual team leaders:

- *Set clear goals and provide continuous performance feedback*
- *Build team cohesiveness*
- *Express flexibility & empathy towards virtual team members*
- *Exhibit cultural awareness (Kayworth and Leidner, 2000, p. 18)*

The researchers identify strategies to achieve those goals of leadership. Communication is a key to all of the goals. The strategies recommended are, in a sense, to make happen what can more easily and naturally happen in a collocated team. Among the strategies recommended is that face-to-face meetings be held periodically either in collocated settings or through videoconferencing to build trust (Kayworth and Leidner, 2000). Team building exercises are suggested for building team cohesion as team members get to know each other (Kayworth and Leidner, 2000). Norms and rules of communication should be established. The researchers give the example of needing to explicitly make clear the time zone used for posted meeting times (Kayworth and Leidner, 2000). It is interesting to observe that both transactional and transformational leadership style behaviors are recommended for leading successful virtual teams. For example, setting clear goals is a transactional behavior while showing empathy is transformational.

A different approach is found in Sivunen (2006). In an examination of four Finnish virtual team leaders and their global teams, Sivunen looked at the strategies used by the leaders to promote member identification with the team, suggested by the research to be important for engendering successful team relationships (Sivunen, 2006). With a qualitative, interpretive approach, she interviewed the leaders, observed communication

by participating in teleconferences with two teams, and transcribed and analyzed discussions made in instant messages (one team) and an online discussion forum (one team). Sivenen found that "the tactics the team leaders used to foster virtual team members' identification with the team fell into four categories: (1) catering for the individual, (2) giving positive feedback, (3) bringing out common goals and workings, and (4) talking up the team activities and face-to-face meetings (Sivunen, 2006, p. 352)." Caring for the individual included acknowledging the right of members to hold different opinions and encouraging them to express them (Sivunen, 2006). This is the hallmark of the facilitator role discussed previously (Denison et al., 1995). Sensitivity to the varying needs of the individual members, including an awareness of different temporal and environmental working conditions, was also found to be part of caring for the individual (Sivunen, 2006), a characteristic expressed in the mentor role as well (Denison et al., 1995).

Positive feedback was also found to be important in building successful team relationships by Sivunen. She notes that the electronic medium can promote the effectiveness of positive feedback in building team identification: the feedback is public and therefore can enhance the entire team's identification and it is transcribed so it can be referred to at later times which, according to Sivunen, can also promote team identification (Sivunen, 2006).

Because of the organizational changes two of the teams had experienced, the leaders of those teams found it necessary to work to clarify goals and create a common direction for the team to follow, thus engaging in director role behaviors (Denison et al., 1995).

The leaders also emphasized the need to build team spirit from the beginning with team-building activities (Sivunen, 2006). Two of the leaders expressed the opinion that an initial face-to-face meeting could build a strong foundation of team cohesion and spirit that could then be maintained through the electronic communication the team would use (Sivunen, 2006).

The four critical techniques for building team identification all require ongoing, effective communication. The author notes that "Communication plays an important role in this process and communication technologies can be used as a tool to deliver the messages promoting identification or as themselves a stimulus to identification in technology-oriented teams (Sivunen, 2006, p. 363)." This emphasis on communication is a recurring theme in the literature when addressing the challenges and strategies for creating and maintaining successful virtual teams.

2.8 Conclusion

Leadership in virtual teams can be examined through a variety of lenses (e.g. by role, by style, by team or leadership configuration). There are a variety of leadership configurations possible in virtual teams and each one has its own unique challenges to overcome. What the studies noted in Appendix A seem to have in common is that, no matter the lens, no matter the leadership configuration, effective communication is key to developing the team cohesion, trust, motivation, and practices that result in effective team performance. For partially distributed teams, this becomes especially important. Leaders are likely to be collocated with some members, while they will need to develop telepresence with others. To avoid the ingroup/outgroup effects that can result from

some members having closer contact with the leader(s), leaders must make a concerted effort to keep open the lines of communication with distributed members and make explicit their roles and responsibilities while working to build a whole team membership identification. The challenges, then, for partially distributed leadership are great. However, an understanding of the success factors for leadership in virtual teams and sensitivity to the need to avoid estrangement of distributed members can promote successful leadership in all of the possible leadership configurations.

The lens of leader roles and most references to leadership in the literature focuses on leader behaviors and attributes that are intended to meet the needs of the organization and members of the group under the supervision of the leader. However, "bad" leadership can occur potentially in any form of team. Kellerman (2004) proposes a typology of bad leadership which is characterized by two main categories of characteristics that are either ineffective or unethical. To ignore bad leadership is to ignore the complete picture of leadership.

While the leadership literature for traditional teams is informative, it cannot be assumed that the leadership behaviors that have proven effective in traditional teams can transfer unmodified to a virtual team with equal success. Appendix A gives a summary of experiments of leadership in virtual teams found in the literature.

CHAPTER 3

LITERATURE REVIEW: TRUST IN VIRTUAL TEAMS

3.1 Introduction

Virtual teams differ from traditional teams in many ways that may impact the development of trust, a critical element for team effectiveness. For example, virtual teams are often formed with members who have no history together and may never meet face-to-face. This chapter explores the relevant literature concerning trust and its influence on team functioning as well as the concept of swift trust (Meyerson et al., 1996) as it is proposed to exist in virtual teams.

Trust in virtual teams is important for effective functioning of the team. Many virtual teams are self-directed and, if not self-directed, because of the distributedness of the team members, close supervision is not possible. Mayer et al. note that because it is not possible to closely supervise members of self-directed teams, trust needs to take the place of such supervision (Mayer, Davis and Schoorman, 1995). Trusting relationships in teams provide benefits to the team. They can reduce transaction costs, increase spontaneous sociability (which increases cooperation) among team members, and promote a respect for authority that enables management to manage without constantly having to explain themselves (Kramer, 1999).

Conversely there may be barriers to the formation of trust. For example, if perceived obligations are not fulfilled, then trust is breached and may diminish or be extinguished (Kramer, 1999). Kramer reports that trust is easier to destroy than to create and thus is fragile (Kramer, 1999).

3.2 Trust Defined: Models of Trust

Most definitions in the literature refer to unidirectional trust in a dyadic relationship. That is, one person known as the "trustor," is directing his or her trust towards another person, known as the "trustee" (Mayer et al., 1995). Although a number of definitions of trust in organizations are reported in the literature, the one that is seen very frequently in virtual team studies is Mayer et al.'s definition of trust: "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party (Mayer et al., 1995, p. 712)." This dissertation research uses Mayer et al.'s (1995) definition of trust.

Mayer's model of trust while not specifically defined for virtual teams, has been used frequently in the virtual team literature (Jarvenpaa, Knoll and Leidner, 1998, Beranek, 2000, Aubert and Kelsey, 2003). Mayer's model of trust has the trustor's propensity to trust, and the trustor's perceptions of the trustee's ability, benevolence, and integrity as explaining a trustor's trusting of a trustee (Mayer et al., 1995). Ability is "that group of skills, competencies, and characteristics that enable a party to have influence within some specific domain (Mayer et al., 1995, p. 717)," and benevolence is "the extent to which a trustee is believed to want to do good to the trustor, aside from an egocentric profit motive (Mayer et al., 1995, p. 718)." Integrity is attributed by the trustor to the trustee based upon the "trustor's perception that the trustee adheres to a set of principles that the trustor finds acceptable (Mayer et al., 1995, p. 718)."

The model takes into account that the trust is dynamic. When a trustor takes a risk in trusting and the outcome is positive, then the perceptions the trustor has of the

trustee are made more positive; however, if the trust leads to negative outcomes, then the trustor's perceptions of the trustee will, instead, decline (Mayer et al., 1995). Mayer et al. posit that the effects of ability, benevolence, and integrity vary in their strength depending upon the length of time the relationship has existed. For example the authors' Proposition 3 states, "The effects of integrity on trust will be most salient early in the relationship prior to the development of meaningful benevolence data (Mayer et al., 1995, p. 722)." As the relationship develops, then, the effects of benevolence on trust will increase (Proposition 4). Therefore, until the trustor has interactions that give him or her a sense of the trustee's intentions towards him or her, the perceptions that the trustor has of the trustee's integrity will have more influence on the trustor's trust.

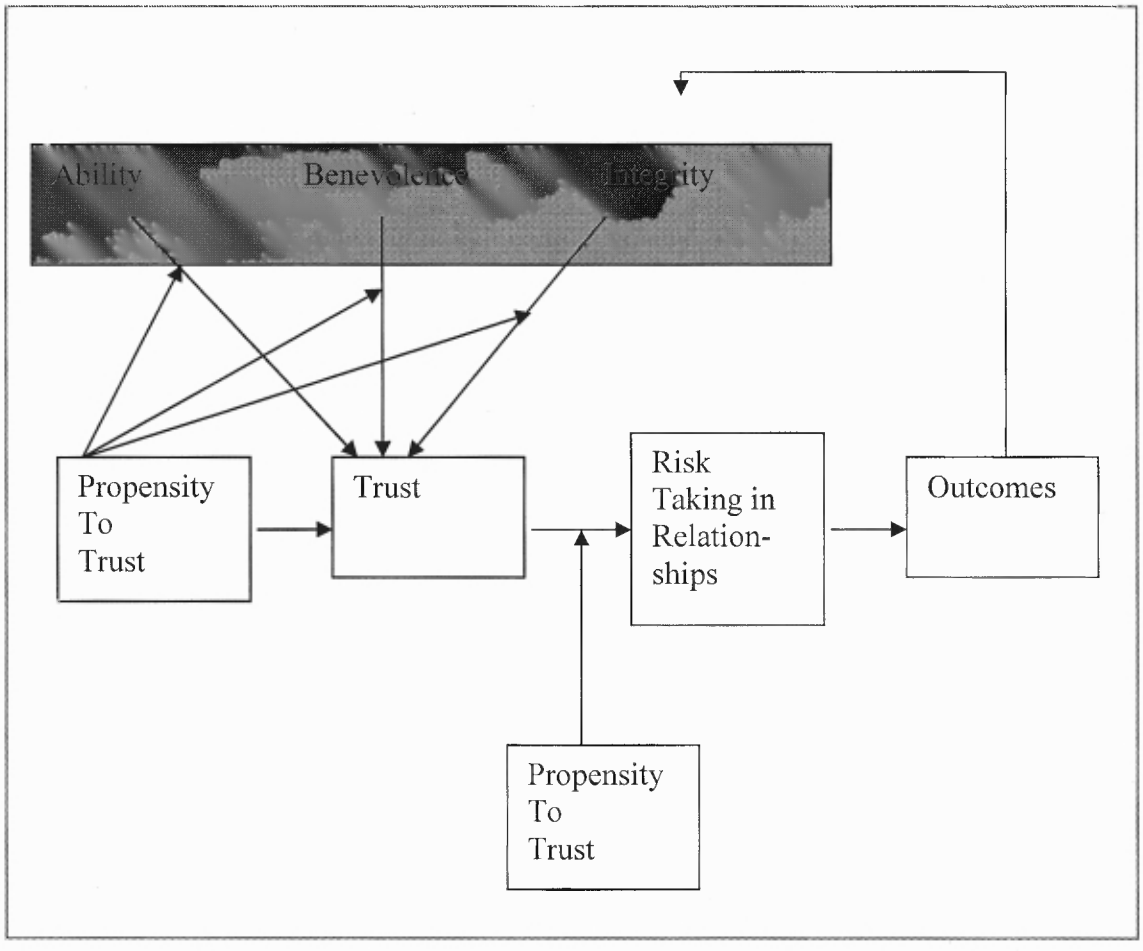

Figure 3.1 Model of trust (adapted from Mayer et al., 1995, p. 715).

Of note is that history and interaction is not necessary with this definition for trust to occur. For example, a person with a high propensity to trust who perceives that the object of this trust has integrity is likely to trust the trustee even before interaction takes place. This perception of integrity need not be based upon a historical relationship, but can develop because of other factors such as the role the trustee plays in the organization or team (Meyerson et al., 1996). Kramer notes that "'proxies' or substitutes for direct, personalized knowledge are often sought or utilized (Kramer, 1999, p. 576)." Thus, in the absence of direct experience, trust can still form on the basis of perceptions that develop from other cues or persons than direct interaction with the trustee. This, as will be explained in another section of this chapter, is important for trust in virtual teams, as virtual team members, being distributed, are often without prior history at the inception of the team formation.

While Mayer et al.'s definition is frequently found, it is not ubiquitously used. Other definitions are also found in the literature. Morris et al. rely on a definition proposed by Currall and Judge: "an individual's behavioral reliance on another person under a condition of risk (Morris, Marshall and Rainer Jr., 2002, p. 23)." Zolin et al. define trust as "a psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or the behavior of another, irrespective of the ability to monitor or control that other party (Zolin, Hinds, Fruchter and Leavitt, 2004, p. 3)." The above two definitions share with the Mayer et al. definition the concept that trust involves a risk or vulnerability.

Piccoli and Ives adopt a definition of trust from Cummings and Bromiley (1996) and define, "Team trust in the virtual environment is defined as the belief that 'an

individual or group (a) makes good-faith efforts to behave in accordance with any commitments both explicit and implicit, (b) is honest in whatever negotiations preceded such commitment, and (c) does not take excessive advantage of another even when the opportunity is available' (Piccoli and Ives, 2003, p. 366). After Jarvenpaa et al. (Jarvenpaa et al., 1998) and Mayer et al. (Mayer et al., 1995), they posit that trust "is rooted in perceptions of teammates' ability, benevolence, and integrity (Piccoli and Ives, 2003, p. 366)."

Henttonen and Blomqvist, on the other hand, define trust in the context of cooperation: "an actor's expectation of the other actors' capability, goodwill and self-reference visible in mutually beneficial behaviour enabling cooperation under risk (Henttonen and Blomqvist, 2005, p. 108)." The inclusion of cooperation as an outcome of trust is not ubiquitously accepted in the literature. Mayer et al. contend that cooperation under risk is not necessarily a result of trust. They provide the example that one might cooperate with someone one doesn't trust because, for example, there might be a punishment for not cooperating (Mayer et al., 1995).

Risk, then, is a common theme in definitions of trust. It is noteworthy that Mayer et al. point out that it isn't the taking of risk that is important, but rather it is the willingness to take the risk that is crucial (Mayer et al., 1995). RTR (risk taking in relationships) refers to the action of taking risk (Mayer et al., 1995). Mayer et al.'s Proposition 5 notes that "RTR is a function of trust and the perceived risk of the trusting behavior (e.g. empowerment of a subordinate) (Mayer et al., 1995, p. 726)." Hung et al. note that "in a given situation, the level of trust is compared to the level of perceived risk (Hung, Dennis and Robert, 2004, p. 2)." That is, one might have trust but not take action

if the perceived risk in taking the action is greater than the level of trust in a given situation. Trust, then, is a perception, a belief, a willingness to take risk. Kramer notes that "most trust is fundamentally a psychological state (Kramer, 1999, p. 571)."

Hung et al. propose an integrative model of trust in virtual teams that has as theoretical foundation Mayer et al.'s model of trust and two process theories of cognition (Hung et al., 2004). The two process theories of cognition used are the Elaboration Likelihood Model (ELM) and the Heuristic-Systemic Model (HSM). The Elaboration Likelihood Model proposes that there are two routes to forming an attitude (Hung et al., 2004). Under the central route, an attitude is formed by the individual actively evaluating available information and deliberating on the merits of adopting a particular attitude (Hung et al., 2004). Under the peripheral route, an attitude is formed as the result of the individual assessing simple positive or negative cues such as the reputation of the person providing the information (Hung et al., 2004). Thus, a central route is taken when there is sufficient information to evaluate, while a less cognitively involved peripheral route is taken when the individual has to rely on indirect cues. Hung et al. expanded the ELM by, in their model, adding a habituation route (Hung et al., 2004). Kramer's antecedent conditions of trust are taken to form the cues used for the peripheral route – that is, the route to trust taken when there is limited knowledge of interacting parties (Hung et al., 2004). When the parties have interacted enough for assessments to be made and motivation is high, the central route is taken. This route is based on the trustor's active evaluation and assessment of the trustee's ability, integrity, and benevolence (Hung et al., 2004). After the parties have had experiences of positive trust, trusting becomes habitual and so the habitual route to trust is taken (Hung et al., 2004). A representation of their

model, which gives rise to four propositions, is shown below in Figure 3. Propositions are made for each path, positing both the cognitive process of assessing risk and the basis for that path to trust.

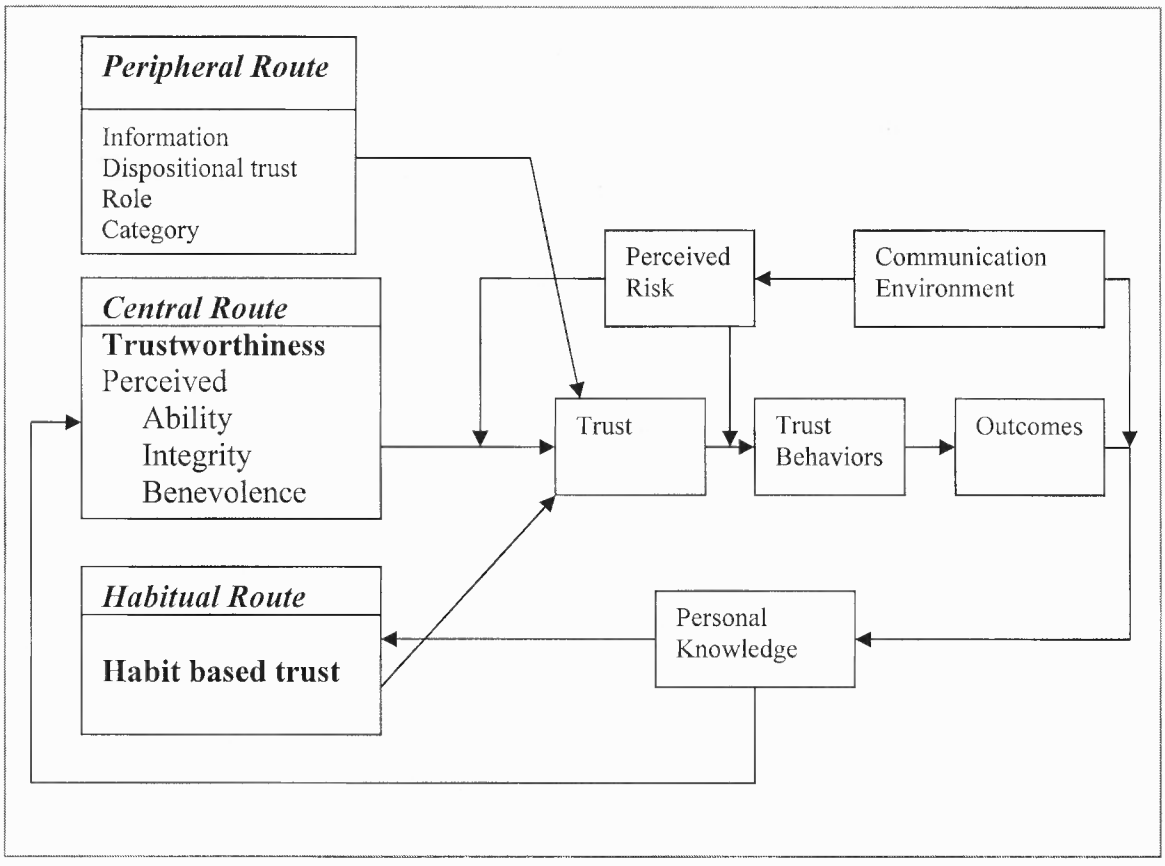

Figure 3.2 A model of trust in virtual teams (adapted from Hung et al., 2004, p. 4).

A different approach of looking at trust in virtual teams is taken by DeRosa et al. (DeRosa, Hantula, Kock and D'Arcy, 2004) by application of their media naturalness theory. Media naturalness theory is posited as an alternative to media richness theory (Daft and Lengel, 1986), to explain media preferences (DeRosa et al., 2004). Media naturalness theory takes into account evolutionary influences, innate differences, and learned schema to account for which media will be preferred by users. According to this theory, the factors influencing preference place face-to-face interaction in the middle of a richness continuum as the most "natural" form of communication (DeRosa et al., 2004).

That is, a medium can be richer (too rich) or less rich (not rich enough). However, individual differences also influence preference and, through experience with a medium, people can learn to use and prefer other media (DeRosa et al., 2004).

DeRosa et al. (2004) posit that under media naturalness theory certain predictions can be made about trust in virtual teams. Foremost is that without experience in a virtual environment, trust will be more difficult to achieve in non-face-to-face interaction, but the difficulties inherent in building trust in a virtual environment will be reduced. Also, the authors suggest that when the team is diverse, the reduction in cues that emphasize differences in virtual teams can be an advantage for building trust (DeRosa et al., 2004). Task focus in virtual teams is also seen by the researchers as an evolutionary advantage for building trust (DeRosa et al., 2004). This emphasis on task is consistent with Kanawattanachai and Yoo's findings, discussed below, that trust development in virtual teams relies more on cognitive processes than affective elements (Kanawattanachai and Yoo, 2002). However, research has also shown that effective teams develop both cognitive based trust and affective based trust (Kanawattanachai and Yoo, 2002, Iacono and Weisband, 1997, Jarvenpaa and Leidner, 1999). Thus, it appears that task focus must be accompanied by social communication for trust to develop and teams to be effective. Additionally, media naturalness theory does suggest that training in technology and experience with working in virtual environments may positively impact the development of trust in virtual teams.

Trust can be examined at the individual or organizational level. Cummings and Bromiley (1996) developed a theory and measure of organizational trust. They proposed a multidimensional definition of trust that includes three dimensions: belief that the

trusted group or individual keeps commitments; belief that the trusted individual or group negotiates honestly; and belief that the trusted individual or group will not take excessive advantage of the trustor (Cummings and Bromiley, 1996). The survey they developed , the Organizational Trust Inventory (OTI), includes items that reflect those dimensions and measure trust across three components: affective state (the way the trustor feels), cognition (the way the trustor thinks); and intended behavior (Cummings and Bromiley, 1996). Thus, each of the survey items they developed fits into one of nine cells in a 3x3 matrix created by the dimensions and components of trust. The survey items were validated and shown to be reliable. The result of their work was two versions of the OTI, a long form and short form both of which are shown in full in (Cummings and Bromiley, 1996).

3.3 Studies of Trust in Virtual Teams

As an important concept in the study of virtual teams, trust has been studied empirically to develop and test models that incorporate it as a construct. A classic study is that of Jarvenpaa, Knoll, and Leidner (Jarvenpaa et al., 1998) who tested a model of the antecedents of trust in global, virtual teams. Using the Mayer et al. conceptual definition of trust (Mayer et al., 1995), Jarvenpaa et al. developed a model that explains trust in virtual teams as developing from the antecedents of propensity to trust and the trustor's perceptions of the trustee's ability, benevolence, and integrity (Jarvenpaa et al., 1998).

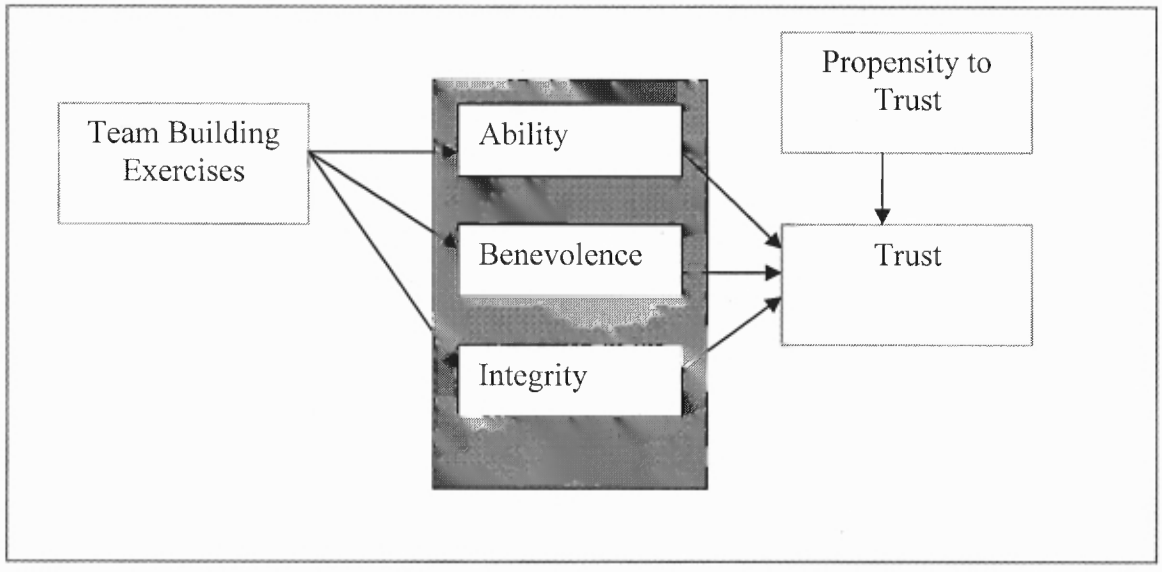

Figure 3.3 Model of antecedents to trust (adapted from Jarvenpaa et al., 1998, p. 34).

Seventy-five teams of four to six members each, from twenty-eight universities around the world were studied for eight weeks. The teams were temporary, geographically and culturally distributed, and functioned asynchronously. Three tasks, the first two of which were voluntary team-building tasks, were performed. The third task was to propose a world wide web site providing a new service or offering (Jarvenpaa et al., 1998). Measures of ability, benevolence, and integrity were taken after the initial tasks and again after the third tasks by administration of a survey. Transcripts of the three highest trust teams and three lowest trust teams were also analyzed in a qualitative analysis.

The researchers found that propensity to trust, ability and integrity were significant at T1 (after the initial two exercises), while benevolence and integrity were significant after the third exercise at T2 (Jarvenpaa et al., 1998). This indicates that perceptions of the trustee's ability, defined as "the group of skills that enable a trustee to be perceived competent within some specific domain (Jarvenpaa et al., 1998, p. 31)," are

important at the start of team work, while perceptions of the trustee's benevolence, defined as "the extent to which the trustee is believed to feel interpersonal care and concern, and the willingness to do good to the trustor beyond an egocentric profit motive (Jarvenpaa et al., 1998, p. 31)," become increasingly significant as the trustor gains experience interacting with the trustee. Integrity is defined as "adherence to a set of principles (such as study/work habits) thought to make the trustee dependable and reliable, according to the trustor (Jarvenpaa et al., 1998, p. 31)." Although the team building exercises were predicted to have a significant effect on trust, the results showed that they did so indirectly through the perceptions of ability, benevolence, and integrity (Jarvenpaa et al., 1998).

Kramer's conceptualization of the bases for trust in others (Kramer, 1999), as discussed above, gives one explanation for these results. For example, if a trustee is in a role that is presumed to require trustworthy behavior and skill in the domain, then at the onset of teamwork a trustor may be willing to trust in that person's integrity and ability. As the two parties interact the trustor will form perceptions of the benevolence of the trustee which will then have greater effect on the trustor's trusting of the trustee.

Aubert and Kelsey examined the relationship of the antecedents of trust as proposed by Jarvenpaa et al. (Jarvenpaa et al., 1998), the formation of trust, and performance (Aubert and Kelsey, 2003). They used the Mayer definition of trust, and tested the same constructs as the 1998 Jarvenpaa et al. study described above (Aubert and Kelsey, 2003). Aubert and Kelsey conducted a three month field study of 71 students from universities in Montreal and Toronto, formed into partially distributed teams. Each team had six members – three from each university. The collocated subteams were self-

selected and then randomly paired with subteams from the other university to form partially distributed teams. The teams had to write a paper, which was graded, on a topic chosen from a list of potential topics. Questionnaires which assessed trust of other members were administered at the beginning of the project and then again after the project completion. For each questionnaire, measures were taken for trust of local teammates and trust of distributed teammates.

The results of Aubert and Kelsey's (2003) study are only partially consistent with the results of the Jarvenpaa et al. 1998 study. While integrity and ability were shown to be important antecedents in both studies, benevolence was not shown to be a significant antecedent in the Aubert and Kelsey study (Aubert and Kelsey, 2003, Jarvenpaa et al., 1998). However, the configuration of teams was different, which might have contributed to differences in study results. What is significant to the study of partially distributed teams is that, in the Aubert and Kelsey study, the trust between local teammates remained higher than the trust between remote teammates, even after frequent interaction. In fact, the difference increased as the trust between collocated teammates increased over time, whilst the trust in remote teammates did not significantly change (Aubert and Kelsey, 2003). Partially distributed teams are susceptible to in-group/out-group effects in which, rather than identifying with the team as a whole, members develop an attitude of "us" versus "them" (Huang and Ocker, 2006, Bos, Shami, Olson and Nan, 2004). The reduced trust between subteams found in this study may be associated with that phenomenon.

The results of the Aubert and Kelsey study also suggest that quality outcomes can be achieved without trust formation as there was not a significant association between level of trust and effective performance (Proposition H5) (Aubert and Kelsey, 2003).

However, the authors also note that it may take more effort to produce a quality result if there is not trust (Aubert and Kelsey, 2003).

Unlike the above studies, the 2002 Morris et al. study used trust as an independent variable rather than a dependent variable. This study, using survey methodology, tested whether a member of a viritual team's trust in other members and/or his or her amount of system use would affect job satisfaction (Morris et al., 2002). The results suggested that while trust has a positive impact on job satisfaction, system use does not affect the impact of the user's trust on job satisfaction (Morris et al., 2002). These results add to the evidence that trust is important for virtual teams.

Virtual teams are often self-managed teams (Carte et al., 2006). However, a question might be asked of what happens when managerial controls more commonly found in collocated teams are applied to virtual teams. A 2003 study reported by Piccoli and Ives (Piccoli and Ives, 2003) investigated the effect managerial behavioral control has on trust in temporary virtual teams versus self-directed temporary virtual teams. Fifty-one groups of three to four members each, from six universities in the US, Europe, and New Zealand participated in this longitudinal study (Piccoli and Ives, 2003). The groups of graduate and undergraduate students were completely distributed – i.e., no two members of the group were collocated, and communication was asynchronous through asynchronous chat, email, and shared document portfolio (Piccoli and Ives, 2003). After a three-week long preliminary exercise, the randomly assigned teams worked on a project to develop a business plan for an Internet-enabled venture.

The treatment groups (behavior control) in the Piccoli and Ives (2003) study had to file weekly reports that documented their progress plans and team member

responsibilities. The control group did not file these reports but, to make the work load balanced, did file a report at the end of the project. Independent variables were behavior control, reneging, incongruence, vigilance, and salience. Reneging is the failure to follow through on an obligation; incongruence is a mismatch of perceptions of obligations between parties in an obligation; vigilance is "an active behavior that team members engage in when they scrutinize whether or not teammates are fulfilling their obligations to the team"; and salience is "a characteristic (e.g. strength of an instance of reneging or incongruence ...)" (Piccoli and Ives, 2003, pp. 367-368).

A survey was administered prior to the beginning exercises and then questionnaires were administered before the main task and after the completion of the main task. Transcripts were coded and the communication logs of selected cases were analyzed. The dependent variable, trust, was measured by a previously validated scale used by Jarvenpaa and Leidner ((Jarvenpaa and Leidner, 1999) that measured the antecedents of trust as proposed by Jarvenpaa and Leidner (Piccoli and Ives, 2003). Case analysis was used to examine hypotheses about the effects of reneging and incongruence on trust, the moderating effect of vigilance and salience, and the effect of behavior control on salience and vigilance (Piccoli and Ives, 2003). Statistical methods were also applied to assess the effect of behavior control on trust (Piccoli and Ives, 2003). The researchers note that the methods used were to evaluate overt behavior rather than, as is common in many other studies, relying on self-reporting by participants (Piccoli and Ives, 2003).

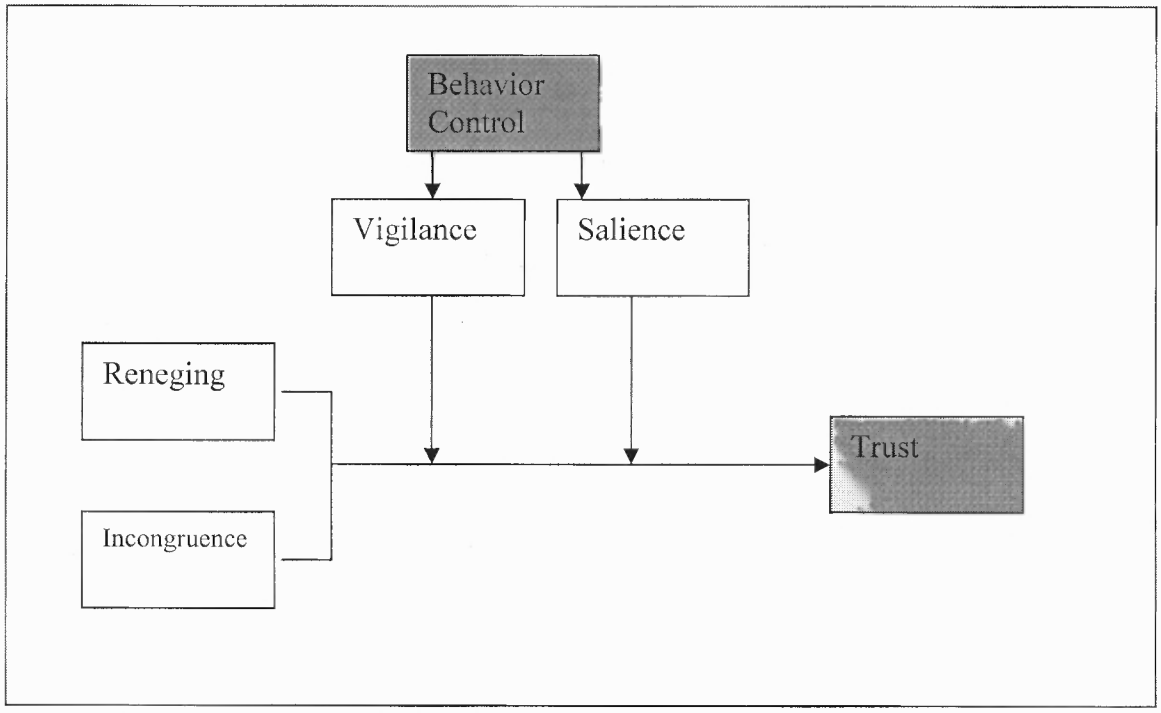

Figure 3.4 Research model of trust (adapted from Piccoli and Ives, 2003, p. 369).

Piccoli and Ives (2003) hypothesized that teams that experienced reneging (H1a) and/or incongruence (H1b) would experience a decline in trust and that vigilance would intensify those effects (H2a) as would salience (awareness) of obligations (H2b). Behavior control was hypothesized to increase vigilance (H3a), and also increase the awareness of incidents of reneging and incongruence (H3b) (Piccoli and Ives, 2003). Finally, the researchers hypothesized that under behavior control, virtual teams would experience significant decline of trust (Piccoli and Ives, 2003).

The researchers report evidence to support the first three hypotheses. However, the results for the fourth hypothesis were mixed. The results suggest that behavior controls do increase vigilance and the salience of reneging and incongruence. As such, in the case that incidents of reneging and incongruence occur in a virtual team, behavior control increases the chances that incidents of reneging and incongruence will be detected, which then leads to a decline in trust. However, in the case that there are no

such incidents or that there are only some incidents early on, behavior control does not significantly affect trust. (Piccoli and Ives, 2003)

The Piccoli and Ives (2003) study suffers from some significant limitations. It is unclear if the workload really was balanced. Working in a group to prepare a report is much more organizationally complex, so assigning individual reports at the end may not be equivalent. The added complexity and the difference in timing of the reports may have had an effect on the results. Also, the subjects had three weeks to work in their teams before the pretest that established their pre-experiment team trust. Thus, swift trust may not have been measured as it may have occurred, when it did occur, during the prior three weeks. That is, the trust measured was likely not that of an inchoate team but rather that of an established team. Also, teams were chosen for examination by the differential between the pre and post-levels of trust, not the absolute trust levels. It is possible that the low trust teams started out low, leading to reneging and salience, and then spiraled down lower. That is, it is possible there is a two-way relationship: not only is trust decline a result of reneging and incongruence, but low levels of trust may lead to reneging and incongruence. However, other studies also examined in longitudinal studies, trust in distributed teams and are discussed below.

In 2004 Zolin et al. reported on a longitudinal study that proposed and tested a model of interpersonal trust in cross-functional global virtual teams. The model is an adaptation of Mayer et al.'s model (Mayer et al., 1995) which proposes that the perception of trust is influenced by the outcomes of interactions. However, Zolin et al. proposed that in the case of geographic or disciplinary distance, it is difficult to assess performance or follow-through and, therefore, they modified the Mayer et al. model to

reflect this limitation (Zolin et al., 2004). The relationship between perceived trustworthiness and trust is therefore, in the Zolin et al. model, moderated by the trustor's propensity to trust, perceived risk and the trustor's perception of rewards (Zolin et al., 2004). (See Figure 3.5)

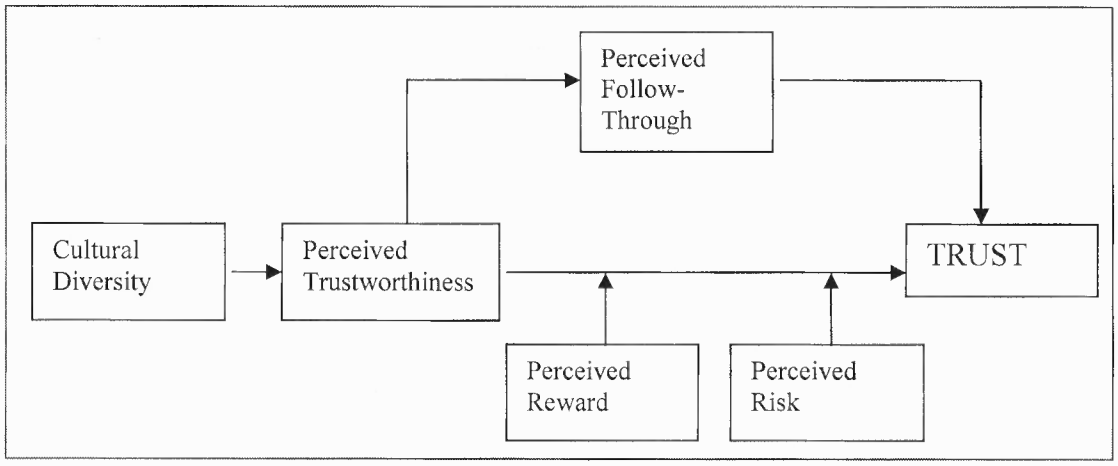

Figure 3.5 Model of interpersonal trust (adapted from Zolin et al., 2004, p. 5).

The primary dependent variable is trust (Zolin et al., 2004). Cultural diversity was hypothesized to have a negative relationship with perceived trustworthiness (H3) (Zolin et al., 2004). That is, the more cultural diversity, the less the trustee will be perceived as being trustworthy. Perceived trustworthiness was hypothesized to have a relationship with trust that would be moderated both by the trustor's perceived risk (H1), and by the trustor's perceived reward (H2) (Zolin et al., 2004). Perceived follow-through, defined as "the extent to which the trustor perceives that the trustee has met expectations (Zolin et al., 2004, p. 8)," was hypothesized to mediate the relationship between the perception of the trustee's trustworthiness and the trustor's trust of the trustee (H4) (Zolin et al., 2004). Finally, the fifth hypothesis (H5) was that "Trustor's initial perceptions of trustworthiness, follow-through, and trust of their co-workers will predict later perceived trustworthiness, follow-through, and trust in cross-functional,

distributed dyads (Zolin et al., 2004, p. 9)." As formulated before the study, the model also had hypothesized a positive relationship between the trustor's propensity to trust. However, because of a lack of reliable measures, it was dropped from the study (Zolin et al., 2004).

Zolin et al's (2004) 4-month longitudinal study had 12 teams of three to four members each. Team members were students from U.S., European, and Asian universities, studying one of three different disciplines – architecture, engineering, and construction management. The teams were formed so that each team had at least one member from each discipline and at least one member not collocated. Geographically distributed members met face-to-face only for a two-day initial meeting and then not again until the final presentations at the end of the project. Communication was over the Internet using meeting applications, message applications, and a computer mediated collaboration tool. Collocated members were also able to meet face-to-face. The task was to design a $5 million building according to specifications given. (Zolin et al., 2004)

In Zolin's et al.'s study (2004), surveys were administered to 108 dyads to measure trust, risk, reward, and perceived trustworthiness. The measure of perceived trustworthiness, as with the Jarvenpaa et al. study (Jarvenpaa et al., 1998), measured the trustor's perception of benevolence, ability, and integrity of the trustee. Trust was measured by the trustor's checking and monitoring of the trustee's work as the researchers note that there is theoretical support for higher levels of checking or monitoring of progress as an indicator of low levels of trust (Zolin et al., 2004). Surveys were administered during the first week of the project and then again one and three months later (Zolin et al., 2004)

The results of the study were that there was partial support for the first two hypotheses at month 1, and that Hypotheses 3, 4, and 5 were supported. The authors note that their findings are contrary to traditional models of trust. They note that, "Traditional models of trust suggest that if a co-worker performs well, he or she will be perceived as trustworthy (see Mayer et al, 1995). We found something quite different in the study we report here. Our findings indicate that, among cross-functional, geographically distributed partners, if a worker is perceived as trustworthy, he or she will be perceived as delivering on work commitments (Zolin et al., 2004, p. 19)." That is, delivering on obligations, in traditional models of trust predicts perceptions of trustworthiness, while in a distributed, cross-functional team it is the perception of trustworthiness that predicts perceptions of the trustee's fulfilling the work obligations. The researchers propose that one possible explanation is that in a cross-functional team, it may be difficult for a worker to evaluate the deliverable of work outside of his or her discipline, especially when the dyad is not collocated, and so it is the perception of trustworthiness that determines his or her belief that the work commitment is fulfilled (Zolin et al., 2004). They also conjecture that an alternate explanation for this surprising finding is that if someone is perceived as trustworthy, then he or she is more likely to meet commitments either because the perception of trustworthiness was correct, or because the fact that the trustee was trusted motivated him or her to be diligent (Zolin et al., 2004). In any case, Zolin et al. note that the results indicate the importance of first impressions in cross-functional, geographically dispersed teams (Zolin et al., 2004). This observation of the importance of first-impressions to trust in virtual teams has great significance for the concept of "swift trust" (Meyerson et al., 1996) which will be discussed later in this chapter.

Trust is proposed to have important, yet different roles in the stages of virtual team development in a study reported by Henttonen and Blomqvist (2005). In this study, trust is defined as, "an actor's expectation of the other actors' capability, goodwill and self-reference visible in mutually beneficial behaviour enabling cooperation under risk (Henttonen and Blomqvist, 2005, p. 108). It is noteworthy that, once again, the element of risk is present in the conceptualization of trust. The researchers used interviewing, analysis of company archives, web-based survey, and a face-to-face meeting to investigate the role and development of trust in the early stages of a virtual team. A corporate level manager was first interviewed informally. Then the main data collection techniques (web-based survey and telephone interviews) were used to collect data from a 23 member, permanent distributed team comprised of managers in a global distributed team that crossed time and geographic boundaries. However the non-response rate was high and resulted in only 16 web-based surveys and 9 telephone interviews being analyzed. Dexler et al.'s (1988) model of the stages of team development (Drexler, Sibbert and Forrester, 1988) was used as foundation for the interviews to understand how trust evolves in virtual teams (Henttonen and Blomqvist, 2005). Drexler's model elucidates the stages of team development: orientation stage, goal clarification stage, and commitment stage (Henttonen and Blomqvist, 2005). The authors found that the initial impressions members had of other members' intentions and capabilities formed trust, but that maintenance and development of trust required ongoing positive team characteristics and behaviors (Henttonen and Blomqvist, 2005). It was suggested that during the initial stages of team development, then, it was a positive assessment of other team members' intentions that formed trust. In the orientation phase, the behavior of the team members

was significant to trust (e.g. information-sharing, cooperation), and in the goal clarification stage what was important was the clear understanding of goals, objectives, and roles (Henttonen and Blomqvist, 2005). The commitment stage is reached when the team members share a vision for the team and in this stage what was important for trust was communication, keeping commitments, getting feedback, stability, and a free flow of information (Henttonen and Blomqvist, 2005). Interestingly, members felt that face-to-face meetings could promote trust building and increase communication in the aftermath (Henttonen and Blomqvist, 2005).

Of particular interest to this discussion are the findings suggesting that the first impression was important "as it defined the direction and depth of future cooperation between individuals (Henttonen and Blomqvist, 2005, p. 112)." Swift trust and "fast trust" were seen as emerging in the initial stages of members contact with each other, and actions and clarification of roles and shared goals were seen as important to the overall success of the virtual team (Henttonen and Blomqvist, 2005). It is this initial formation of trust and the maintenance and development of trust in virtual teams that will be discussed below in the section on "swift trust."

3.4 The Effects of Trust and Structural Context

Studies of trust have had conflicting results. A possible explanation comes from a model and study by Jarvenpaa, Shaw, and Staples (2004). Trust, they propose and test, may have different effects depending upon the situation. With weak situational strength, members of a team "lack clear guidance or other powerful factors of how to interpret others' behaviors (Jarvenpaa, Shaw and Staples, 2004, p. 253)." Strong structure implies

that there are external cues such as norms that will determine how a member will behave. Before a team has had a chance to know one another and develop common goals and expectations, i.e., before the midpoint of the team life, it may have weak situational structure. After they have been at work for a while, i.e., after the midpoint transition point, the structure may become strong in that there has been time for the team to come to agreement on team goals and expectations (Jarvenpaa et al., 2004). When there are no external cues such as common goals, there is ambiguity and uncertainty and trust becomes important to help reduce the ambiguity and uncertainty and thus will have a direct effect on attitude (Jarvenpaa et al., 2004). But when there are group goals and norms they guide behavior and trust is not needed or acts as a mediator, not directly upon behavior. When trust moderates behavior, it does so by affecting how one assesses the past or present behavior of the trustee or how one interprets the past or present behavior and motives of the trustee (Jarvenpaa et al., 2004). Thus, Jarvenpaa et al. (2004) posit that before that transition point, trust has a direct effect on attitudes and after the transition point, it has moderating effects because of the difference in strength of the structure of the team.

Jarvenpaa et al. (2004) conducted a series of two studies to investigate the research question, "How does trust affect the attitudes and performance of people engaged in IT-enabled relationships? (Jarvenpaa et al., 2004, p. 251)" The subjects were masters students from 11 universities in 8 countries. Teams were assigned that were fully distributed; that is, no two members were from the same university or country. The first study did not have any intervention; in the second study the student participants engaged

in a socialization exercise in the first half of the 8 week project to develop strong situational structure.

Participants in both studies had the same two tasks. The first task, which was not graded, was to ascertain the critical success factors for enterprise resource planning software. The second task, which was graded, was to develop a business plan. The grade served as the measure of the dependent variable, task performance. The dependent variables of team process and individual satisfaction were measured by surveys administered at the beginning, midpoint, and end of the project. Communication level was measured as the number of emails sent through the listserv that the participants used by each member's teammates.

Jarvenpaa et al. (2004) tested the research model. It hypothesized that initial trustworthiness and early communication level would be associated with early trust. Initial trustworthiness was also proposed to affect early cohesiveness. Then, after the transition point, early trust would moderate effects of late communication levels on late cohesiveness, late satisfaction, subjective outcome quality, and task performance. The model is shown below in Figure 3.6:

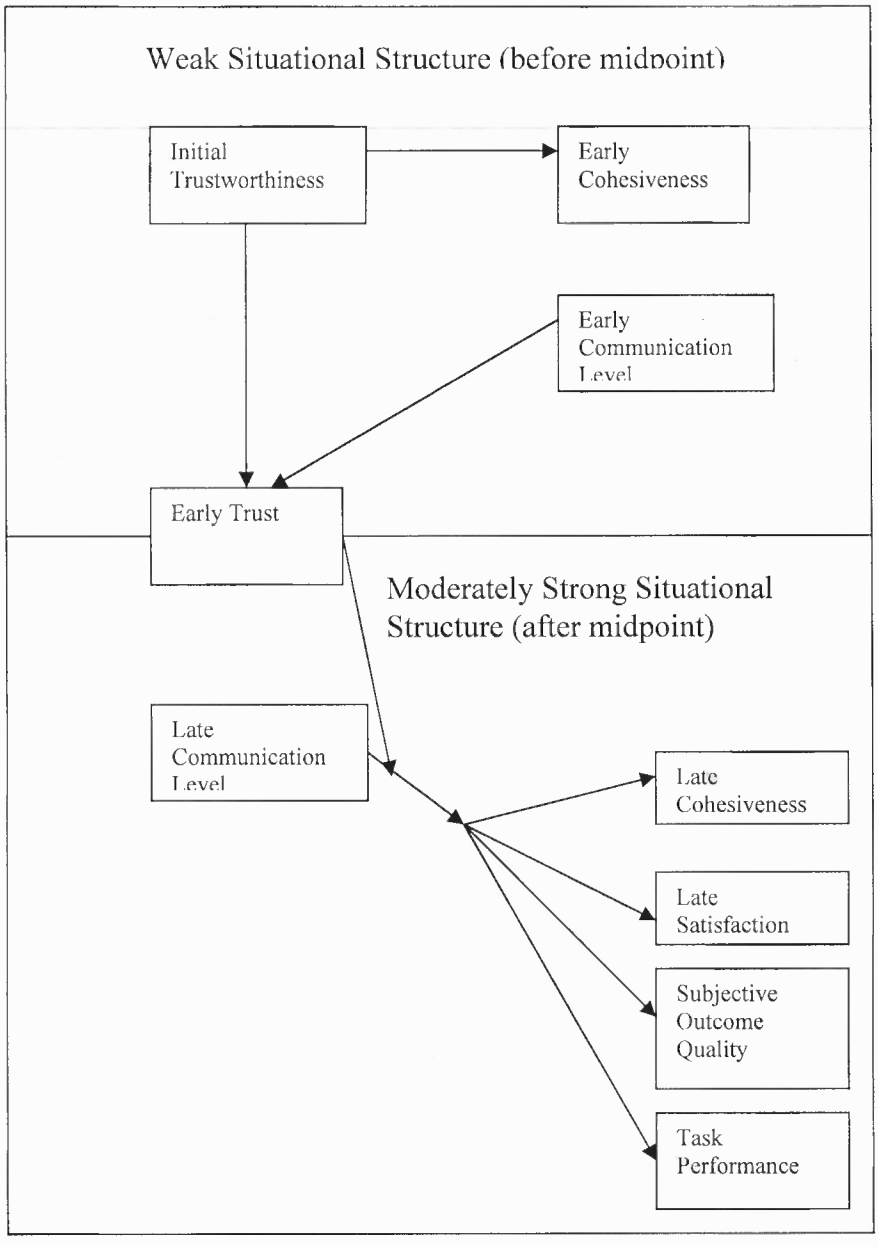

Figure 3.6 Research model (adapted from Jarvenpaa et al., 2004, p. 254).

The Jarvenpaa et al. (2004) model was supported for Study 1. In Study 1 the situational structure was weak and trust was shown to have a direct effect on attitudes. For Study 2, early trust was not found to have a moderating effect on the relationship between communication levels and late cohesiveness, late satisfaction, subjective

outcome quality, or task performance. However, direct effects were found for early trust to late cohesiveness, late satisfaction, and subjective outcome quality. The results did find that the model explains more variance in the most of the dependent variables in Study 1 where the structure was weak or moderate, than it did in the second study for strong structure. Interestingly, the relationship between early trust and objective task performance was not significant. This seems to indicate that although a lack of trust can degrade the efficiency of a team and the perception of outcome quality, actual quality may not be impacted.

This study may explain why studies in the literature of trust are inconsistent. The situational structures of studied groups may have varied and so the results when examining trust, given the findings of this study, would have also varied. It is also important that the findings concerning the effect of trust on outcome quality be considered. Whenever possible, objective measures should be used in addition to perceptions of outcome quality. The next section discusses "swift" trust, a kind of trust that develops quickly and is based on cues other than actual experience with the trustee.

3.5 Swift Trust

For any virtual team that is comprised of members without prior history together that must perform quickly, the development of trust is an important issue. Examinations of studies of "swift trust" can yield understanding of the development of such trust and the characteristics that can promote both its development and maintenance.

The concept of swift trust did not come out of the literature on virtual teams. Rather, it was formulated by Meyerson et al. as a means of describing the unique

characteristics they proposed trust building and maintenance have in face-to-face temporary teams (Meyerson et al., 1996). Meyerson et al. note that in temporary teams, tasks are often highly complex, yet the team often lacks the traditional organization's formal structures for control and coordination: a temporary team doesn't have the time a traditional team does to engage in activities that build confidence and trust and yet, they can be observed to have behaviors that suggest that trust has developed (Meyerson et al., 1996). Meyerson et al. propose that it is a form of trust that ties these temporary systems together, but that it is a unique kind of trust that they call "swift trust" (Meyerson et al., 1996).

Swift trust in temporary teams is proposed by the authors to be "a unique form of collective perception and relating that is capable of managing issues of vulnerability, uncertainty, risk and expectations (Meyerson et al., 1996, p. 167)." The trusting behavior that the members of a temporary team engage in to manage these issues is what they call "swift trust." An important aspect of swift trust is that members, who have little to no history together, will behave in trusting ways as a result of initial perceptions of the trustee's trustworthiness that are based, not upon experience with the trustee (i.e., not based upon actual evidence) but, rather, the trustee's role, categories (e.g., stereotypes), or the presumption that someone else (e.g., the person that has formed the group) has already vetted the trustee and found him or her to be trustworthy (Meyerson et al., 1996). The authors note that initial swift trust can engender future trust by setting off "a familiar cycle in which trust becomes mutual and reinforcing. Trust allows one to engage in certain behaviors, and these behaviors, in turn, reinforce and strengthen members' trust in each other (Meyerson et al., 1996, p. 188)."

Although Meyerson et al.'s conceptualization of swift trust is based upon (and examples are given for) temporary face-to-face teams, researchers have used this concept to explain trust in virtual teams (Iacono and Weisband, 1997, Jarvenpaa and Leidner, 1999, Coppola et al., 2004). A virtual team, whether temporary or permanent, has in common with the type of group about which swift trust is proposed, the fact that frequently the members, at the inception of the team, have no history upon which to base assessments of trustworthiness. Also, virtual teams lack the cues available in traditional, permanent teams about which to gather evidence of trustworthiness. Connaughton and Daly (Connaughton and Daly, 2004) also suggest that trust develops differently in virtual teams than it does in traditional teams. Trust in virtual teams is often not based upon experience with personal relationships, but rather other cues, such as shared goals and the impending deadlines. This trust, especially if the team is temporary, must develop quickly. The development of such trust is an example of swift trust. (Connaughton and Daly, 2004). Swift trust has been studied in virtual teams, as described below.

3.6 Studies of Swift Trust in Virtual Teams

Swift trust has been observed and studied in virtual teams. Although each of the teams studied in the research discussed below were temporary teams, this author suggests that swift trust is likely to be observed in permanent virtual teams as well. At the outset, a virtual team, whether or not it is to be temporary or permanent, shares characteristics with a temporary team. Meyerson et al. note that an important characteristic of temporary teams that have the potential for swift trust is that they have not worked together much, if at all, prior to the team formation (Meyerson et al., 1996). In a virtual team, because of

the distributedness of the team members that is likely to be the case as well, even when the team is formed to be permanent. This author then suggests that it would be beneficial to study the development and course of swift trust in permanent virtual teams, as well as temporary ones.

In 1997, Iacono and Weisband reported on an experiment that studied how trust develops and is maintained in virtual teams. They predicted that it is the communications "initiations" and "responses" that affect the maintenance of swift trust, and that, over time, higher performing teams would be more successful in maintaining the trust (Iacono and Weisband, 1997). They conceptualized communication as "a social activity requiring the attention and interaction of two or more people...We conceptualize this active interaction as initiations and responses (Iacono and Weisband, 1997, p. 413)". Thus, the communication they posit swift trust depends upon is not quantity of communication but, rather, that the communication has implicitly or explicitly a request for a response (initiation), or is a direct response to a request (response).

In the Iacono and Weisband (1997) study, 48 students from three universities were formed into 16 teams. Two of the teams were not included in the analysis because all of their members were from the same university. The teams had a task of researching and writing a five page policy paper. Prior to the task activity, the students had a week during which they introduced themselves and self-selected into teams. The second week the teams organized their task plans and selected a topic to research. At the end of the 24 day project, the teams presented their projects in a videoconference. Surveys were administered the first day. E-mails were coded for initiations and responses. Initiations were coded into categories of: getting together, work: process, work: content, work:

technical, needing contact, and fun talk (Iacono and Weisband, 1997). Performance was measured by the grades given to the final paper. The independent variables were measured as follows: ability as average GPA; computer access by querying as to whether the students had computers and modems at home; computer experience by self-report; and diversity by assessing whether a team was diverse in grade level (graduate vs. undergraduate), school (how many from the same school), and gender (Iacono and Weisband, 1997).

Results showed that diversity, computer access, previous computer experience, and ability were not related to performance or process (Iacono and Weisband, 1997). However, high performing teams were, on average, older than low performing teams (Iacono and Weisband, 1997). High-performing teams issued more total initiations through the life of the project than did low-performing teams, especially at both the beginning and the end of the project. On the other hand, the low-performing teams generated their highest initiations at the middle of the project (day 13) (Iacono and Weisband, 1997). High-performing teams formed their teams more quickly and were able to engage in multiple tasks simultaneously. The results also showed that high-performing teams did not communicate just about work content. Rather, work process issues were dealt with throughout the project (Iacono and Weisband, 1997). The authors conclude that the results are consistent with the theories espoused by Meyerson et al. (Meyerson et al., 1996) such that trust "is more about doing than relating (Iacono and Weisband, 1997, p. 419)". That is, it wasn't the quantity of communication messages that related to success, but rather the content (initiations and responses) in the messages.

The authors conclude that, "We argue that members who initiate interaction are displaying some level of trust (Iacono and Weisband, 1997, p. 419)."

Jarvenpaa and Leidner (1999) report on a study of temporary virtual teams that investigated whether trust occurs in global virtual teams, how trust is developed in such teams, and what communication behaviors seem to facilitate it in the teams (Jarvenpaa and Leidner, 1999). The subjects were masters students from 28 universities who were divided into 75 teams such that no team had more than one member from a particular university, thus ensuring distributedness. Twelve of the teams, the most extreme cases in terms of level of trust at each time (e.g. three highest at T1, three lowest at T1), were used in the data analysis. The data were collected from e-mail archives and from two questionnaires. The main task was to prepare a report that proposed a web site that would be of interest to IS practitioners. There were two initial voluntary tasks as well, that were team building and introduction activities. The questionnaires were administered after the second voluntary task, and after the final project due date. The two questionnaires were identical with the exception of additional items related to trust outcome that were included in the second questionnaire. The measures of trust were adapted from Mayer et al. (1995) and Pearce et al. (1992) (Jarvenpaa and Leidner, 1999).

Supporting the rapidity with which swift trust occurs, the results suggested that the trust seemed to develop quickly. Additional results suggested that communication about the task and project seems necessary for trust to be maintained. However, concomitant with that, it was also shown that social communication made in addition to task oriented communication (not a substitute for it) may strengthen trust, that responses to initiations are as important as the initiations, and that it is necessary that commitment

and affect (e.g., excitement) be explicitly communicated for high trust (Jarvenpaa and Leidner, 1999). The results can be seen to be consistent with the results of the Iacono and Weisband study (Iacono and Weisband, 1997) discussed above.

In 2004 Coppola et al. reported on a study of online asynchronous classes to analyze whether the development of swift trust in the beginning of classes could help explain why some classes are very successful (Coppola et al., 2004). Transcripts of online class communication were coded for swift trust for two classes. The coding was done for the two week period at the beginning of the course, and a two week period near the end of the course. Also measured was quantity of activity levels near the end of the course as a measure of the level of interactivity. The classes were chosen based upon the results of an end-of-the-semester questionnaire administered to all classes at the university and were chosen such that one class had an instructor rated "most effective" and the other had a "least effective" instructor (Coppola et al., 2004). The authors hypothesized that, relevant to swift trust, "the most effective online teachers get a good start in the very first week of online classes, which is the essence of swift trust, with online conferencing (Coppola et al., 2004, p. 97)." They also posited that if swift trust took place, trust would remain for the length of the course (Coppola et al., 2004).

The results of Coppola et al.'s (2004) analysis showed that the effective teacher was active even before the class began, was active during the first two weeks, and was still active during the final two weeks of the class. During the first two weeks the effective teacher used much of the communication types associated with creating swift trust (Coppola et al., 2004). On the other hand, the ineffective instructor only began posting communications after the course had already begun, only contributed a few

postings, and during the last two weeks analyzed did not post at all (Coppola et al., 2004). Thus, in the cases examined, swift trust was established by early communication and was maintained by the instructor's continued interaction with the class. The authors suggest that to promote swift trust establishment, instructors should communicate early, involve the class in tasks, and nurture a positive social atmosphere(Coppola et al., 2004). It would be interesting to see if swift trust established at the beginning of a course would extinguish, and if so how quickly, if an instructor was to begin with trust-promoting behavior, but then become inactive and unsupportive.

Another study using the concept of swift trust as the foundation was conducted by Kanawattanachai and Yoo (2002) and examined trust throughout the lifecycle of virtual teams as associated with team performance. Trust was conceptualized as a multidimensional construct with affective elements (Affective Based Trust – ABT) and cogtnitive elements (Cognitive Based Trust – CBT). Examples of affective elements are caring and emotional connection. Cognitive elements include reliability and professionalism (Kanawattanachai and Yoo, 2002). The authors hypothesized that throughout the team lifecycle CBT would be higher than ABT; that higher-performing teams would show higher levels of both ABT and CBT at the inception of the team formation; and that as the teamwork continued, in higher-performing teams, both ABT and CBT would increase, while they would decrease for lower-performing teams (Kanawattanachai and Yoo, 2002).

The results of Kanawattanachai and Yoo's (2002) study using MBA students as subjects indicated that, in fact, the level of CBT was higher than ABT throughout the team lifecycle for both conditions. The higher-performing teams did not show higher

levels of either ABT or CBT at the beginning of the project, contrary to the hypothesis. Additionally, although CBT and ABT both increased for highly effective teams, they both remained constant for low-performance teams (Kanawattanachai and Yoo, 2002).

These results suggest that although task-oriented behaviors, leading to the development of cognitive trust, may be more important for virtual teams, affective trust is also important for successful outcomes, consistent with other studies (Iacono and Weisband, 1997, Jarvenpaa and Leidner, 1999, Coppola et al., 2004).

3.7 Conclusion

Trust in virtual teams is conceived of as being different than trust in traditional teams. Challenges to building trust may be greater in virtual teams as the experiential cues may be missing. However, through the development of swift trust, a trust built not on experience but other cues, trust can be developed and maintained.

Trust has been shown to be important to team outcomes such as satisfaction and performance. The constructs that influence the development of trust have been studied in both traditional and virtual teams. While the studies of traditional trust are informative for understanding trust in virtual teams, it has been shown that trust in virtual teams often takes the form of "swift trust" (Meyerson et al., 1996), a form of trust that develops quickly and is based not on prior experience but other cues such as the role the member plays in the team. The development, strengthening, and maintenance of trust in virtual teams is challenged by the lack of face-to-face interaction found in traditional teams. But, it can develop and be maintained under circumstances conducive to trust. Communication is key to trust. Leadership, as will be shown in the next chapter, can

play an important role in the development of the factors, such as communication, that can encourage trusting relationships in virtual teams. Appendix B summarizes the Empirical Studies of Trust in Virtual teams and Appendix C summarizes the Empirical Studies of Swift Trust reviewed for this chapter.

CHAPTER 4

BOUNDARY ISSUES

4.1 Introduction

Time separation and cultural differences can create boundaries that impact virtual team functioning as much as or more than geographic distance. This chapter focuses on issues of temporal and cultural dispersion and in-group/out-group effects that can result from strong boundaries.

Virtual team distributedness, as noted in the discussion of definitions of virtual teams, can take on many dimensions, such as geographic, temporal, and cultural distributedness. These characteristics can act as boundaries that the teams need to cross in order to maximize team effectiveness. Empirical studies in the literature address the effects of one or more of these boundaries. Results, as will be discussed in this chapter, are mixed as to the influence such boundary crossings have. However, it is clear that the challenges when the boundaries exist are different than when they do not exist. For example, cultural differences, be they national, organizational, or demographic, can impact the ease with which communication occurs.

As virtual teams become more pervasive and more global and/or interorganizational, boundary issues are likely to increase. It is projected that "... more than 60% of tasks at Global 2000 companies will eventually be accomplished by distributed teams (Connaughton and Shuffler, 2007, p. 389)." Geographic, cultural, and temporal discontinuities will need to be addressed, understood, and managed as more and more teams experience them.

Partially distributed teams (PDTs) share many issues and characteristics with both collocated teams and those teams that are fully distributed. However, the characteristic of having members collocated with some other members and yet geographically distant from others makes PDTs particularly susceptible to some issues that may not be greatly found in either fully distributed or face-to-face teams. Research has shown that coalitions can form as a result of an imbalance in communication channels (Pool, 1976). Partially distributed teams by nature have this issue as members have more (e.g., face-to-face) channels for communicating with their collocated teammates than they do through which to communicate with their distant ones.

Partially distributed teams may be susceptible to some issues because of the inequality of geographic distance between members. Polzer, et al. (2006) found that geographic distance can create and activate strong faultlines. Thus, coalitions based on distance can form based on proximity that can lead to conflict between distributed subteams in a PDT. Collocated subteams often use face-to-face communication with their subteam members while using electronic media for communicating with distant teammates. The difference in ease of communication and immediacy of feedback can also impact the functioning of the team as a whole. In sum, the relationships between collocated subteam members and the relationships between distant teammates are likely to be different which can impact the team.

In the literature, the terms "boundary," "discontinuities," and "faultlines" are used with regard to issues caused by various factors of distance. There are subtle distinctions between these terms. The Oxford English Minidictionary defines "boundary" as "a line that marks a limit" (Oxford Minidictionary, 1997, p. 55). The term has no innate

connotations of "good" or "bad." A "discontinuity," on the other hand, is a disruptive or potentially disruptive boundary (Watson-Manheim, Chudoba and Crowston, 2002). Thus, a discontinuity is a type of boundary. However, in the context of this discussion, it would not be misleading to use the two terms interchangeably because when boundaries are discussed they are done so in the context of disruption to team processing or effectiveness. Faultlines divide "a group's members on the basis of one or more attributes (Lau and Murnighan, 1998, p. 325)." Thus one or more boundaries may act as a faultline if the attributes defining the boundaries are such that they each divide a group the same way.

This chapter explores some of the major findings in the literature concerning the effects of these boundaries for virtual teams and, in particular, then focuses on the in-group/out-group effects in PDTs.

4.2 Hofstede's Indexes of Cultural Distance

Often referred to in the literature (Connaughton and Shuffler, 2007) are Hofstede's cultural dimensions. Hofstede identified five dimensions of cultural distance: Power distance, Uncertainty avoidance, Individualism, Masculinity, and Long-term orientation (Hofstede, 2001). Hofstede surveyed employees of IBM in 72 countries in two surveys (1968 and 1972) and later collected data from other, non-IBM respondents in the same countries (Hofstede, 2001). From this data he was able to assign indexes to each of the countries surveyed for each of the dimensions.

Power distance refers to the extent in which subordinates accept and expect that power is distributed unequally in an organization or society; Uncertainty avoidance is the

extent to which individuals in a culture are acculturated to be uncomfortable in unstructured situations; Individualism (versus collectivism) is the extent to which individuals in a culture are focused on looking after self or group; Masculinity (versus femininity) refers to the emotional roles of members of a society whereby masculinity is "tough" and femininity is "tender'; and long-term orientation refers to the extent that individuals in a culture accept delayed gratification of needs (Hofstede, 2001). It should be noted that the original studies Hofstede conducted resulted in the description and indices for the first four dimensions; the dimension of long-term (versus short-term) orientation was added later and the index for that dimension was calculated for a subset of the original countries.

Of interest is that these dimensions are not necessarily uncorrelated. For example, there is a strong correlation between Uncertainty avoidance and Power distance for European countries (Hofstede, 2001). The dimensions together do give a comprehensive understanding of a country's culture and as such are invaluable and used frequently in the literature.

4.3 Connaughton and Shuffler's Review of the Literature

Connaughton and Shuffler (2007) review findings in the literature on the effects of these boundaries for multinational, multicultural (MNMC) distributed teams. The authors surveyed the literature and analyzed twenty-five articles that were found (20 of them empirical) that address the effects of these discontinuities. They provide a review of the issues and an agenda for future research.

Connaughton and Shuffler note that the definition of culture in virtual teams is not consistent across the literature. However, they determined that often used is Hofstede's (1980) individualism or collectivism dimension. Connaughton and Shuffler also found that the cultural differences addressed in the literature were largely focused on nationality differences. However, culture is far more complex than that. For example, with the increasingly transient nature of the western world, even within a single nation team members may have different ethnic or national backgrounds. Organizational cultures differ and there are likely even regional differences in cultures within a single nation or organization.

Connaughton and Shuffler also review the literature as it addresses the effects of geographic distributedness in MNMC teams. They note that the findings are mixed: Chudoba et al. (2005) found that geographic distance in and of itself did not impair virtual team collaboration. Yet, other studies have found that it does present additional challenges.

The authors of the literature review present a research agenda that includes the following action items: adopt multi-faceted, multi-level views of culture; acknowledge the complexities of distribution; and investigate when culture and distribution are consequential to virtual teams (Connaughton and Shuffler, 2007).

Although this literature review is very useful in both understanding the current state of research and illustrates well many of the issues that these boundaries raise, it suffers from at least two weaknesses. First, it only briefly addresses the issue of temporal distance. As teams become more geographically distributed (east to west), temporal boundaries are likely to become stronger. Temporal boundaries can influence the ability

of interdependent subteams to work together as overlap in time may be limited or nonexistent. Additionally, cultural differences may influence temporal perceptions that teams have (e.g., a culture may have a "slower" pace so that the words "needed immediately" may have different meanings). There are empirical studies that address these issues (e.g., Espinosa and Pickering 2006; Rutkowski et al., 2007) and inclusion of them in the review may have been beneficial. Also missing was the theoretical work of Lau and Murnighan (1998, 2005) defining "faultlines" which provides a framework with which to analyze the effects of multi-dimensional distributedness on virtual teams. This will be discussed in a later section of this chapter. However, the breadth of the literature review and the research agenda, in particular, are useful to point out that these boundary issues are increasingly prevalent and important and need to be addressed by the research community.

4.4 Discontinuities: Recognition of the Effects of Boundaries

Each of the dimensions of distributedness (e.g., cultural, temporal, geographic), may cause what Watson-Manheim et al. (2002) refer to as a "discontinuity." Discontinuities are defined as "gaps or a lack of coherence in aspects of work, such as work setting, task, and relations with other workers or managers (Watson-Manheim et al., 2002, p. 193)." The authors define virtual work as, "work that spans one or more discontinuities (Watson-Manheim et al., 2002, p. 194)." This is a broad definition that is in line with other definitions of virtuality such as that of Mowshowitz (Mowshowitz, 1994). For example, in the context of the Watson-Manheim (2002) study, a worker who reports in a matrix organization to more than one supervisor would be considered a virtual worker

even if she or he was collocated with all of the managers and did not use electronic communication media. However, the boundaries that challenge virtual teams, as described in this paper, in fact do fit the definition of discontinuities and therefore the Watson-Manheim et al. (2002) study is both relevant and informative to this literature review.

In an analysis of 75 peer-reviewed articles, authored from 1986 to 2001, they discovered that most studies published that addressed discontinuities focused on time and space (Watson-Manheim et al., 2002). Thus, geographic and temporal dispersions were the most frequent dimensions of distributedness that were addressed in the literature surveyed.

Discontinuities in the context of virtual teams, then, are boundary conditions that may be disruptive or otherwise adversely affect the teams. Watson-Manheim et al. (2002) also discuss the concept of "continuities." Continuities are the factors that are in place that can bridge the discontinuities, i.e. overcome them. In the context of our discussion, we can say, for example, that geographic distributedness provides a discontinuity but that frequent communication may act as a continuity to counteract it. Other examples of continuities are "common task; common beliefs and values; common media; and common work practices (Watson-Manheim et al., 2002)." Watson-Manheim et al. (2002) also note that a number of studies they examined assumed that technology could be a continuity bringing dispersed team members together. Indeed, in a virtual team, technology can serve as a bridge for dispersed team members. However, if the experience with the technology or the access to the technology varies among team members, the technology can actually act as a discontinuity. As the members gain

experience or access improves, the discontinuity can become a continuity. This phenomenon of discontinuities becoming continuities can also happen for other discontinuities as members develop routines, shared norms and expectations, etc. (Watson-Manheim et al., 2002).

Thus, the boundary issues discussed in this chapter may act as discontinuities, while the remedies proposed by some researchers may provide for counteracting continuities. The finding that space and temporal discontinuities were most prevalently addressed is consistent with most definitions of virutality which refer to geographic dispersion. However, the more recent literature has shown an increase in attention to cultural and other boundary issues. Thus, one might speculate that there is more attention paid to the multitude of discontinuities now than when Watson-Manheim et al. performed their study.

4.5 Delay: A Consequence of Distributedness

Herbsleb et al. (2000) performed a case study of a partially distributed software development team in an investigation of the effects of distance on dependencies and delay. Four sites (one in the UK, one in Germany, and two in India) of the Lucent Technology team were studied. Modification Requests (MR), made as part of the change request process, were analyzed and surveys were administered. Modification requests contain data that reveal whether a change involves multiple sites and how long it takes to complete, giving information as to the dependencies between sites for a given task and any delay incurred.

The results of the analysis showed that when an MR involved multiple sites it took significantly longer to complete than those that were completed within just one site (Herbsleb, Mockus, Finholt and Grinter, 2000). Survey results were consistent with the MR analysis. Thus, when tasks involve multiple sites, a delay is introduced that is not incurred when the work is contained within one site.

Most interesting to this discussion is the finding that although the respondents reported that they received needed help more from their local colleagues than from their remote ones, they also reported that they believed they gave equal assistance to their remote and local colleagues (Herbsleb et al., 2000). This discrepancy is particularly significant because a linear regression indicated that the only predictor of delay was the reported assistance received (Herbsleb et al., 2000). It is possible that there is insufficient awareness of remote group needs and activities, suggesting that leadership must bridge that gap and, if they are able to do so, that may reduce delays.

4.6 A Study of the Effects of Culture on Performance

Cultural distance, as studied in the literature, has had mixed results. For example, Jarvenpaa and Leidner (1999) did not find that cultural differences affected trust. One study that did find an effect for cultural diversity was a two-year empirical study performed by Swigger, et al. (2004) which examined the effects of cultural diversity on performance in teams of distributed student learners.

One hundred ten computer science students from a university in Turkey and one in the United States were paired into 55 teams of two, with one student from each university in such a way as to provide for a variety of team cultural and GPA diversity.

Cultural diversity factors were measured by the Cultural Perspectives Questionnaire (CPQ) prior to the formation of the teams, the results of which were used to assign team membership (Swigger, Alphaslan and Brazile, 2004). The teams used supported collaborative work (CSCW) software, designed by the researchers for the experiment, which provided asynchronous and synchronous collaborative tools over the Internet. The three tasks performed had increasing requirements for collaboration: the first task required teams to collaborate on a software design but code the software individually; the second task required collaboration throughout the design, coding, and testing phases of programming a game; and the final task was for the team members to run a tournament in which they had their games play each others' games.

The dimensions of cultural diversity, as measured by the CPQ, included the individual's valuing of tradition, belief in predestination, and belief in rigid power structures (Swigger et al., 2004). The researchers used logistic regression to analyze the relationship of the cultural perspectives as measured by the CPQ and GPA to team performance, measured by deliverable grades. Grading criteria were used to increase consistency across evaluations of the deliverables. Results showed that the measures of CPQ and GPA for teams were predictive of team performance. For example, if one team member had a high GPA, the performance was satisfactory. Less obvious was the finding that if a team had a member who believed in a rigid (hierarchical) organizational structure, the performance was more likely to be poor. Those teams for which at least one member did not feel a sense of control over his/her destiny were more likely to have poor performance, especially if the other team member held a contrary view of destiny. If a team member had at least one student who believed in the necessity of balancing

work and life activities, it was statistically significantly more likely to perform better on the first task, and more likely, albeit not statistically significantly so, to perform better on the second task. The third dimension of perspectives of culture that was found to have an effect was that of orientation towards the future ("Future-Oriented"). Those teams for which both members did not have a perspective of focusing on future consequences when making decisions were more likely to perform poorly. There were differences in results of interactions of the cultural perspectives between the first and second task. For the second project there were no significant interactions; while for the first there was a significant interaction between perceptions of "maximum hierarchical" (belief in rigid organizational structure) and "maximum harmony" (belief that it is necessary to have balance between work and life) (Swigger et al., 2004).

It is important to note that, overall, there were not significant differences between the students of the two countries on the CPQ scores for the categories shown to have influence on team performance (Swigger et al., 2004). This suggests that perhaps certain cultural beliefs are more likely to affect performance than others, and that differences in cultural perspectives within a team can negatively impact the performance of the team. The importance of this study is that it suggests that cultural diversity can influence team performance. However, it is possible that the effects of cultural diversity in a dyadic team may differ from those that might occur in larger teams with more varied configurations of cultural perspectives. Student teams may also differ from work teams in their ability to understand and collaborate with varying cultures. In fact, the researchers found that the students had a great many misconceptions about the other culture, and so an introductory exercise was used to acquaint the members with members

of the other university before the first project. Nonetheless, it is important to note that cultural diversity can be expressed in many different ways, and that these divergent beliefs can affect the ability of a team to perform effectively.

4.7 Cultural and Geographic Effects on Virtual Team Communication: McDonough et al., 1999

As noted above, the effects of culture have been studied on trust in virtual teams (Jarvenpaa et al., 1998) and team performance (Swigger et al., 2004). A somewhat different approach was taken by McDonough et al. (1999) in a study of the effects of cultural and geographic distributedness on communication in virtual teams. Communication, as has been discussed in this paper, is a vital component for developing trust and team efficacy in virtual teams. Thus it is important to study if, and how, crossing cultural boundaries influences team communication.

McDonough et al. (1999) administered questionnaires to 22 new product managers or team leaders in ten companies. The questionnaires solicited data about the respondent's company's global new product teams (GNPT) and the media used to communicate within those teams. Four items measured team performance in terms of overall performance, satisfaction, process, and product quality. The questionnaire also solicited usage data for a list of communications technologies. Additionally, 19 of the respondents were interviewed; 15 by phone and four in face-to-face sessions. The interviews were guided by grounded theory methodology and began with a set of questions regarding the respondents' particular GNPT histories, leading to questions about the impact of the team characteristics on communication.

Interview results suggested that cultural business practices and geographic dispersion affect team communication. In particular, the business practices identified that had such effect were: "1) problem-solving approaches; 2) communication mode to leaders and across functional boundaries; 3) decision-making processes" (McDonough III et al., 1999). The researchers identified the differences in these practices as emanating from different national cultures. That is, the differences in how teams approach solving problems; the norms for communication from team members to leaders; and the norms for how decisions are made were found to differ by culture with implications for structuring team communications. For example, while the U.S. teams preferred a trial-and-error approach to problem-solving during which they would try possible solutions one at a time, the French teams preferred to analyze all possible solutions before settling on one to implement. This difference results, according to the researchers, in different information needs: at any given time, the U.S. teams would need only the information relevant to the solution being attempted, while the French teams would need larger amounts of data at one time to analyze simultaneously many possible solutions.

In addition, McDonough et al. (1999) reported that differences in communication modes from team members to leaders could be seen between the American teams, in which communication flowed freely in all directions, and the Japanese teams who would rarely, if ever, question a superior and would only communicate in a formal manner with them. Finally, decision-making practices differed by national culture. The Japanese engaged in consensus decision-making and the Americans would often have decisions made by fewer people, often without the knowledge of the rest of the team. This has implications for information flow and communication as the more people involved in the decision

process, the more information needs to be disseminated (McDonough III et al., 1999). Thus, cultural differences influence the volume and content of information needed and, therefore, communication needs.

The researchers found that communication needs are directly influenced by the cultural dimensions of language, technology capabilities, and geographic distributedness of the teams (McDonough III et al., 1999). Although English was the language of convention for business communication, the researchers found that for those who had a different native tongue, written communication caused fewer misunderstandings than oral communication (McDonough III et al., 1999). Technologies used in different countries may not be compatible and require additional interfaces. Finally, geographic distributedness can create communication problems when different time zones are involved thus resulting in less, or no, overlapping work time. The researchers note that people would often work from home so they could be available to communicate synchronously with their distributed counterparts (McDonough III et al., 1999). This, the study revealed, resulted in greater volumes of information flowing between team members. When asynchronous means of communication were used, such as email, team members tended to send more information than they would in a real-time interaction (e.g., phone) because the lack of interactivity created a risk that information would be discarded inadvertently (McDonough III et al., 1999).

The researchers conclude that in a GNPT, communication needs are driven by a need for speed, communication richness, and large volumes of information (McDonough III et al., 1999). They investigated the capabilities of a number of media to meet those needs. They conclude that no one medium can meet all of them, however, they note that

in any given instance, it is likely that only a subset of the needs are required (McDonough III et al., 1999). For example, while face-to-face can transmit large volumes of information and is a rich medium, in a global distributed team it takes time to convene members and so speed is lacking. The implications are that a multitude of communication media should be provided, so that the appropriate one(s) can be chosen for any particular instance.

The relationship between performance, as assessed by the respondents, and communication media use was analyzed by stepwise multiple regression (McDonough III et al., 1999). Phone, enabling fast and rich communication, was found to be positively associated with team performance, while greater use of videoconferencing was found to be negatively related (McDonough III et al., 1999). This might seem surprising as videoconferencing can provide for rich, real-time communication but, the researchers propose, the results may be due to the poor quality of the media (at the time) as well as the need to schedule the conference and then travel to participate in it (McDonough III et al., 1999). One might speculate that as videoconferencing technologies, including web cam, improve, the results might be different. In fact, this potential was expressed by participants in a later study (Pauleen and Yoong, 2001) of facilitators of virtual teams. The facilitators studied believed that video conferencing might be a good, cost-effective alternative to face-to-face meetings for building team relationships. However, it should be noted that the participants in the later study only reported their belief in video conferencing's potential, not that they actually had it available to use.

While the results indicate that no one medium is a panacea for all communication needs (and only phone was significantly related to performance), the study results suggest

that an "affiliated set" of phone, FAX, email, teleconferencing, and company database can meet the communication needs of a GNPT (McDonough III et al., 1999) and positively influence performance. That is, if a company supplies all of the "affiliated set" of media, then at any given time, communication needs may be met by one of the set.

Thus, this study is relevant as it discusses some of the barriers to effective communication brought about by cultural characteristics embedded in business practices and geographic dispersion. Cultural differences impact not only individuals and their interactions, but influence organizations and their business practices, creating different communication and information needs. By providing a suite of available media, one can ameliorate the resulting differences in needs that interactions between culturally distant members bring about.

4.8 The Effects of Cultural Differences on Task-Technology Fit: Massey et al., (2001)

As discussed above, cultural differences can influence the media chosen (McDonough III et al., 1999). This phenomenon has been studied by another team of researchers with emphasis on why certain media "fit" the task better for some cultures than for others (Massey, Hung, Montoya-Weiss and Ramesh, 2001). Massey et al. (2001) propose that in global virtual teams, culture influences the perceptions of what technologies best "fit" the task at hand. Appropriating Hofstede, Massey et al. categorize culture by the dimensions of individualism-collectivism, communication contextuality, and uncertainty avoidance. Individualism-collectivism is defined as "the preference to act as individuals rather than as members of a group (Massey et al., 2001, p. 208)." Communication

contextuality "refers to the amount of information needed to make decisions versus 'just the facts' (Massey et al., 2001, p. 208)." Finally, uncertainty avoidance refers to the degree to which the members of a culture seek to avoid uncertainty. Each dimension of culture will influence the communication style, and therefore the task-technology fit for that culture. For example, a collectivist society will want a richer technology that allows for "real-time" interaction while members of an individualist society are likely to be comfortable with a division of labor and the leaner technology that supports it (Massey et al., 2001).

Different cultural dimensions lend themselves to different communication styles. Massey et al. (2001) identify four styles of communication, all of which have implications for the best task-technology fit: direct-indirect; elaborate-succinct; personal-contextual; and instrumental-affective. Direct-Indirect is defined as "the extent the message sender reveals his/her intension through explicit verbal or textual communication (Massey et al., 2001, p. 209)." Individualist, low-context cultures are more likely to have a direct style while the collective, high-context cultures are more likely to adopt an indirect style of communication (Massey et al., 2001). Elaborate-Succinct style refers to the actual quantity of the message with the elaborate style using more rich and expressive words than the succinct style (Massey et al., 2001). Again, cultural dimension can promote the adoption of one style over another. For example, in low uncertainty avoidance, low context cultures, the exacting style of few words is more likely to be adopted (Massey et al., 2001). The personal-contextual style "refers to the use of certain linguistic devices to enhance the sense of personal ("I') identity, ...(Massey et al., 2001, p. 209)." It is natural that individualist cultures prefer a personal style while

collectivist cultures tend to adopt a contextual style (Massey et al., 2001). The instrumental- affective style refers to the member of the communication dyad on whom the focus is placed. If the focus is on the sender and oriented towards goal-achievement it is an instrumental style; focus on the receiver with an orientation towards process or negotiation is an affective style (Massey et al., 2001). The instrumental style tends to be adopted by members of individualist, low-context cultures, while the affective style tends to be adopted by members of collectivist, high-context societies (Massey et al., 2001).

The researchers report on two case studies and an exploratory experiment, the results of which indicate that their conceptualization of the effect of culture and style on communication technology-task fit is valid. One case study was of an organization that had culturally diverse GVTs (global virtual teams), while the other case study was one of an organization that had culturally homogenous GVTs. The processes and tasks for the two organizations were similar. The culturally diverse organization was far less successful in their efforts, experiencing a great degree of difficulty overcoming the cultural diversity. The researchers concluded, based upon the exploratory field studies, that "cultural differences do matter in GVTs (Massey et al., 2001, p. 210)."

The researchers also conducted a laboratory experiment to study the proposition that perceptions of communication task-technology fit are affected by cultural differences. The 8-day experiment had, as subjects, graduate students placed in 5-person geographically dispersed teams. The teams' communication was restricted to Lotus Notes® as they worked on a case involving a global company developing marketing strategies (Massey et al., 2001). At the completion of the study, the participants answered questions that were focused on the "fit" of the communications software to the

task in which they had been engaged. The focus on the task process was on the communication "conveyance" of information and "convergence" of information as defined in the literature by Dennis and Valacich (Massey et al., 2001). Conveyance of information refers to the transmission of information while convergence refers to the developing of shared understanding and meaning of the information. Lotus Notes® was determined by the researchers to be a "lean technology, with low interactivity and low social presence (Massey et al., 2001, p. 211)." The questions asked of the participants were related to the participants' perceptions of fit between the system and either conveyance or convergence activities. The results showed that the expected perceptions of fit based upon the styles inherent in different cultures were, in fact, found. For example, with regard to conveyance activities, the Asian participants (high-context culture) perceived the system as a better fit for explaining themselves compared to the US participants (individualist, low-context culture). This was consistent with the theory. High-context cultures tend to adopt contextual and affective communication (Massey et al., 2001). But, English was not their first language although it was the language they used in the experiment. The rehearsability allowed by the system's asynchronous, text-based features allowed them time to work on the composition of their messages so as to best explain themselves (Massey et al., 2001). On the other hand, the US participants would have a style that would promote a desire to control conversation, which the asynchronous nature of the system would not allow (Massey et al., 2001).

That culture "matters" in communication and the best fit between communication technology and task in GVTs is an important finding for a study of PDTs. As culturally different, geographically distributed subteams communicate by electronic means, the

selection of the technologies to enable that communication is critical. An awareness of the culturally determined "fit" of different technologies is critical. Of course, there is also the issue of what is to be done when the best technology for one subteam is a poor choice for the other subteam with whom the former is to engage in communication. These issues present challenges to leaders of PDTs as they go about choosing the technology or suite of technologies to be used in their teams.

4.9 A Study of the Effects of Cultural Heterogeneity on Work Atmosphere and Conflict in Virtual Teams: Paul and Ray (2009)

Cultural diversity, as discussed above, can impact outcomes and choices of technology. It can also affect the perceptions of work atmosphere and conflict, as demonstrated in a laboratory experiment conducted by Paul and Ray (2009).

The experiment was conducted to test a model, shown below in Figure 4.1, of the association of cultural diversity with perceptions of work atmosphere, group participation, and task conflict.

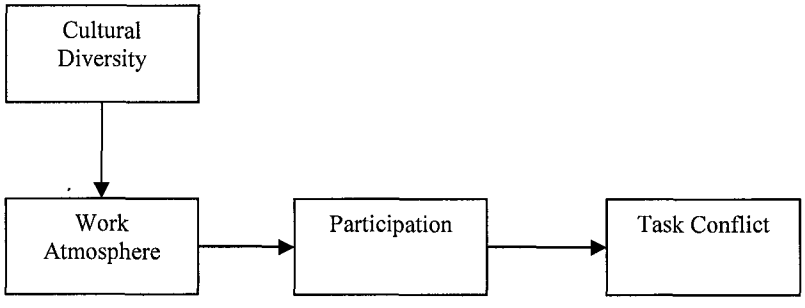

Figure 4.1 Effects of cultural diversity (adapted from Paul and Ray, 2009, p. 5).

Eighty one subjects, some graduate students at a US university, and the rest graduate students in India participated in a laboratory experiment. They were placed into

virtual teams that were either culturally heterogeneous (15 teams) or culturally homogeneous (12 teams). The only communication the team members had was by instant messaging using Lotus Sametime®.

The communication between team members was anonymous. A facilitator for the team monitored the communications and assisted with software issues as they arose. The facilitator did not participate in the task. The task was to assume the role of an advisory committee and recommend to the administration of university (fictitious) how to allocate funds collected as technology fees. There were two versions of the task; one had more decision-making complexity than the other. Fourteen teams had the more complex task while the remaining 13 performed the basic, less complex task. A survey was administered which measured participation, perceptions of intra-group conflict, and perceived work atmosphere. Objective data was used to measure cultural diversity.

The results supported the model. Homogeneous teams had significantly higher perceived work atmosphere; participation was significantly positively related to work atmosphere; and task conflict was significantly positively related to participation. Thus, the researchers found that a favorable work atmosphere promotes participation and that moderate task conflict improves the quality of decision-making.

This study is relevant to the study of PDTs because in global PDTs, cultural diversity across subteams is the norm. Further research that tests this model in PDTs would be useful to answer questions specific to PDTs. For example, one might ask if the cultural diversity within subteams affects the strength of in-group/out-group dynamics by weakening faultlines.

4.10 The Effects of Time Dispersion

Temporal boundaries are often thought of as occurring because of time zone differences. Espinosa and Carmel (2003) assert that, in addition to time zone differences, temporal separation can also be the result of differences in work hours, differences in weekends (e.g. Israel's weekend is Friday and Saturday), shift work, and holidays not coinciding. Even differences in the structure of a work day (e.g. different lunch hours) can contribute to time separation (Espinosa and Carmel, 2003). In a conceptual article (Espinosa and Carmel, 2003) the researchers address the impacts of time separation on global virtual software development teams by presenting a discussion of how the challenges are overcome in practice, a theoretical foundation for understanding time separation, and a mathematical model that describes the coordination costs of time separation. This was followed by a case study (Espinosa and Pickering, 2006) investigating the effects of time separation on coordination processes and outcomes. The end of this section will summarize a conceptual paper on cultural differences in perceptions of time by Saunders et al., 2004.

The basic premise of Espinosa and Carmel, 2003, is that time separation leads to increased coordination costs. They define coordination as "the management of dependencies among task activities to achieve a goal (Espinosa and Carmel, 2003, p. 254)." As such, the theoretical basis for their discussion and model is coordination theory. Arising from their definition is the observation that independent activities need not be coordinated. Therefore, sequential techniques such as "follow-the-sun" whereby distributed sites work in sequence are best done when dependencies are limited. Other

work arrangements can be where tasks are pooled such that they depend on the same resources, or reciprocal where the tasks are interdependent (Espinosa and Carmel, 2003).

When teams are distributed, time separation brings additional challenges of coordination. The greater the time separation, the greater the challenges will be. For example, if there is no overlap in work hours, communication becomes difficult and when tasks are interdependent one site may not be able to proceed until considerable time has passed because of the lack of time synchronicity. Espinosa and Carmel (2003), after reviewing their prior studies of global virtual teams and interviewing professionals, identify three practices used by virtual software development teams to overcome the challenges of time separation: asynchronous, synchronous, and education (Espinosa and Carmel, 2003).

Asynchronous techniques are those that maximize the use of asynchronous technologies to communicate to distributed members during nonoverlapping work hours. These techniques include organizing work in what the researchers call "bunch-and-batch" so that a large portion of tasks is completed before deliverables are sent to the other sites, and creating formal structures for messages and activities so as to reduce the need for communication for clarification (Espinosa and Carmel, 2003).

Synchronous techniques are those that increase the ability for distributed members to communicate effectively in real time. For example, teams may alter the work day schedule so that there is more overlapping time, focus on non-interdependent tasks during non-overlapping time, and/or assign liaisons who are trained at the distant site and then return and work compatible hours to bridge the communication gaps (Espinosa and Carmel, 2003).

Finally, the researchers found that training team members to understand the issues of time separation (e.g. understand the time zone differences) is an education technique used by successful temporally distributed teams (Espinosa and Carmel, 2003).

Based upon their analysis of the practices of virtual software development teams and coordination theory, the researchers built a mathematical model of production costs and coordination costs that explains the additional costs time separation can cause In the model, coordination costs are comprised of communication, delay, clarification and rework costs (Espinosa and Carmel, 2003). The model is a simplification of the dynamics of coordinating tasks in a virtual software development team. Simplifying assumptions are made. For example, coordination is assumed to be the result of a dyadic communication in which a "Requestor" requests a "Producer" perform a task (which could be to clarify misunderstanding, perform an action, etc.) (Espinosa and Carmel, 2003). In reality, of course, coordination may involve multiple actors and multiple paths of communication. Additionally, the model is based upon coordination only in the domain of software development. Nonetheless, the researchers assert that the model can be extended to more complex interactions and other domains.

Production costs are determined, in the model, by "the costs of carrying out individual tasks (Espinosa and Carmel, 2003, p. 256)." Production costs are incurred by the "Producer" and are not affected by distance or time separation (Espinosa and Carmel, 2003). Communication costs are incurred by both the Requestor and Producer and are a function of the costs of maintaining communication links (both synchronous and asynchronous) and the costs of sending messages Delay costs are a function of the costs of the time the Requestor is delayed while the Producer completes the requested task

(Espinosa and Carmel, 2003). Clarification costs refer to the costs of the delays incurred when a communication is not understood and the Producer and Requestor must repeat communication to clarify the message (Espinosa and Carmel, 2003). Finally, Rework costs are a function of the need for the Producer to rework a task in the case that s/he has begun working on it before the Requestor communicates that the message was not understood and clarification is needed that changes the Producer's understanding of what needs to be done.

The costs that determine Coordination costs may be affected differently by different magnitudes of time separation. For example, if the Requestor makes a request at what is the beginning of his/her workday but the end of the Producer's workday, then the delay will be considerably larger than if the request is made at a time that is the end of the Requestor's day but beginning of the Producer's day. If there were no need to clarify communication or rework tasks, then tasks could be structured to minimize Communication, Production, and Delay costs by using such paradigms as "follow-the-sun" work arrangements (Espinosa and Carmel, 2003). However, in equivocal and interdependent tasks there is often a need to clarify and rework and so "follow-the-sun" is not appropriate for those tasks (Espinosa and Carmel, 2003). Rework costs and Clarification costs, then, are highly dependent on both task complexity and the size of the time separation and are therefore termed "vulnerability costs" (Espinosa and Carmel, 2003). Thus, as noted above in the example, Coordination costs are sensitive to when in the day the request is made and the measure of time separation between the Producer and Requestor.

It is also interesting to note that the researchers propose that the probability of a misunderstanding that leads to Clarification costs (and perhaps Rework costs) is a function of the medium used (Espinosa and Carmel, 2003). For example, in face-to-face communication there are additional cues that reduce the probability of misunderstandings (Espinosa and Carmel, 2003).

This model, although simplified and developed to explain Coordination and Production costs in one domain, can inform leaders of partially distributed teams in any domain. Leaders need to be sensitive to the factors that determine the costs and take measures such as structuring work day hours to increase overlap if tasks are interdependent and choosing rich media for communication to minimize the costs.

Espinosa and Pickering (2006) interviewed 23 members of global teams at a semiconductor company in a case study to investigate the effects of time separation on coordination processes and outcomes. Semi-structured interviews were conducted and transcripts were coded and analyzed using a grounded theory approach. Eleven propositions resulted from the analysis. Most salient are the findings that led to Proposition 4: "Coordination costs – i.e. delay, effort, and miscommunication – are very salient to time-separated team members (Espinosa and Pickering, 2006, p. 5)." This is consistent with the model described above. The researchers found that most interviewees found coordination costs to be very important to them, especially those related to delay. Next in importance to the team members were coordination cost issues which were, as were the issues associated with delay, mostly related to distance and time separation. A little over half of the interviewees found the cost of repairing miscommunication as salient, but very few discussed the need for rework because of miscommunication.

Also relevant to a discussion of the effects of time dispersion, was the finding that there were only small differences in how coordinated team members were in relation to their team configuration. That is, collocated team members were more coordinated than geographically distant members; and geographically distant members were more coordinated than time separated members; but the differences were small. The researchers propose that this suggests that time distance increases the effort necessary to coordinate. However, other problems may arise if such obstacles are removed so that teams with time proximity won't necessarily be better coordinated.(Espinosa and Pickering, 2006)

In a later paper, Espinosa and Pickering (2006) then suggest actions that can be taken to improve effectiveness for global virtual teams. They suggest that the team members meet face-to-face at the inception of the project to get to know each other, share goals and objectives, assign roles and responsibilities, etc. To assist with coordination, they suggest that a contact person be assigned at each site to coordinate with other sites. They also recommend that coordination procedures be established from the start, and that meeting times be rotated so that no one team is required to always meet during their off-work night hours. Finally, they recommend that tasks be broken into modules so that dependencies between sites are reduced whenever possible. (Espinosa and Pickering, 2006)

Thus, the case study reported by Espinosa and Pickering (2006) lends support to the model proposed by Espinosa and Carmel (2003). It also is informative as to the difficulties with coordination that can occur with geographic and temporal dispersion. The recommendations are consistent with those found elsewhere in the literature. What is

significant about these articles is the recognition that temporal dispersion can occur within the same time zone and still cause disruptions to coordination.

Temporal distance can also be the result of different perceptions of "time" that are a result of cultural differences. This is most likely to be an issue for global teams that span multiple cultures but can also occur within a collated team if it is multicultural. Problems occur when team members have what Saunders et al. (2004) term "time visions." They define time visions as, "different perceptions of time across sets of time dimensions. (Saunders, Van Slyke and Vogel, 2004, p. 19)" Time visions effect how people perceive deadlines, schedules and other temporal artifacts. Time visions are a result of individual perceptions which are shaped by the cultures in which the individuals live and work.

When a team has members with different time visions, conflict and misunderstanding can arise. For example, deadlines will have different meanings to those with differing time visions. This can lead to misunderstanding and frustration. But leaders in organizations can take measures to manage differing time visions. Saunders et al. (2004) suggest that the biggest issues may be with deadlines, establishing team rhythms, and establishing performance measures. Saunders et al. (2004) recommend that leaders create an awareness of the time vision differences; promote the development of team norms so that everyone will know what is expected in response to such time sensitive matters as deadlines; create an inter-subjective time vision so that there is an active sensitivity to others' perspectives, and match technology with time visions (Saunders et al., 2004). For example, scheduling tools are appropriate for those with a clock time (vision of time as linear and homogeneous) vision while asynchronous

communication media may help those whose vision is monochromic (individuals focus on one thing at a time) so that they can delay action on one activity while they attend to another (Saunders et al., 2004).

Saunders et al.'s (2004) conceptual paper is illuminating and adds to an understanding of why cultural distance can create temporal difficulties. It is instructive to leaders as to how to manage these temporal differences so as to maximize the benefits of each represented time vision while minimizing the conflict that differing time visions can create.

4.11 Boundary Issues for Facilitators: A Field Study: Pauleen and Yoong, 2001

As boundary issues may affect team process and performance, they may drive the choices leaders make in terms of communication technologies and team processes. Pauleen and Yoong (2001) conducted a field study of facilitators of virtual teams to uncover what boundary issues they found important and how those issues influenced information communication technology (ICT) choices.

Grounded action learning methodology was used by the researchers in this investigation. Grounded action learning research involves having the participants work on real issues they face in order to come up with solutions and analyzing the efforts to develop understanding in an iterative process of analysis and data collection. Over a period of three years data were collected by having the seven participants meet in "training" sessions that included discussion and reporting of their activities as well as training in virtual team facilitation. Semi-structured interviews were also conducted between sessions. The data were analyzed using qualitative research methodologies that

included open and axial coding of transcripts of all sessions and interviews. Although there were no hypotheses, as is usual with a grounded theory approach, the researchers did frame their investigation with a focus on facilitating team relationships in the context of boundary issues. Each facilitator was faced with one or more boundaries of time, distance, culture, organization, and language.

The researchers found a critical issue for the facilitators was that of relationship building and management. Personal relationships between team members are important for communication quality. The quality of communication, as has been discussed in this paper, can influence team performance. Thus, a critical role for virtual team facilitators is to build relationships with team members (Pauleen and Yoong, 2001). Their study (2001) focuses on the experiences the facilitators reported having in the context of attempting to build relationships using information communication technologies despite the impediments of various boundaries.

One interesting finding was that the facilitators often chose from the available media the communication technologies with which they were most familiar. Thus, email and telephone were considered to be primary means of communication (Pauleen and Yoong, 2001). While email was used as a basis for communication, telephone, a richer medium, was often the choice for building personal relationships (Pauleen and Yoong, 2001). The researchers also found, however, that less familiar communication channels were also used. In particular, the researchers found that facilitators thought Internet-based synchronous chat was advantageous for "facilitating the 'informal' interactions traditionally found in face-to-face teams, thus enhancing the relationship-building attempts (Pauleen and Yoong, 2001, pp. 211-212)."

The respondents also recognized that different goals and tasks may have different communication needs and that cultural differences may influence the appropriate choice of communication media as well as the level of relationship building required. For example, less relationship building would be needed in a team that is intra-organizational, even if there are diverse cultures represented, if there is a strong overall organizational culture than in a similarly composed team for which there is not already a strong organizational culture that can foster common ground and initial trust. Various subgroups, perhaps departments in an intra-organizational virtual team, may have different preferences for technologies. For example, one department may use email most frequently while another may prefer telephone. It is even possible that not all technologies used by subgroups are available in common. The implication is that when planning the team building process and choosing the communication channels to support it, facilitators need to consider the preferences and styles of the team members. These special considerations are an indication that facilitators and team members need training and organizational support to obtain the skills necessary for boundary crossing behaviors in virtual teams (Pauleen and Yoong, 2001).

The researchers conclude that the biggest challenge for facilitators of virtual teams with strong boundaries is to develop a team culture that incorporates the individual cultures of the team members. These observations are informative not just for understanding the impact that boundaries of distributedness can have, but how to ameliorate their effects as well. The findings suggest that the effects of such boundaries on virtual teams and how to ameliorate the impact are complex issues that should be further researched.

4.12 Faultlines

Noting boundaries caused by dimensions of distance may not be enough to predict or explain diversity effects on a team. The composition and variety of the attributes of any dimension may vary with different results. This concept is encapsulated in a variable, faultlines, introduced by Lau and Murnighan (1998) in a conceptual paper focused on the effects of demographic faultlines. This model was then extended by Polzer et al. (2006).

Lau and Murnighan define faultlines as dividing "a group's members on the basis of one or more attributes (Lau and Murnighan, 1998, p. 325)." As a result of faultlines, coalitions of informal subgroups can form which can lead to conflict and a lack of team cohesion.

The authors note that faultlines can vary in strength and are stronger when there are more attributes aligned the same way on the faultline (Lau and Murnighan, 1998). The authors give the example that a demographic faultline will be stronger "when all of the women in a group are over 60 years old and all of the men are under 30 (Lau and Murnighan, 1998, p. 325)."

Faultline strength then is weakened if there is a great deal of diversity or very little diversity. That is, faultlines are most likely to be strong and active when there is moderate diversity. If there is little diversity then group members are likely to identify with the entire group. If there is a great deal of diversity, then there may be too many attributes to form distinct subgroups with which members may identify. Subgroup identification can divide a team into coalitions and prevent team cohesion from developing.

However, that there are conditions ripe for formation of subgroups may not, according to Lau and Murnighan (1998) guarantee that the subgroups will form. It is, they note, the actual formation of the subgroups, as opposed to the potential based on faultlines that can cause deleterious effects. Faultlines are most likely to form at the inception of a team. However, if the team is focused on activities that minimize awareness of the diversity of attributes, then the subgroups may not form. For example, if there are pressing deadlines or external competition, then the focus may be away from the within-team diversity and team cohesion may develop instead (Lau and Murnighan, 1998). If the subgroups do not form, Lau and Murnighan (1998) say that the faultlines are not activated. When faultlines are not activated they may weaken over time as the team cohesiveness grows stronger. On the other hand, if the faultlines are salient to the team members, then they may be activated and subgroups may form. The strength of the faultline will influence the stability of the subgroups (Lau and Murnighan, 1998). If the faultline is weak, then the stability of the subgroups is less and members are more likely to identify with the entire team than the nebulous subgroups. On the other hand, if the faultline is strong then over time the subgroup identification may grow and conflict may ensue between the subgroups (Lau and Murnighan, 1998).

Thus, strong faultlines can result in a few strongly distinct subgroups. Although the concept of faultlines was introduced by Lau and Murnighan (1998) in a discussion of faultlines that result from demographic diversity, clearly other dimensions of distance, such as cultural diversity, can result in faultlines as well. This has implications especially for partially distributed teams. PDTs are likely to have subteams that differ culturally with diversity of attributes such as organizational culture, native culture, and language

differences that naturally align along a cultural faultline. The challenge, then, is to weaken the faultline so that team cohesiveness can develop and in-group/out-group effects can be minimized.

In fact, Polzer et al. (2006) demonstrated in an experiment that geographic faultlines can develop and be activated and impair team functioning. Two-hundred sixty-six students, located at 14 universities in 10 countries were divided into 45 teams (Polzer, Crisp, Jarvenpaa and Kim, 2006). The study compared three team configurations: fully distributed and two configurations of partially distributed teams. The PDTs were comprised of either two distributed subteams of three team members each, or three distributed subteams of two members each. The faultine model (Lau and Murnighan, 1998) would predict that the faultline would be strongest amongst the team with two subteams.

The seven week study by Polzer et al. (2006) had the participants engage in a team building exercise and two tasks with deliverables. The team building exercise was one of introductions, selecting a hypothetical person to help the team, and discussions of expectations for success. The first task with deliverables was to select and research a business innovation. The final task was to create a business idea for the business innovation chosen and prepare a business plan for a company operating in four countries chosen as part of the previous task.

The results of a survey administered at the end of the Polzer et al. (2006) project were analyzed to determine the amount of conflict and trust individual members and groups experienced. All hypotheses were supported. The results confirmed that participants experienced less trust and more conflict with their distant colleagues than

with collocated members. Supporting the faultline model, the results suggested that teams with two subteams experienced less trust and more conflict than those with three subteams. Teams with three subteams experienced more conflict and less trust than the fully distributed teams. (Polzer et al., 2006) The analysis also revealed that, not surprisingly, participants experienced more trust and less conflict with their collocated colleagues than with distant colleagues (Polzer et al., 2006). While there may seem to be a contradiction in the findings because the two-subteam teams had more collocated members, in fact, these findings support the faultline model which predicts that faultlines will be strongest when there are fewer, equal sized, distinct groups (Lau and Murnighan, 1998). Also of interest was the finding that there was less trust and more conflict between distributed subteams when members of at least one subteam were homogeneous with respect to nationality (Polzer et al., 2006). It should be noted that in such a subteam there would be an overlap of geographic attributes and a demographic attributes, thus strengthening the faultline (Polzer et al., 2006).

This study has important implications for managers which are discussed by the researchers. While it may seem natural to divide up tasks by location, doing so may strengthen and activate faultlines. Communication patterns can also make faultlines more salient and activate them. For example, the study revealed that the collocated subteams relied increasingly on face-to-face meetings which, of course, could not include distributed team members (Polzer et al., 2006). This can heighten the awareness of differences between subteams which can make the faultline more salient. Therefore, the researchers suggest that managers encourage a reliance on electronic communication that can include all team members (Polzer et al., 2006). Finally, the recommendation is made

that managers must encourage team identification and performance rather than subteam identification.

The concept of faultlines is, therefore, particularly relevant to a study of partially distributed teams. The faultline model, especially as extended by Polzer et al. (2006) can inform researchers and managers of how and why conflict can arise between members of a team even if the stated team goals are accepted by all members.

4.13 Geographic and Cultural Influences on Subgroup Formation: Panteli and Davison (2005)

Another investigation of the emergence of subgroups based upon geographic proximity in partially distributed teams was reported by Panteli and Davison (2005) who conducted a study of the formation of subgroups in global virtual teams. In this field study, teams were formed with two collocated subgroups. However, the subgroups were not identified as subgroups to the participants. That is, the participants were only told that they were part of the team and that some members were from their location, while others were from the other location. The researchers posited that subgroups would emerge based on geographic proximity and that the subgroups would eschew computer mediated communication resulting in most of the communication taking place within, not between, subgroups.

Forty-seven student participants were formed into eight teams of six members each (with one team of five) with the task of performing a case study analysis of the use of a knowledge based system. For each team, half were from either a university in the UK or one in Hong Kong. The Hong Kong students were all postgraduates; the UK

students were either first year postgraduates or last year undergraduates. There was an eight-hour time difference between the two universities. Although there were individual member demographic differences, each subgroup had similar demographic mix. It must be emphasized that the members were assigned to teams; at no time were they referred to as being in a subgroup or requested to form subgroups.

The teams used a web-based conferencing tool, Blackboard, which had facilities for both asynchronous and synchronous communication. Each team member submitted a personal reflection at the completion of the project as well. The teams interactions, including discussion board and chat archives were analyzed. To some extent, it was found, subgroups based on geographic proximity formed in every team. There was no evidence of subgroup formation based upon any other characteristics. However, the analysis showed that there were different degrees of impact of the subgroups among the different teams. The researchers "labeled these low, moderate and high impact (Panteli and Davison, 2005, p. 195)." The degree of impact was determined by three factors: when the subgroups emerged, the effect of the subgroup division on the distribution of work, and the communication (i.e., communication used and communication content). Thus, a team with high impact subgroups had early emergence of subgroups, divided tasks along geographic subgroup lines, had little to no social discourse, and had communication that reflected this division (e.g., "we" and "you" peppered the electronic conversation) (Panteli and Davison, 2005). Teams for which the subgroup formation had moderate impact on interactions formed subgroups later in the teams' lives. Initially there were attempts to work as a single unit but as challenges arose subgroups emerged. In one team, for example, early on a suggestion that tasks be divided along geographic

lines was rejected indicating an effort to work as a single unit (Panteli and Davison, 2005). In some teams with moderate impact occasional face-to-face meetings among collocated members were held as well. This, naturally, excluded the other subgroup. Two teams, however, demonstrated throughout the project efforts to work as a single unit and build a cohesive overall team. More social communication took place in these teams than in the other teams and the communication was almost exclusively via electronic communication media. The only face-to-face communications were towards the end of the project and, the researchers report, "there is no evidence to suggest that these teams depended on the subgroups to make progress in addressing their tasks (Panteli and Davison, 2005, p. 196)." Asynchronous communication was valued and used most frequently to overcome the time difference in these low-impact teams.

Viewed in light of the faultline model, these findings suggest that geographic faultline activation and eventual strength can be affected by the efforts of team members from the start to build a cohesive single team. Also, conflict does not need to exist for geographic faultlines to impact team functioning. It can be suggested, then, that to avoid faultline activation and strengthening, social interaction should be encouraged and a common, electronic communication media be predominately used even within collocated subgroups. However, Panteli and Davison (2005) suggest that there is a downside to building a cohesive overall team and mitigating the effects of emerging geographically based subgroup formation. When the impact is high there tends to be more face-to-face collaboration within a subgroup which can alleviate a sense of isolation members might feel at the local level; on the other hand, such members are likely to feel more isolated at the team level (Panteli and Davison, 2005). The strong collocated subteam can lead to a

bias towards the subgroup and against other distributed team members. The next section discusses research on the phenomenon of in-group/out-group effects.

4.14 In-Group/ Out-Group Effects

When team members form subgroups based upon perceived similarities with their subgroup members and differences with other members of the team, the subgroup (the "in-group") can develop a bias towards their own subgroup and against the other subgroups ("out-groups") based upon the perceived similarities and differences (Huang and Ocker, 2006). Polzer et al. (2006) demonstrated that geographic faultlines can result in this "us vs. them" attitude between distributed subgroups where each subgroup has collocated members.

Huang and Ocker (2006) conducted a multi-method case study to investigate the issues student participants had while working in partially distributed teams. Seventy-one seniors were assigned to one of 12 teams. Teams had between five and seven members and each team had a randomly assigned leader. The students attended a university that had a Main Campus and branch campuses. Team members were from either the Main Campus or one of two branches, with all teams having a majority of members collocated at the Main Campus and no team having all members from the same campus. The teams worked on one of two equivalently complex tasks in which they were to investigate the state-of-the-art for a particular product and explore additional functionality that could improve the product (Huang and Ocker, 2006). Each project was for a real Fortune 100 company sponsor. Weekly status reports were prepared by the teams for their sponsors who then gave the teams feedback. The students also individually maintained a record of

their communications with teammates and described their experiences working in a PDT by completing weekly personal reflections and completing surveys and peer-evaluations of their teammates (Huang and Ocker, 2006). Although both qualitative and quantitative data were collected and analyzed by the researchers, in (Huang and Ocker, 2006) they report only on the qualitative analysis of the personal reflections and the findings regarding in-group/out-group effects experienced by the teams.

The analysis showed that for many teams, in-group/out-group effects that impacted interaction among team members occurred that were associated with the geographic faultline (Huang and Ocker, 2006). Interestingly, they also found that there were two other faultlines (distribution of power and information flow) that existed in parallel to the geographic faultline (Huang and Ocker, 2006). The distribution of power faultline was a result of the Main Campus having more prestige, providing more team members to the team, and being the location to which the sponsors visited at the beginning of the project (Huang and Ocker, 2006). The Main Campus professor was also the contact person with the client and sponsor thus adding to the perception of power differences between the Main Campus and branch campus (Huang and Ocker, 2006). Branch campus members sometimes felt like "second-class citizens" as a result and as a result there was a clear feeling of "us vs. them". Main Campus also had an advantage that information flowed from the Main Campus professor through them to the branch campus. This caused some resentment amongst branch campus members and increased the divisiveness between the subteams (Huang and Ocker, 2006).

The researchers report finding that the negative influences of these faultlines decreased trust and increased conflict among the subteams (Huang and Ocker, 2006).

However, the effects were moderated by other factors: work ethic, quality of work, and media mix used across subteams. Perceptions of work ethic issues were not confined to across subteams as within subteams some members felt others were not carrying their weight. However, some members felt that their distant members faced fewer consequences for not maintaining an appropriate work ethic (Huang and Ocker, 2006) which is a manifestation of an "us vs. them" attitude and conflict. As with work ethic issues, reports of sub-par quality of work were not confined to cross subteams as some members reported poor quality emanating from fellow subteam members (Huang and Ocker, 2006). However, a number of members reported a belief that the quality of work coming from the branch campus was inferior to the work of Main Campus students (Huang and Ocker, 2006). Most significant to this discussion perhaps is the finding that media mix was an important factor that mediated the effects of the faultlines. When teams were restricted to using email and instant messaging for their meetings with distant teammates, they found those media to be insufficient to accomplish their goals (Huang and Ocker, 2006). The result was often a communication breakdown that led to conflict. However, some teams were able to overcome the limitations of provided collaborative media by incorporating other media (eg. teleconferencing) to their repertoire of communication channels (Huang and Ocker, 2006).

Interestingly, the researchers found that because the faultlines ran in parallel, conflict was reduced in some cases by members shifting their perception of causation from one faultline to another that resulted in less contentious feelings (Huang and Ocker, 2006). For example, rather than attributing Main Campus members' behavior to the power faultline and assuming that Main Campus members were always taking charge,

some branch campus members attributed the behavior to the less contentious information flow faultline and assumed that Main Campus members were just sharing information that they received first (Huang and Ocker, 2006).

It is not uncommon for partially distributed teams to form with a group at headquarters and subteam(s) at branch office(s). This research can inform managers of such teams of what to look for and possible measures to take to reduce the in-group/out-group effects that can result from one or more faultline. For example, it is important that all members feel as though they are "in the loop" and if horizontal information flow is necessary, as it was in this case study, that efforts be made to reach out to the distant subteams and make sure they feel empowered and included. Providing multiple methods of communication media can also help reduce conflict. If there are parallel faultlines, then it behooves the management to try to direct the attention of members to the less conflictual one. The findings of this case study should be explored in future research as they provide much insight into the causation of conflict and reduced trust that can occur in partially distributed teams.

In a laboratory experiment, Bos et al. (2004) report findings that lend insight into possible causes of in-group/out-group effects in partially distributed teams. The researchers report about a simulation game in which five players were collocated and five players were isolates. The game involved the buying and selling of a commodity, shapes, to fill individual orders for a string of shapes. Each player was randomly assigned "specialty" shapes that they could produce and sell at a low cost and each also had a list of a string of eight shapes for the order they were to fill. As only two players could produce each of the five specialty shapes, and the players could only produce a maximum

of six of their specialty shapes per round to sell, there was a scarcity of shapes so that negotiation and decision-making was required in the players' attempts to fill their orders. The shapes can be viewed as representing member specialty skills and the trading of them the exchange of such skills in collaboration between members (Bos et al., 2004). The isolates were called "telecommuters" by the researchers, although they did not use that term in any communication with the participants. All five specialty shapes were available in both the telecommuter group and the collocated group. It should be noted that although the telecommuters were aware that there were five collocated players and the others were isolates, at no time were the telecommuters referred to as a group by the researchers. Thus, any group formation among the telecommuters would emanate from the players themselves, not from any assignment as a group. (Bos et al., 2004)

One hundred and thirty subjects, the majority of them students, were assigned to one of 13 teams of ten participants each. Each team played five rounds of the game in their session. Although the collocated members could discuss and arrange trades face-to-face among themselves, actual trading was done using a web-based text messaging system and all communication to and from telecommuters was conducted on the system.. The system tracked the transactions and logged who sold what to whom. This log provided the primary data source for analysis. The players also completed post-experiment questionnaires that asked about demographics, prior relationships with other players, and game strategy. It is noteworthy that the players were referred to by shape (e.g., blue-square), so unless a player shared his or her name in a text message, any prior relationship with another player should not have had an impact. (Bos et al., 2004)

The analysis of the data supported the hypothesis that collocators would collaborate more with other collocated members instead of telecommuters (Bos et al., 2004). A regression analysis confirmed that this tendency was significant, with collocators buying 65% of their shapes from other collocators (Bos et al., 2004). The researchers propose that this bias was a result of convenience (Bos et al., 2004). Although the transactions needed to go through the web messaging system in order to take effect, negotiations among collocators could quickly and easily be accomplished face-to-face. The researchers also propose that there was some social pressure as well; it was psychologically more difficult to say no to an offer of trade face-to-face than over the system (Bos et al., 2004). Although not ubiquitous among all teams, there was also some evidence of social conflict between collocators and telecommuters. The researchers observed that in some teams, collocators discussed telecommuters and identified those who where "difficult" and should be avoided (Bos et al., 2004). However, the findings suggest that the major driver for in-group effects observed were the communication patterns and the fact that trading for collocators was significantly more with other collocators than with distributed telecommuters (Bos et al., 2004).

Perhaps the most interesting finding was that telecommuters formed a trading in-group themselves. That is, the telecommuters tended to contact and trade predominantly with other telecommuters. However, an analysis of the post-survey and debriefing showed that the telecommuters were not acutely aware of the location of their preferred trading partners (Bos et al., 2004). The researchers concluded that the telecommuter in-group formed as a reaction to being ignored by the collocators (Bos et al., 2004). In the first five minutes of trading, telecommuters contacted other telecommuters and

collocators equally, it was only as the trading progressed that the bias towards other telecommuters was evident (Bos et al., 2004). Ignored by collocators, the telecommuters began to trade with each other and, as the post-survey results showed, they had a preference for trading with previous trading partners and so the bias was perpetuated as the game progressed (Bos et al., 2004). This result is important as it demonstrates both how in-group/out-group effects can spawn more biases and the importance of equalizing communication opportunities between team members.

Much to the surprise of the researchers and game players, all of whom expected that collocation would provide an advantage that would result in increased effectiveness, there was no difference in effectiveness of the collocators or telecommuters (Bos et al., 2004). The researchers posit that it may be the ability of the telecommuters to concentrate and avoid interruptions that strengthens their ability to perform effectively and overcomes the disadvantages of being isolates (Bos et al., 2004).

However, the configuration of the teams and the structure of the game may have exaggerated the divide between collocators and telecommuters, resulting in outcomes that may not be generalizable to all partially distributed teams. For example, the two groups had the potential to be self-sufficient; that is, each group had all the shapes needed to fill all the orders and thus, although they were not made aware of this, they could operate independently (Bos et al., 2004). This may have helped strengthen the in-group/ out-group effects and also contributed to the findings that the two groups were equally effective. This suggests that care be taken when assigning team members; if collaboration is desired a distribution of skills that encourages collaboration and common communication media for important messages may be desirable.

In a field study of employees in the IT business function of a global organization, Webster and Wong (2008) compared virtual teams, semi-virtual teams (i.e., PDTs), and traditionally collocated teams and found that there were differences which they ascribe to in-group/out-group effects. Webster and Wong (2008) collected 453 usable surveys from the employees. Of those, 79 were members of a collocated team, 118 were members of a fully virtual team, and 256 were members of what the researchers call 'semi-virtual' teams.

Significant to this research is that the results indicated that members of PDTs (semi-virtual teams) had more group identity, trust and perceptions of task skill for their collocated teammates than they did for their remote teammates (Webster and Wong, 2008). This supports the idea that in-group/out-group dynamics affect PDTs. Also supporting that were the results of comparing the three structures of teams' perceptions of group identity, communication frequency, and trust. Contrary to the hypothesis that "Members of co-located teams will communicate more and exhibit more positive team member perceptions ... than will members of semi-virtual or virtual teams (Webster and Wong, 2008, p. 46)," the researchers found that semi-virtual team members' perceptions of their local team mates was highest. However, the level of trust for the remote members was marginally significantly lower for remote members than for local members in semi-virtual teams.

Webster and Wong (2008) conclude that semi-virtual teams (PDTs) are different than both traditionally collocated teams and fully distributed virtual teams and that the structure of semi-virtual teams "sets up in-group/out-group biases (Webster and Wong, 2008, p. 54). However, they also conclude that, if possible, the creation of semi-virtual

teams should be avoided (Webster and Wong, 2008). Webster and Wong (2008) do discuss means of coping with the issues of semi-virtual teams if it is necessary to form them. They suggest, for example, that leaders emphasize whole team identity and that members be trained early on in the team lifecycle to the challenges of working in semi-virtual teams and the issues of in-group/out-group effects..

Staples and Webster (2008) also conducted research that led them to conclude it is best if organizations avoid forming hybrid virtual-teams (PDTs) because of the deleterious effects of in-group/out-group dynamics. They administered a survey and received 824 usable surveys. The survey participants were members of a large global high tech organization that had many distributed teams and participants in an online panel who worked in a variety of organizations and team structures (Staples and Webster, 2008).

In terms of team virtualness, there were 283 respondents who were in traditional collocated teams, 358 who were in fully distributed virtual teams, and 84 in hybrid teams. The survey tested a model of trust within the team effects on knowledge sharing within the team; knowledge sharing effects on team effectiveness, and the moderating effects of task independence and virtualness on those relationships.

Most significant to this dissertation research are the findings with regard to the moderating effects of virtualness on the relationships from trust to knowledge sharing and from knowledge sharing to team effectiveness. While the results were insignificant for virtualness moderating the relationship from trust to knowledge sharing, it was significant as a moderator on the relationship from knowledge sharing to team effectiveness. In particular, they found that the relationship between knowledge sharing and performance

was strongly significant for both traditional and fully distributed virtual teams, but weak for hybrid teams (Staples and Webster, 2008). This, they suggest, is a result of in-group/out-group dynamics. Thus, they suggest that hybrid teams should be avoided. However, if they are necessary, they recommend that strong efforts be made to keep all team members equally informed and that working towards a whole team identity early on is critical (Staples and Webster, 2008).

The above two papers (Webster and Wong, 2008, Staples and Webster, 2008) are important to the study of PDTs as they are among the few to date that recognize the special issues of these semi-virtual/ hybrid teams. However, it is impractical to reach the conclusion that PDTs should not be used at all because of the problems they engender; in the current age of mergers and restructuring, they are inevitable. Instead, further research is needed to fully explore the special characteristics and problems of PDTs to inform leaders and members of them how to best avoid or mitigate the problems.

4.15 Conclusion

Boundary issues of cultural, geographic, and temporal dispersion are complex. Perhaps most significantly, communication effectiveness is vulnerable to effects of boundaries and this can impact performance effectiveness. Leaders of virtual teams need to be cognizant of the effects of boundaries in devising mechanisms for overcoming the obstacles they can bring. PDTs may be especially susceptible to in-group/ out-group effects. These effects can result in subteam identification that is so strong as to impede communication and collaboration with other subteams within the team.

The studies discussed in this chapter are particularly useful in highlighting some of the issues these boundaries create. Appendix D summarizes the literature reviewed during the writing of this chapter.

CHAPTER 5

CONSTRUCTS

5.1 Conditions

In Study 1 and Study 2, teams were assigned to one of three leadership conditions: Centralized, Hierarchical, or Decentralized. In the Centralized condition the team self-selected one overall team leader and no subteam leaders; in the Hierarchical condition, the team selected one overall team leader and a subteam leader for each of the two subteams.and in the Decentralized condition there was to be no overall team leader but the subgroups each selected a subteam leader. Leaders were selected as part of the first week's activities to create a team contract. Member and leader responsibilities were posted in each team's private PDT System space.

Distance is operationalized as cultural, temporal, and geographic distance and was held constant in Study 1 (each team had a US subteam and a Netherlands subteam) and is measured in Study 2 and the combined semesters data set analysis at the team level for the distance between the two subteams in a team. Temporal distance is measured as the number of time zones between the two subteams.

Culture is measured as the culture of the country in which the university of the subteam resides. The measurement does not take into account individual or regional cultural distances within a country. Culture is measured using the Hofstede's indexes (Hofstede, 2001) for the dimensions of Individualism/ Collectivism, Power Distance, Uncertainty Avoidance, and Masculinity/Femininity.. However, preliminary analysis of the four original Hofstede indexes suggested that they suffered from multicollinearity making it inappropriate to use them all in the analysis. Individualism is the extent to

which individuals are focused on looking after themselves or their group. Of the four (or five) dimensions of cultural distance explored by Hofstede, Individualism/ Collectivism is the one most studied in connection to team collaboration and communication (Hung and Nguyen, 2008). Thus, it was the one chosen to study in this research. Of the four, Individualism/ Collectivism is most aligned with what is being studied as the results in the literature indicate that it affects virtual team participation, collaboration, and communication choices and styles (Hung and Nguyen, 2008, Massey et al., 2001).

For each team, the measure for a cultural distance is the absolute value of the difference of the Individualism/ Collectivism indexes for the two countries from which the subteams come. The cultural indexes for the U.S., the Netherlands, Spain, and the UK were obtained from Hofstede (2001). The dimension indexes for China are estimates obtained from www.gert-hofstede.com/hofstede_dimensions.php. Table 5.1 below shows the cultural and temporal indexes and distance scores for the countries and structures of teams that participated in Study 1 and Study 2. Note that because distance was held constant in Study 1, it was not used in the separate analysis of that study.

Table 5.1 Cultural and Temporal Indexes and Distances

Country	Individualism and Collectivism Hofstede Score	Time Zone (GMT +)
USA	91	-4
UK	89	1
Spain	51	2
China	20	8
Netherlands	80	2
Team Configuration	**Individualism and Collectivism Distance**	**Time Zone Distance**
USA -- UK	2	5
USA -- Spain	40	6
USA -- China	71	12
USA -- USA	0	0
USA--NL	11	6

Unfortunately, a correlation test of temporal distance and Individualism/ Collectivism revealed that they are perfectly correlated for the data set used in this research. Therefore, cultural distance was dropped from the analyses.

Geographic distance can impact how easily face-to-face meetings are held. However, for Study 1 and Study 2, all non-zero distance teams were comprised of subteams that had east-west distance and were separated by at least one time zone. Therefore, geographic distance and the issues it raises are captured by the time zone differences. Thus, only time zone differences are measured for distance.

5.2 Measures of Intervening Variables

Refer to Appendix E for the scale items used to measure the intervening and dependent variables.

5.2.1 Enactment of Leader Roles

The post survey had 18 items per leader type (subteam or team) relating to the eight roles identified by Quinn (1988). The eight roles are innovator, broker, producer, coordinator, monitor, facilitator, and mentor. The producer motivates members to reach goals and improve production; the director sets objectives, establishes rules and policies, and clarifies expectations; the coordinator sets schedules, handles crisis, and addresses logistical and technical issues; the monitor monitors the team and its activities to check for compliance with rules and whether the team is meeting its objectives; the mentor develops people in a helpful and considerate way; the innovator responds to environmental changes; and the broker coordinates and negotiates with people outside of his/her group to obtain needed resources (Quinn, 1988). The participants were asked about the extent to which their leaders enacted each role behavior using scale items adapted from (Denison et al., 1995) with two 7-point semantic differential scale items per role and two additional new items (one for the director role and one for the monitor role).

5.2.2 Perceived Leader Effectiveness

Perceived leader effectiveness is measured by one 10-point semantic differential scale item each for team, subteam, and co-subteam leader. The logic in the post survey allowed skipping this question for leaders not in place in a respondent's team

5.2.3 Trust

Ten scale items for trust within a subteam (with the same ten items repeated for trust between subteams) were included in both the post survey and the first personal reflection. The ten 7-point semantic differential scales for trust had four questions (8 in all) adapted

from (Jarvenpaa et al., 1998) and six questions (12 in all) adapted from (Cummings and Bromiley, 1996) to measure affective trust in the dimensions of "keeps commitments," "negotiates honestly," and "avoids taking excessive advantage."

5.2.4 Communication Media

To capture what communication media teams used, both the second personal reflection and the post survey had a series of questions asking the frequency of use of 13 different communication media (plus "other" for which a text field was provided in Study 2) on a scale of 1 (never) to 7 (to a great extent) for communications within a subteam. The questions were then repeated for communications between subteams. The communication media rated were the PDT System (called "wiki" in Study 1), instant messaging, e-mail, text messaging, Facebook, phone, Internet phone (e.g., Skype), face-to-face meetings, fax, video conferencing, teleconferencing calls, course management system, and external forums or bulleting boards.

5.3 Measures of Dependent Variables

Refer to Appendix E for the scale items used to measure the intervening and dependent variables.

5.3.1 Performance

Perceived performance of the subteam and team was measured in the post survey by six 7-point semantic differential scale items each for the subteam and team. The scale items were adapted from (Mortensen and Hinds, 2001). Each question asked about one of the

six dimensions of performance: efficiency, quality, creativity, adherence to schedule, coordination of member efforts, and communication between members.

Objective performance was measured by the grades given to the final deliverable by designees of the researchers, using a grading rubric designed by the researchers. Each team report was graded by a single grader. Also, two experts experienced in software development evaluated the final reports using the same rubric as the grader. One expert graded both Study 1 and Study 2 reports. Two experts each graded one of Study 1 or Study 2 reports. Objective performance, based upon the evaluations of the final deliverable, is only at the team level. For each study, the average of the three grades (Graders, Expert 1, and Expert 2) were used to measure objective performance.

While objective performance and perceived performance are both measures of group performance, they differ in a significant way. Objective performance is measured as the quality of the output (i.e., the final proposal). On the other hand, perceived team/subteam performance is measured as the perceptions of dimensions of the processes of the team functioning. That is, objective performance measures the performance of a product while perceived performance measures the performance of a process.

5.3.2 Satisfaction with a Leader

Satisfaction with a leader was not measured in Study 1. In Study 2 it was measured for both team and subteam leaders by 3 new semantic differential scale items. Through an oversight, the first two questions were 7-point semantic differential items and the third question was a 10-point item. Therefore, for analysis, the third question answers were normalized to fit in the range of a 7-point scale

5.3.3 Satisfaction with a Group

Satisfaction with a group (collocated subteam or "other" remote subteam) was measured in the post survey with three 7-point semantic differential scale items adapted from (Fuller, Hardin and Davison, 2006-7). That is, each question was answered for both "my" subteam and for the "other" subteam.

5.4 Other Variables Measured

5.4.1 Ineffective "Bad" Leadership

Ineffective "bad" leadership, although not in the research model, was measured for analysis by three newly designed survey items in the post survey. One question was to measure incompetence, one to measure rigidity, and one to measure intemperance, which are the three dimensions identified by (Kellerman, 2004) as characterizing bad leadership which is ineffective.

5.4.2 Emergent Leadership

In Study 2 in the post survey respondents were asked if any members emerged as a subteam or team leader and given the opportunity to name up to three such members per type of leader.

CHAPTER 6

RESEARCH QUESTIONS, HYPOTHESES, AND MODEL

6.1 Introduction

Partially Distributed Teams (PDTs) are hybrids of fully distributed virtual teams and traditional collocated teams. While PDTs have some of the characteristics of both traditional and fully distributed teams, they also have some unique characteristics and issues. For example, in-group/out-group effects are likely to be strong in a PDT as the geographic distance creates a faultline (Polzer et al., 2006) such that subteams develop strong subteam identity and fail to, or struggle to, develop whole team identity. Because of the special issues of PDTs, one cannot assume that the understanding of leadership in traditional and fully distributed teams is valid for PDTs. There may be special problems for their leadership, especially with regard to communication and effective functioning.

Leadership configurations of a PDT are unique to PDTs. It is not known what effects leadership configuration may have on team outcomes. Neither is it known what effects distance (cultural, geographic, and temporal) will have. These are important issues to address because the findings may be beneficial to consider when designing PDTs. Therefore, the overarching research question guiding this research is:

Do leadership configuration and/or distance have an impact on outcomes in PDTs and, if so, through what processes do they have this impact?

6.2 Research Questions

Leadership behaviors can be viewed through a variety of lenses, including style of behavior (e.g., as transactional or transformational) (Kahai, Sosik and Avolio, 2003, Hambley, O'Neill and Kline, 2006), leadership roles (Quinn, 1988, Denison et al., 1995, Carte et al., 2006, Hooijberg and Choi, 2000), or the configuration of the team. In PDTs configuration can be quite varied with one overall team leader and no subteam leaders; one or more subteam leaders and no team leader; subteam and team leaders; no designated leadership; or a combination of the above. This research uses the lens of leadership roles which have been studied in the literature for traditionally collocated teams (Denison et al., 1995) and for fully virtual teams (Carte et al., 2006), but not yet fully explored for PDTs. It cannot be assumed that the roles enacted in traditional and fully distributed teams are also enacted in PDTs. Leadership in PDTs has special issues such as in-group/out-group effects brought on by geographic faultlines which influences what leaders do. Therefore, it is prudent to examine the roles enacted by leaders in PDTs, leading to the research question:

RQ1: What do leaders in PDTs do and how does leadership configuration affect what leaders do?

Trust has been shown in the literature to be important for effective and efficient team functioning. The constructs that influence the development of trust have been studied in both traditional and fully distributed teams (e.g., Mayer et al., 1995, Jarvenpaa et al., 1998). While studies of traditional trust are informative for understanding trust in virtual teams and PDTs, it has been shown that trust in virtual teams often takes the form of "swift trust" (Iacono and Weisband, 1997, Jarvenpaa and Leidner, 1999, Coppola et

al., 2004), a form of trust that develops quickly and is not based on prior experience, but rather on other cues such as the role the member plays in the team (Meyerson et al., 1996). In a PDT trust issues may be especially significant. In-group/out-group effects are likely to be magnified by the geographic faultline that results from having distributed subteams where each subteam has collocated members. Thus trust may be more difficult to develop and maintain, greately challenging PDT leadership. As an important construct, one might ask of trust in PDTs:

RQ2: Does leadership configuration have an impact on the development of swift trust and longer term trust in PDTs and what are the effects of trust?

The enactment of leadership roles has been shown to be associated with perceptions of leadership effectiveness in traditional teams (Hooijberg and Choi, 2000) but while those results are informative, they cannot be assumed to seamlessly transfer to PDTs. The leadership roles needed for effectiveness may be different in PDTs because of the special issues PDTs have. For example, leadership configuration may influence the perception of leader role enactments. If a leader enacts a role, but the members are unaware (cognitively distant) of the behaviors, then it can influence the perception of that leader's effectiveness. Leader distance to members varies as leadership configuration varies and so, one might ask:

RQ3: Does leadership configuration have an impact on perceived leadership effectiveness in PDTs and what are the effects of leadership effectiveness?

Distance (cultural, geographic, and temporal) has been shown to impact team functioning in fully distributed virtual teams (Herbsleb et al., 2000). However, the fact that some members are distant while others are collocated may make the effects of

distance different for PDTs. Leaders are challenged to overcome the effects of distance and the challenges may be different depending on leadership configuration. Therefore, one might ask:

RQ4: Does distance (cultural, temporal, and geographic) impact trust, leader role enactments, and/or perceived leader effectiveness?

Unfortunately, not all leadership behavior is positive. There are cases of "bad" leaders as described by Kellerman (2004). Bad leadership is a characteristic of an individual leader together with compliant responses of some members and therefore can occur in any type of group or team. However, the effects of bad leaderswhip have been sorely neglected in the literature. Kellerman (2004) describes two types of bad leadership: ineffective and unethical. This research will be examining ineffective bad leadership. The effects of such leadership in PDTs are unknown and therefore the question is asked:

RQ5: What are the effects of ineffective "bad" leadership in PDTS?

If indeed leaders do enact the Quinn (1988) leadership roles in PDTs, they may not enact the same ones with the same frequency in all leadership configurations or structures. That is, the enactment patterns may differ depending upon leadership configuration or whether the leader is a team leader or subteam leader. Therefore, this research asks:

RQ6: Are there different patterns of enactment of leader roles in different leadership structures?

Leadership configuration and/or distance may be associated with the media used for communication. For example, in the Centralized condition where there are no

subteam leaders, more synchronous media between subteams may be used as the whole team focuses on working together, while in the conditions in which there are subteam leaders, a divide and conquer process may be chosen making the use of synchronous media between subteams less critical to use. Communication has been shown in the literature to be critical for trust to develop (Iacono and Weisband, 1997, Jarvenpaa and Leidner, 1999, Coppola et al., 2004). Thus, there may be an association of media used and trust. Communications media use may also be associated with role enactment patterns. The literature on executive support systems suggests that different technologies are best suited to support specific roles (Carlsson and Widmeyer, 1994). It is also possible that there is a fit between communications media and leader role enactment, whereby some media are better suited to support certain role enactments. Additionally, cultural differences have been shown in the literature to affect the perceptions of task-technology fit (Massey et al., 2001) and therefore distance, particularly cultural distance, may affect the communication media chosen. Therefore Research Question 7 asks:

RQ7: Is there an effect on communications media used by leadership configuration and/or distance and are there relationships between the media used and trust and/or the media used and enactment of leader roles?

Leadership can emerge in teams that have designated leaders as well as those that are self-managed. If a leader emerges, one might speculate that there is a gap or need that the emergent leader fills, leading to the question:

RQ8: Do teams with emergent leaders have greater or less satisfaction than those who retain their designated leadership structure?

6.3 Research Model

The research model is shown below in Figure 6.1. As shown in the model, it is hypothesized that leadership configuration and distance have effects on outcomes through the processes of enactment of leader roles, perceived leadership effectiveness, and trust. Communication media used is also proposed to be affected by leadership configuration and distance, and also to be associated with patterns of leader role enactment and trust. The remainder of this chapter presents and discusses the hypotheses associated with each research question.

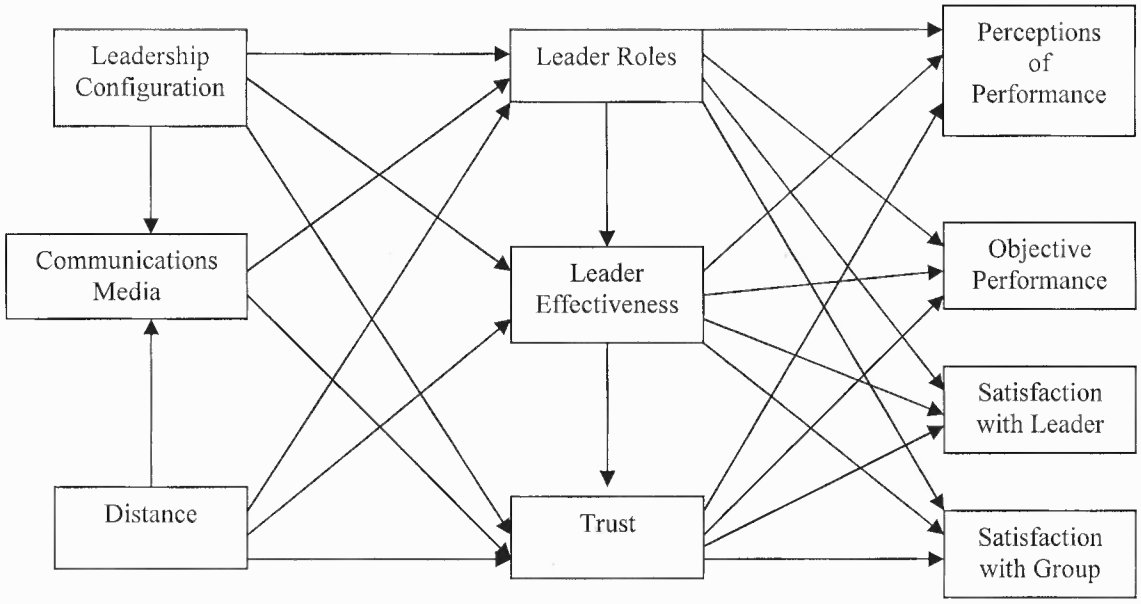

Figure 6.1 Research model.

6.4 Hypotheses Arising from Research Question 1

Research question RQ1 asks, "What do leaders in PDTs do and does leadership configuration affect what leaders do?

What leaders "do" can be viewed through the lens of leader roles as identified by Quinn (1988). While those roles have been shown to be enacted in both traditional (Quinn, 1988, Denison et al., 1995) and fully distributed teams (Carte et al., 2006), they have not been examined specifically for PDTs. Leadership in a PDT cannot be assumed to be the same as leadership in a fully distributed or traditionally collocated team. For example, while a team leader in a fully distributed team is geographically distant from all team members, and one in a traditional team is collocated with all members, a team leader in a PDT is collocated with some members and distant from others. Therefore, the PDT leader has a unique challenge of overcoming in-group/out-group effects that might result from the differences in "presence" s/he has with the two groups of members. This, in turn, may affect the behaviors the leader engages in. It is plausible that the Quinn (1988) roles are in fact enacted by PDT leaders, but it is prudent to verify it, and so it is hypothesized that:

H1a: Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs.

In the Hierarchical and Centralized conditions there are team leaders who are distant from at least some of the members of the team. A distant leader needs to develop "telepresence" (Zigurs, 2002), which can be more difficult to develop than the presence that collocation gives a leader. This should affect perception or salience of leadership

behavior. A role is salient if it is noticed by the members and therefore we judge a leader role to be salient if it is reported by the team member. Therefore, it is hypothesized that:

H1b: Leadership configuration will influence role enactment.

Emergent leadership has been identified in the literature, for example, by (Yoo and Alavi, 2004). The roles identified by Yoo and Alavi (2004) and/or Quinn (1988) may be enacted and/or shared by members who are not designated leaders. It is proposed in this research that leaders emerge to fill a gap. Therefore, subteam leaders are more likely to emerge in subteams when there are no subteam leaders in place (Centralized condition), and emergent team leadership is more likely to occur when there is no designated team leader (Decentralized condition). This leads to the following hypotheses:

Hypothesis1c: Emergent subteam leadership is more likely to occur in subteams for which there are no designated subteam leaders than in other leadership configurations.

Hypothesis 1d: Emergent team leadership is more likely to occur in teams for which there is no designated team leader than in other leadership configurations.

As role behaviors are intended to promote positive outcomes, it is hypothesized that:

H1e: Role enactment of leader behaviors will be positively associated with perceived team and subteam performance and objective performance.

It has been hypothesized that subteam leader role enactment will be more salient to members than will team leader role enactments because of the proximity of the leader. Being aware of a leader's activities is a plausible antecedent to formulating an opinion of both the effectiveness of and satisfaction with that leader. Additionally, in virtual teams

leader roles have been shown to positively affect perceptions of leader effectiveness (Wakefield et al., 2008). Therefore, it is hypothesized that:

H1f: Role enactment will be associated with perceived leader effectiveness.

H1g: Leader role enactments will be associated with satisfaction with a leader such that subteam leader role enactments will have stronger (positive or negative) associations with satisfaction with a leader than will team leader role enactments.

When a leader's role behaviors are salient to members, the leader has achieved some level of presence, or in the case of a distant leader, "telepresence." Prior research has shown that satisfaction with a decision is higher when leaders are present than when there are no leaders (Kim, Hiltz and Turoff, 1998). Satisfaction with a group is more general than satisfaction with a decision; i.e., it encompasses more dimensions of affect. However, the presence of a leader, felt through the salience of leader role enactment, may also promote general satisfaction with a group. Therefore, it is hypothesized that:

H1h: Leader role enactment will be positively associated with satisfaction with a group such that subteam leader role enactment will be associated with satisfaction with the collocated ("my") subteam and team leader role enactment will be positively associated with satisfaction with both the collocated and the distant ("other") subteam in the team.

6.5 Hypotheses Arising from Research Question 2

Research Question 2 asks, "Does leadership configuration have an impact on the development of swift trust and longer term trust in PDTs and what are the effects of trust?"

Communication is a key element for building trust (Coppola et al., 2004, Jarvenpaa and Leidner, 1999). Coppola (2004) found that the effectiveness of the instructor in a class, in particular effectiveness of communication, influenced the building of swift trust. Swift trust is based on cues other than personal experiences; a possible cue is that the trustee is already trusted by a trusted authority. Therefore, the leader of a team may influence the building of trust by such measures as building communication, trust building exercises, and expressing his/her own feelings of trust. Local, collocated leadership behaviors are likely to be more salient to members of a team than leadership that is geographically distant. Distant leaders must develop "telepresence" (Zigurs, 2002) to project both presence and position. Collocated leaders have the advantage of face-to-face contact, while distant leaders must express their leadership with the less rich (Daft and Lengel, 1986) electronic medium. Thus, it may be that leadership behaviors will be more salient and influential when the leader is collocated. In that case, collocated subteam leaders' efforts at building trust and the communication that promotes trust may be more effective than the efforts of a distant leader. Additionally, although a team leader is collocated with one subteam, s/he may be cognitively distant from even the collocated team if s/he does not focus attention on the collocated subteam, but rather on the team as a whole instead. Since leadership influences the building of trust, this leads to:

H2a: Leadership configuration will impact trust such that teams with distributed leadership (i.e. Hierarchical and Decentralized) will develop higher levels of initial (swift) trust and longer lasting trust than teams with centralized leadership.

High trust has been shown to lead to better outcomes (Hung et al., 2004, Coppola et al., 2004). However, studies in the literature (Aubert and Kelsey, 2003, Jarvenpaa et al., 2004) suggest that trust, while associated with better perceptions of outcomes, is not associated with objective performance. Therefore, in this research it is hypothesized that there is a relationship to meet the requirements for hypotheses, but it is not expected that the hypothesis that there is a relationship between trust and objective performance will be supported.

In a PDT there are multiple ways for trust to be expressed. Trust can exist within a subteam and/or for the entire team. However, it is possible that trust will exist within a subteam and not for the distant subteam(s) (i.e. not between subteams). Such a situation may exist when in-group/out-group effects are strong and it is proposed that in such a case there will not be a perception of high team performance, leading to the hypotheses:

H2b: Trust within a subteam will be positively associated with perceptions of subteam performance.

H2c: Trust between subtreams will be positively associated with perceptions of team performance.

H2d: Trust will be associated with objective team performance.

Trust may also be associated with satisfaction with a leader. As noted above, leader actions influence the building and maintaining of trust. If a member has high trust in his or her team or subteam, then s/he is likely to trust and be satisfied with the leader as well. Therefore, it is hypothesized that

H2e: Trust for members of a subteam will be associated with satisfaction with a subteam leader.

H2f: Trust between subteams will be associated with satisfaction with a team leader.

Trust may also be associated with satisfaction with a group. Trust is a positive affect that is hypothesized in PDTs to lead to perceptions of positive outcomes and is an expression of a belief that the trustee will perform important actions without being monitored (Mayer et al., 1995). Therefore, a high trust team has members who are likely to be satisfied with their group members and the outcomes of the group's work. This is hypothesized to lead to general feelings of satisfaction with the group such that:

H2g: Trust for members of a subteam will be positively associated with satisfaction with the collocated ("my") subteam.

H2h: Trust between subteams will be positively associated with satisfaction with the remote ("other") subteam.

6.6 Hypotheses Arising from Research Question 3

Research Question 3 asks, "Does leadership configuration have an impact on perceived leadership effectiveness in PDTs and what are the effects of leadership effectiveness?"

As discussed above, it is proposed that subteam leader role behaviors will be more salient to members than team leader role behaviors. It follows that if a member is unaware of a leader's actions, then s/he is unlikely to perceive the leader as effective. Therefore, it is hypothesized that:

H3a: Leadership configuration influences perceptions of leader effectiveness such that perceptions of leader effectiveness will be higher for subteam leaders than for team leaders.

In virtual teams it has been shown that effective leadership positively affects members' perceptions of team performance (Wakefield et al., 2008). If a member perceives a team or subteam to be effective, then it is reasonable that s/he will ascribe some of that success to the effectiveness of the leader(s). Effective leadership should lead to better outcomes. Therefore, it is hypothesized that:

H3b: Perceived leader effectiveness will be positively associated with team and subteam performance.

It is proposed that there is a correlation between trust and perceptions of leader effectiveness. Effective leaders are able to promote trust (Coppola et al., 2004). In a PDT, though, leaders may be team leaders or subteam leaders. In the case of a team leader, an effective leader will focus on building trust for the entire team. An effective subteam leader will build trust in his or her subteam. However, it is proposed that even team leaders will also focus on their collocated subteam. As above, it is also proposed that subteam leader efforts at building trust will be more effective than team leader efforts. Therefore, it is hypothesized that:

H3c: Effective team leadership will be more positively associated with team trust than with subteam trust.

H3d: Effective subteam leadership will be more positively associated with subteam trust than with team trust.

H3e: Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership.

If a leader is perceived as effective, then it is natural for the member to also be satisfied with the leader, leading to the hypothesis:

H3f: Effective leadership will be positively associated with satisfaction with the leader.

Effective leadership is hypothesized to be associated with both performance and satisfaction with a leader. These are positive feelings about the group that may generalize into a general satisfaction. A subteam leader is likely to influence mostly the satisfaction with that subteam, while a team leader who is effective may influence satisfaction with both subteams. Therefore, it is hypothesized that:

H3g: Effective subteam leadership will be positively associated with satisfaction with the collocated ("my") subteam.

H3h: Effective team leadership will be positively associated with satisfaction with both the collocated ("my") subteam and the remote ("other") subteam.

6.7 Hypotheses Arising from Research Question 4

Research Question 4 asks, "Does distance (cultural, geographic, temporal) impact trust, leader role enactments, and/or perceived leader effectiveness?

The literature suggests that distance can create boundaries and faultlines that impact team functioning (Herbsleb et al., 2000, Swigger et al., 2004, McDonough III et al., 1999). Boundary issues may impact trust. In particular, cultural, geographic, and temporal distance may make trust more difficult to achieve and maintain. Trust requires effective communication and distance can impede communication (McDonough III et al., 1999). For example, temporal distance can create delays that can strengthen faultlines as the delays may not be understood to be a result of temporal distance, but rather be perceived to be a lack of responsiveness. The greater the distance, therefore, the stronger

the resulting faultline. This may make it even more difficult for a team leader to promote whole team identity. Therefore, it is hypothesized that:

H4a: The stronger the distance faultlines between subteams in PDTs, the lower the team trust.

The lack of awareness of leader role behaviors can result in ascribing team problems to a lack of leader effectiveness. For example, if there are delays in responses as a result of temporal distance, members may perceive the problem as a result of leader ineffectiveness. Therefore, it is hypothesized that:

H4b: The stronger the distance faultlines among subteams in a PDT, the lower the perceived leader effectiveness.

Distance may also affect the saliency of leader role behaviors to members. Strong faultlines can strengthen subgroup identity and weaken the whole team identity (Polzer et al., 2006) and, as a consequence, diminish team effectiveness. Then subteam members may not be aware of, or may ignore, team leadership that is not collocated with them, and to compensate, leadership may be shared and distributed amongst the collocated members. It is possible, however, that the issues of distance may compel leaders to enact even more strongly certain roles to manage the problems that arise because of distance. In that case, distance may actually increase the saliency of leader role enactments. Team leaders likely focus on coping with the issues of the distant subteams and subteam leaders will address issues of reaching across distance to their distant counterparts or, in the case of the Hierarchical condition, may be interacting with a team leader who is not collocated with them. This leads to the hypotheses:

H4c: The larger the distance faultlines between subteams, the more likely there will be emergent leaders who share leader roles with the designated leader(s).

H4d: Distance faultlines between subteams will affect the level of saliency of leadership role enactments to team members, either positively or negatively.

6.8 Questions Arising from Research Question 5

Research Question 5 asks, "What are the effects of ineffective bad leadership in PDTs?"

Ineffective bad leadership has three dimensions: incompetence, rigidity, and being intemperate (Kellerman, 2004). A leader who exhibits one or more of these characteristics can be characterized as being ineffective (Kellerman, 2004). Because the focus of research in the literature is on beneficial leadership, the literature does not provide guidance for the development of hypotheses about ineffective bad leadership. However, if the results of the post survey indicate that ineffective bad leadership was manifested in the studied PDTs, it will be explored. Questions to be asked are:

RQ5a: Is ineffective bad leadership salient in PDTs?

RQ5b: Is there a relationship between ineffective bad leadership and emergent leadership?

RQ5c: Is there a relationship between ineffective bad leadership and leader role enactments?

RQ5d: Is there a relationship between ineffective bad leadership and perceptions of leader effectiveness?

RQ5e: Is there a relationship between ineffective bad leadership and trust?

6.9 Questions Arising from Research Question 6

Research Question 6 asks, "Are there different patterns of enactment of leadership roles in different leadership structures?"

There is no literature to guide hypotheses for this research question. It is to be explored through an analysis of leader role enactments to see if any pattern emerges. For example, there may be a pattern in which some leadership roles are enacted more frequently in some conditions or by some types of leaders more than by others. Recognizing such patterns, if they exist, is important for a complete understanding of the effect of leadership configuration on leadership in PDTs. Understanding patterns of leader behavior, together with an understanding of leader effectiveness as it is influenced by leadership configuration, can guide future research into the training in leadership roles to promote leadership effectiveness.

6.10 Hypotheses Arising from Research Question 7

Research Question 7 asks, "Is there an effect on communications media use by leadership configuration and/or distance and are there relationships between communications media used and/or the technology used and enactment of leader roles?"

The participants will be providing information as to the frequency of their use of various communication media. The literature does not provide guidance as to what direction relationships between the constructs will take, if the relationships exist. Understanding patterns of media use and associations with leader roles and/or trust can lead to insights that can inform choice of technologies to provide to PDTs. Relationships between the constructs therefore are hypothesized as follows:

H7a: There is a relationship between leadership configuration and communications media used.

H7b: There is a relationship between distance and communications media used.

H7c: There is a relationship between communications media used and enactment of leader roles.

H7d: There is a relationship between communications media used and trust.

6.11 Questions Arising from Research Question 8

Research Question 8 asks, "Do teams with emergent leaders have greater or less satisfaction thatn those who retain their designated structure?"

The literature does not provide cues as to what predictions can be made for this question. However, by identifying teams that have emergent leadership through survey questions, and asking participants to rate their satisfaction with team and subteam, one can do an analysis to see if there is a difference in satisfaction for teams or subteams that do have emergent leadership.

CHAPTER 7

PILOT STUDY

7.1 Overview

In the spring of 2007, a pilot study was undertaken in advance of a full scale field experiment. The main purpose of the pilot study was to test and assess procedures and measurements before undertaking the full scale study. Previously, another pilot study was conducted with a single leadership configuration for all teams (Plotnick, Ocker, Hiltz and Rosson, 2008). For this pilot, leadership configuration was varied but distance was not measured.

One hundred forty five undergraduate and graduate students from United States universities in four states (Alabama, California, Hawaii, and Pennsylvania) were assigned to a partially distributed team (total of 15 teams) comprised of two subteams each. Subteams had four to six members each. For each team, within the subteams students were enrolled in the same university which was distant from the university of the other subteam in the team. The task was to develop functional requirements for an emergency response system for a specified country. All teams performed the same task.

There were three leadership conditions: Centralized, Decentralized, and Hierarchical with five teams per condition. In the Centralized condition there was an overall team leader, but no subteam leaders; in the Decentralized condition there was a subteam leader for each subteam, but no overall team leader; and in the Hierarchical condition there was a team leader and also a subteam leader for each subteam. Leaders were self-selected by the teams during the first week of the project.

Private space on a communication system, called the "wiki" in the pilot study, was provided to each team. There were discussion forums, the capability to create pages, and ability to upload pages. Participants within subteams met face-to-face; there was no face-to-face interaction between subteams. Although encouraged to use the "wiki" participants were not prohibited from using other forms of electronic communication.

Although all participants completed the task, completing the experimental instruments (e.g. surveys) was voluntary. Those students who volunteered to complete them were given consent forms prior to the start of the project. Extra credit was given for participating in the research or for an alternate assignment. The first week, the research participants completed a background survey and at the end of each week they completed a personal reflection in which they wrote about their experiences the prior week. At the end of the project the research participants completed a post survey. Surveys were web-based using the application SurveyMonkey®.

Triangulation was used for analysis as quantitative methods were employed to analyze the post surveys and qualitative methods were employed to explore the personal reflections for major themes regarding trust, leadership experiences, and perceptions of leadership behaviors and effectiveness.

7.2 Qualitative Analysis of Personal Reflections

The participants completed a total of four personal reflections (one per week). A single coder, this researcher, coded all of the leaders' reflections and the reflections of two teams randomly chosen from each condition, using codes based on theory in the literature. Coding was done using Atlas.ti®, a software application designed for

qualitative analysis. As coding progressed, additional codes were added to reflect themes that arose and the reflections were iteratively coded to include those themes. Pseudonyms are used in quoting the personal reflections to protect confidentiality. The number of participants, including leaders, in the teams for whom members' reflections were coded was: 19 Centralized; 20 Hierarchical; and 18 Decentralized. The total number of participants whose personal reflections were coded was 66.

7.2.1 Leadership Roles

Quinn (1988) described eight roles that leaders may enact when leading teams: producer, director, coordinator, monitor, facilitator, mentor, innovator, and broker. See Chapter 5 of this dissertation for descriptions of each role. The analysis of the personal reflections revealed that seven of the eight roles were enacted at least once by leader participants (See Table 7.1). There were no suggestions in the personal reflections of innovator role behaviors. It is noteworthy that no configuration had all roles reported.

Table 7.1 Breakdown of Reported Leader Roles

	Producer	Director	Coordinator	Monitor	Facilitator	Innovator	Mentor	Broker
Decentralized SubLeader	1	1	0	1	0	0	1	0
Hierarchical SubLeader	5	3	2	5	1	0	1	0
Hierarchical TeamLeader	1	2	1	2	2	0	0	0
Centralized TeamLeader	4	12	10	2	1	0	6	3

In the Hierarchical condition it can be observed that there were more roles reported, and more reports of role enactments, for the subteam leader than for the team leader. Although the sample was too small to draw definitive conclusions, it is possible that in the Hierarchical condition subteam leadership was more salient to the members as the team leader may have dealt directly more with the subteam leaders than with the members. One Hierarchical member, in discussing the team leader, said, "Mary (I think that's her name) made up some guidelines on what responsibilities come with being a leader." That is, the team member was unsure of the name of the team leader; thus the team leader was cognitively distant from the team member.

Thus, the qualitative analysis of personal reflections indicates that the leadership roles as described by Quinn (1988) are salient to members of PDTs. The findings suggest that leadership condition may influence the enactments of these roles. There are more reports of role enactment in the Centralized condition than the other two, especially for the mentor, coordinator, and director roles. It is only the Centralized condition that does not have subteam leaders. It is possible that when there are subteam leaders, leadership behaviors are more shared between the leaders and with non-leader members and therefore are less salient to the participants. The findings also suggest that emergent leadership behaviors, especially that of initiator (Yoo and Alavi, 2004), may influence the selection of leaders. When a member takes the initiative to plan or perform tasks, other members are aware of those behaviors and judge the member suitable for a leadership role. Since the expression of leader roles as described in the literature is validated for PDTs by qualitative analysis in this pilot, quantitative analysis was also performed on the post survey.

7.2.2 Perceptions of satisfaction with Leaders and Leader Effectiveness

All of the non-leaders' personal reflection entries that referred to satisfaction or dissatisfaction with the leaders were positive. The references went from extreme accolades ("The leadership we have is absolutely amazing.") to understated compliments ("Our team and subteam leaders are good."). These results were mirrored by the overwhelming positive references to leader effectiveness. All of the leadership configurations had personal reflections that expressed satisfaction with leadership and leadership effectiveness. However, the Decentralized condition had far fewer references than either of the other two. As mentioned above, it may be that leadership behaviors are shared more in this condition and so are not as salient to members.

7.2.3 Perceptions of Satisfaction with Role Behaviors

There were many behaviors that the reflections revealed led to these positive feelings. In terms of the leadership roles (Quinn, 1988) discussed above, some of the reported behaviors that were appreciated fit specific roles:

Producer role: "The leaders did a good job in helping our team get a lot accomplished this week." (Hierarchical member)

Director role: "Our team leader has gone over the specifics of what is expected. Our leader has been great in explaining what is going on and what needs to be done." (Centralized member)

Coordinator role: "Mary and Sarah (team and subteam leaders) did a great job organizing our group and coordinating specific online meeting times with our team members in Hawaii." (Hierarchical member)

Monitor role: "I think the leaders ..... made sure everyone contributed and that everything was completed" (Hierarchical member)

Facilitator role: "Ben, our leader, is doing a great job and we've made so much progress since the first week in terms of communication and cooperation." (Centralized member)

Mentor role: "My leader is doing an excellent job. He allows us to send all of our work to him before we submit it." (Decentralized member)

There were no references that specifically apply to the innovator or broker roles in terms of satisfaction and/or effectiveness.

Thus, by and large the personal reflections suggest that leadership was perceived as effective and that members were satisfied with their leaders' efforts. It is noteworthy that there were a few (three) references made by leaders to dissatisfaction with leadership. Two were from a Decentralized subteam leader who expressed dissatisfaction with her other subteam counterpart. This suggests that there was a contentious relationship between the two subteam leaders in the team. As it was a Decentralized team, there was no overall team leader to help resolve subteam conflict as was seen in some reflections in both the Hierarchical and Centralized conditions.

The other entry that noted a leader's dissatisfaction was from a Hierarchical subteam leader who was not satisfied with his own efforts. "I think my leadership was lacking a bit this week. A couple of my team members have not participated at all this week, and I never communicated with them that they have not made an impact on this project."

7.2.4 Perceptions of Satisfaction Over Time

Four personal reflections were completed by each participant. An analysis of members' reflections in two teams per condition suggtests that the pattern of expressions of satisfaction with leader(s) were different by condition as can be seen below in Table 7.2.

Table 7.2 Instances of Personal Reflections Expressing Satisfaction with Leader

	Team Number	R 1	PR 2	PR 3	PR 4	Total by team	Total by condition
Centralized Condition	11	1	2	3	0	6	14
	14	2	6	0	0	8	
Hierarchical Condition	21	0	1	0	0	1	8
	24	3	2	1	1	7	
Decentralized Condition	31	1	1	0	0	2	4
	33	0	1	0	1	2	
Total		7	13	4	2	26	26

Figure 7.1 below shows graphically the number of references to satisfaction with leader by leadership condition and time:

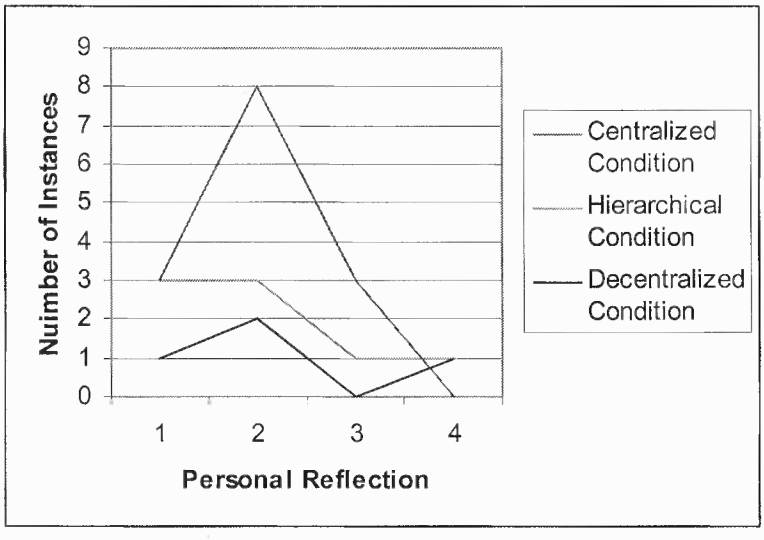

Figure 7.1 Satisfaction with leader by condition and time.

Overall, the number of expressions of satisfaction with a leader peaked at Reflection 2. However, that was driven by the Centralized condition teams having relatively many more such entries at that time. In the Hierarchical condition there was a

constant, albeit small, number of expressions of satisfaction for the first two weeks. Then the number dropped to zero for the last two weeks. In the Decentralized condition, there were a small number of entries for the first two weeks, none the third week, then one the last week. It must be noted that because there were virtually no mentions of dissatisfaction in any of the conditions, conclusions about the level of satisfaction are difficult to draw. However, it may be that the leadership activities were most salient in the second week when tasks were being organized and assigned.

7.2.5 Trust

Trust has been suggested by the literature to be important for team effectiveness and may be even more important in virtual teams where leaders are not present to supervise (Mayer et al., 1995). Jarvenpaa et al. (1998) tested a model of the antecedents of trust in global virtual teams as proposed by Mayer et al. (1995). Their model explains trust in virtual teams as developing from the antecedents of propensity to trust, and the trustor's perceptions of the trustee's ability, benevolence, and integrity (Jarvenpaa et al., 1998). There were some references to trust and lack of trust in the personal reflections of all three leadership conditions; some were descriptive enough to indicate which antecedent of trust had motivated the feelings; other reflections were not descriptive and only indicated general feelings of trust.

In the Hierarchical condition there were five references to trust and/or the antecedents of trust. All were positive and therefore indicated that trust existed. In contrast, references in the Decentralized and Centralized conditions were mixed. In the Decentralized condition there were three references; one indicated a lack of trust; one was mixed; and one indicated a perception of ability in the other subteam. The

Centralized condition reflections were even more negative. Of the four reflections, three were expressions of a lack of trust and one, made at the end of week 3, indicated a bulding of trust "as individual contribution increases." The mixed reflection indicated trust for the local subteam but not for the remote subteam because "we have not done anything." Thus, the trust or lack thereof, was built upon perceptions of contribution (ability) and communication.

That there were so few responses relative to trust suggests that trust issues were either not important or not salient to the members. However, those responses given suggest that it is ability and integrity that are most salient to members when they are forming perceptions of the trustee's trustworthiness.

7.2.6 Communication Problems

There were a number of communication problems reported in each condition (Centralized 11; Decentralized 7; Hierarchical 9). In each condition there was only one such problem reported at the end of the first week (lack of responsiveness of the remote subteam). The majority of references to problems with communication occurred after the second and third week when the teams were most involved in the task and therefore had high communications needs.

The two major themes that emerged were the lack of responsiveness of the remote subteam and not coming to an agreement on the medium for communication. For example, a Hierarchical subteam leader wrote, "we did not communicate well enough because the Hawaiians were using MSN Messenger and we were using AIM Messenger."

The preference for synchronous communication is apparent from the reflections. A number of participants complained about the lack of responsiveness of the other

subteam when using the PDT System ("wiki") or other asynchronous media. A Centralized participant noted, "Even e-mails take hours before any response is received."

Some of the lack of responsiveness was caused by conflicting schedules. The universities had different vacation schedules and they were not aware of these differences.

Interestingly, there were no specific references to time zone differences causing communication problems. However, it is likely that the temporal distributedness contributed to the time delays the participants found frustrating when waiting for responses from their "other" remote subteam.

Clearly communication problems were exacerbated by the subteams' failure to agree ahead of time on communication processes and protocols and their lack of awareness of the schedules of the other universities.

7.3 Quantitative Analysis of the Post Survey

7.3.1 Overview

The pilot study participants completed a post survey at the end of the four week project. Questions pertaining to leadership roles as defined by Quinn (1988) and leader encouragement of communication and work interactions were analyzed using the SAS® statistical package. Of 145 student participants, 99 took the survey. The survey was completed by 30/46 participants in the Centralized condition, 33/47 participants in the Decentralized condition, and 33/52 in the Hierarchical condition. The survey used logic so that the participants were only presented with questions pertaining to leadership that

was in their team (e.g. Decentralized participants were only asked about subteam leaders, not team leaders).

7.3.2 Leader Roles

Included in the survey was a set of items measuring the eight roles identified by Quinn (1988). The set was repeated twice; once as pertaining to subteams, and once pertaining to team leaders. Two questions derivede from a previously validated scale (Denison et al., 1995) were asked for each role. An additional question pertaining to director behavior and one pertaining to monitor behavior also were asked.

Prior research has suggested that factor analysis, a means of measuring validity, is not appropriate for all constructs (MacKenzie, Podsakoff and Jarvis, 2005, Petter, Straub and Rai, 2007). Constructs may be classified as either reflective or formative. Reflective constructs are those for which the measures each are reflective of the entire construct; formative constructs, on the other hand, are those for which the measures each reflect a part of the meaning of the construct and in total the measures define the constructs. With formative constructs, the measures may correlate with each other yet to delete any may alter the meaning of the construct as it is the group, not individual measures, that define the construct. As such, factor analysis is not an appropriate analytic tool for formative constructs. Mislabeling a formative construct as reflective is a common error and is one that can lead to Type I and Type II errors (Petter et al., 2007). Conceptually, the leader roles are an example of measures that, as a group, define a formative construct. However, the items measuring each role are reflective with respect to the role each measures. Therefore, a factor analysis was not performed on the roles as a whole. This also motivated the decision to assess reliability separately for each role rather than for all

roles together. In fact, although Denison et al. (1995) found convergent and divergent discriminant validity for the set of roles, in a later study (Hooijberg and Choi, 2000) three of the roles (producer, director, and coordinator) were found to have high intercorrelations, leading to the conclusion that they were all indicators of a single factor the authors called "goal achievement." In fact, it may be that the leadership roles are correlated, not because they are individual indicators of one factor, but because they are the factors that in sum define a formative construct, leader roles.

To test reliability of the role scales, Cronbach's alpha was calculated for the items for each role. As seen in Table 7.3, all alphas were satisfactory (over .7) thus reliability was achieved.

Table 7.3 Reliability Measures of Leader Roles – Cronbach's Alpha

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Team Leader	0.951	0.845	0.898	0.924	0.917	0.877	0.822	0.924
Subteam Leader	0.966	0.869	0.934	0.925	0.915	0.878	0.76	0.877

To ascertain whether or not leader roles were salient to members, for each leadership condition means of leadership role scores were calculated. The results, shown below in Tables 7.4 and 7.5 were that for each role, for both subteam and team leaders, the mean was over 5 out of a possible 7, indicating that leader roles identified by Quinn (1988) were enacted in these PDTs.

Table 7.4 Team Leader Role Enactment Means

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Decentralized	5.294	5.338	5.353	5.255	5.441	5.235	5.074	5.485
Hierarchical	5.748	5.726	5.935	5.839	5.711	5.667	5.565	5.711

Table 7.5 Subteam Leader Role Enactment Means

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Centralized	5.897	6.173	5.931	5.885	5.879	5.644	5.191	5.948
Hierarchical	5.565	5.516	5.339	5.452	5.613	5.215	5.290	5.435

To test whether the leadership condition impacted the saliency of leader role behaviors, nonparametric tests (Kruskal-Wallis) were performed as Kruskal-Wallis does not make the assumption that the dependent variable is normal, as the t-test does. None of the role measurements were normal, as the results of univariate analysis (Kolmogorov-Smirnov) showed and so the nonparametric tests were conducted. The results were that at the .05 level of significance, only the broker role with regard to team leaders was significantly different by condition.

7.3.3 Perceptions of Leader Encouragement

For each leader type (subteam and team), the respondents were asked to rate on a 7-point semantic differential scale from strongly disagree to strongly agree whether or not the leader encouraged members to work together in the subteam and whether or not the leader encouraged members to work together between subteams. Also asked was whether the leader encouraged members to communicate in their subteam and between subteams.

7.3.3.1 Leaders Encouraging Working Together... Although the measures for encouragement were not normally distributed, the t-test is robust to that requirement. Therefore, paired t-tests were performed and the results suggested that overall for all

subteam leaders across all conditions, there was more encouragement for working together within the subteam than for working together between subteams (t=5.74, p<.0001). Similarly, the team leaders encouraged working together more within subteams than between subteams (t=3.14, p=.0027).

Only in the Hierarchical condition were there both team and subteam leaders. An analysis of that condition alone yielded suggestions that in the Hierarchical condition subteam leaders encouraged both working together more within subteams than did team leaders (t=2.74, p=.0108), and working together more between subteams than did the Hierarchical team leaders (t=2.42, p=.0224). It can be understood then, that there was in general more encouragement within subteams than working together between subteams. In the Hierarchical condition, where both types of leaders were present, subteam leaders did more encouraging than did team leaders. One cannot, however, generalize that to all conditions as in the Centralized and Decentralized conditions there is only one type of leader.

A nonparametric test (Kruskal-Wallis) was employed to analyze whether or not configuration significantly influenced leaders' encouragement of working together. The results, shown below in Table 7.6 indicate that there is no significant difference by leadership configuration.

Table 7.6 Leaders Encouraging Working Together (Kruskal-Wallis tests)

Leader Type		Configuration1	Configuration2	Chi Squared	Pr>Chi Squared
Subteam Leaders	**Within**	Decentralized	Hierarchical	.5232	.4695
	Between	Decentralized	Hierarchical	1.4215	.2332
Team Leaders	**Within**	Centralized	Hierarchical	2.2262	.1357
	Between	Centralized	Hierarchical	3.7915	.0515

7.3.3.2 Leaders Encouraging Communication. Overall for all subteam leaders, paired t-tests suggest that there was more encouragement for communicating within subteams than for communicating between subteams (t=4.03, p=.001). Similarly, team leaders encouraged communicating within subteams more than communicating between subteams (t=2.59, p=.0119). In the Hierarchical condition, where both types of leaders were present, subteam leaders encouraged both communicating between subteams more than did team leaders (t=2.50, p=.0189) and communicating between subteams more than the Hierarchical team leaders (t=2.20, p=.0364).

As with the encouragement of working together, nonparametric tests (Kruskal-Wallis) were performed to analyze whether or not configuration significantly influenced leaders' encouragement of communicating. The results, shown below in Table 7.7, indicate that there was no difference by configuration.

Table 7.7 Leaders Encouraging Communicating Together (Kruskal-Wallis tests)

Leader Type		Configuration1	Configuration2	Chi Squared	Pr>Chi Squared
Subteam Leaders	**Within**	Decentralized	Hierarchical	.8534	.3556
	Between	Decentralized	Hierarchical	.0065	.9356
Team Leaders	**Within**	Centralized	Hierarchical	2.3262	.1272
	Between	Centralized	Hierarchical	1.4372	.2306

7.3.4 Leadership Roles vs. Perceptions of Performance

The survey asked respondents to rate the performance of their team and subteam on six dimensions: efficiency, quality, creativity, adherence to schedule, coordination, and communication. Cronbach's alpha reliability measures were adequate for both the perceived performance of subteam (α = .968) and for the perceived performance of team (α = .948). A factor analysis was performed for both measures of performance. In both

cases all items loaded on one factor with high loadings indicating that the six items regarding performance of team or subteam were all reflective of a single construct.

Tests were done to examine whether leadership configuration directly affected the perceived performance. For perceptions of team performance, an ANOVA was performed and the results indicated that leadership configuration does not significantly affect the perceptions of team performance ($F=1.77$, $p=.1754$). For subteam performance a nonparametric test (Kruskal-Wallis) was performed because subteam performance was not normally distributed and transformations failed to achieve normality. Those results also indicate that leadership configuration does not significantly affect perceptions of subteam performance (Chi-Square=.0905, $p=.9558$). However, it is proposed that leadership configuration may indirectly affect perceptions of performance through both the roles enacted and the type of leadership (subteam or team) associated with the configuration.

Therefore, more tests were performed. Correlations (Pearson's r) were performed to ascertain if there is a correlation between leadership role enactment and perceptions of performance. This was done for both subteam leader role enactments and team leader role enactments vs. perceptions of performance of team and subteam.

All subteam leader roles were significantly correlated with both subteam and team performance, indicating that there is an association between subteam leader behavior and perceived team and subteam performance. In contrast, none of the team leader roles were significantly correlated with subteam performance although most roles are correlated with team performance. This suggests that when team leader behavior is associated with performance, it is for performance at the team level only.

7.3.5 Trust

The survey had three items measuring trust, both for the respondents' subteam and for the other subteam in their team. The questions were adapted from a previously validated scale (Jarvenpaa et al., 1998). However, internal consistency measured by Cronbach's alpha were not sufficient to proceed with further analysis (trust for my subteam $\alpha = .094$; trust for the other subteam $\alpha = -.269$).

7.4 Conclusion and Lessons Learned

In this pilot, measures of satisfaction and trust were not available for analysis because the trust scale did not achieve adequate reliability and satisfaction was not measured in the survey. Cronbach's alpha is sensitive to the number of items (Cortina, 1993). Therefore, in the full-scale study the number of trust items were to be increased to include all four from Jarvenpaa et al. (1998) and trust items from another previously validated scale (Cummings and Bromiley, 1996) in the hopes of achieving satisfactory reliability.

Coding of the personal reflections validates the applicability of Quinn's (1988) leadership roles typology to PDTs. Qualitative analysis suggested that leadership configuration does influence leader role enactments. However, the quantitative analysis suggests that, with few exceptions, leadership configuration does not have a significant effect on leadership behavior. Yet there are real differences between subteam leader and team leader behaviors. Findings from the quantitative analysis also suggest that leaders focus more on within subteam interaction than between subteam interaction. These results are disappointing as one would hope that leaders would focus on team identity and interaction. However, it should be noted that in the pilot leaders were not given any

instructions as to what their responsibilities were. Students may not have had experience with leadership. Therefore, it was decided to provide descriptions of leader and member responsibilities in the full scale field studies.

Other problems were discovered through the pilot. For example, some of the teams did not reveal, as instructed, who the leaders were. Also, there were communication problems. For example, some teams did not agree on the communication media they would use between teams (e.g. which instant messenger) and so they had difficulty communicating. Therefore, it was planned that in the field studies the teams would create contracts (from a template) in which they would specify such things as who the leaders are, what communication media would be used, and how often they would communicate between subteams.

In addition, as problems were identified in the analyses of the pilot study, training modules to instruct participants how to avoid or manage those problems (e.g. unresponsiveness of the remote subteam) were prepared for use in the full scale studies.

All in all, the pilot was a useful exercise giving insights into both how PDTs function, what problems can arise, and what measures should be taken to ameliorate those problems.

CHAPTER 8

QUANTITATIVE ANALYSIS OF STUDY ONE

8.1 Introduction

During the fall semester of 2007, a full scale study was undertaken. The independent variables were leadership configuration and distance (cultural, geographic, and temporal). Although leadership configuration (Centralized, Decentralized, and Hierarchical) was varied through a manipulation, distance was held constant as all teams were comprised of students from the Netherlands and the east coast of the U.S.A. Since distance was held constant, relationships proposed in the model which include distance as a variable are not explored for this study.

This chapter describes first the subjects, conditions, and task. Then, quantitative analysis results are reported for those hypotheses for which data was collected in surveys or personal reflections. There were some variables in the model (i.e., satisfaction with the team/subteam, satisfaction with a leader, emergent leadership, and ineffective leadership) which were not measured in the surveys in this study. For hypotheses and research questions involving those variables, qualitative analysis through content coding of the personal reflections was done and is reported after the quantitative analysis results. Sections describing the analyses and results are organized by research question.

8.1.1 Subjects

Three hundred sixty four undergraduate students from three universities in two countries (USA and the Netherlands) were placed into 40 teams of seven to 11 members each. Each team consisted of two subteams. Each subteam within a team was from a different

university and country. Each subteam, however, was from the same face-to-face or hybrid class and so the members of the subteam were collocated with each other but distant from their teammates belonging to their team's other subteam.

8.1.2 Conditions

Teams were assigned each to one of three conditions: Centralized, Hierarchical, and Decentralized. In the Centralized condition, the team was to have one overall team leader and no subteam leaders; in the Hierarchical condition, the team was to have one overall team leader and each subteam (2) was to have one subteam leader; in the Decentralized condition, there was to be no overall team leader but each subteam (2) was to have one subteam leader. Each team PDT system private space included a link to a description of the leadership they were to choose along with leader responsibilities for each type of leadership in the assigned condition. Teams selected their leaders as part of the first week's activities to create a team contract. The teams were not informed of the name of their leadership condition but were only presented with information about the type of leader in their condition. There were to be 14 teams in the Centralized condition; 13 teams in the Hierarchical condition; and 13 teams in the Decentralized condition.

A manipulation check was done by examining the team contracts. The analysis of the team contracts indicated that, by and large, teams did not follow the instructions and did not select only the types of leaders they were instructed to choose. For all conditions, the teams tended to select leadership corresponding to the Decentralized condition, or some variation of that.

For the Centralized condition, only four teams selected an overall team leader and only an overall team leader. Eight teams selected subteam leaders and no overall team

leader (i.e., Decentralized condition). Of those eight, one selected two subteam leaders (co-leaders) for each subteam. One team selected a team leader and subteam leaders (2 subteam leaders per subteam). There was incomplete information for two teams.

For the Hierarchical condition, again, the majority of teams selected subteam leaders and no overall team leader. Four of the teams properly selected an overall team leader and one subteam leader for each of the two subteams. One team selected an overall team leader who also was to function as one of the two subteam leaders. Seven teams failed to select an overall team leader. Of those seven, one assigned co-subteam leaders (i.e., two subteam leaders per subteam). There was missing information for one of the teams.

The Decentralized condition teams were more successful in adhering to their assigned condition. However, one team did also select an overall team leader putting them in the Hierarchical condition, and two teams assigned co-subteam leaders for one or both of the subteams.

Thus, the participants seemed most comfortable in the Decentralized condition (i.e., choosing subteam leaders and no overall leaders). For future studies leadership selection instructions should be made stronger and clearer. Instructions should also be given that no one person should fill more than one position.

In addition, one Netherlands subteam moved to another team when they failed to receive responses to their emails from their US counterparts. The US subteam then continued the project alone but was no longer part of a partially distributed team. Therefore, data from that US subteam is not included in the analysis leaving a total of 359 subjects.

For the purposes of analysis, teams were assumed to be in the condition indicated by their team contract, not the assigned condition. Thus, for analysis, there were 28 teams in the Decentralized condition, four in the Centralized condition, and seven in the Hierarchical condition. In some cases, respondents still answered questions for leaders that should not have been in the selected condition as indicated by the team contract. Those responses were not included in the analysis. For example, if a team contract indicated that the team had self-selected the Decentralized condition and a respondent from that team answered a question about a team leader, the response was not included in the analysis.

Additionally, leader responsibilities were provided for each type of leader for the assigned conditions. The responsibilities were examined across the three conditions, the results of which were that the basic responsibilities were equivalent across assigned conditions.

8.1.3 Task

The primary task was to prepare a written report in response to a Request for Proposal (RFP) for a Grassroots Regional Resource Repository (GRRR) which was to be an emergency preparedness information system for the country of Peru. The participants were to prepare the report as if they were analysts in a multi-national consulting company bidding on the RFP. The final report was to specify the functional requirements of the GRRR as well as who the users would be and what policies to manage it were needed. All teams worked on the same task and the final report was due at the end of the four-week study period. Intermediate deliverables were designed to help the participants work well in a PDT and guide them in the process of preparing the final report. Final reports

were graded by a designee of the researchers as well as by two experts, all of whom followed the same grading rubric to ensure grading consistency.

8.1.4 Communication Media

Each team was provided with private space on the PDT system, a customized wiki that does not function as a wiki as open editing is not provided. Participants were able to post to discussion forums, create discussion forums, upload files, and create pages. Subteams also had the capability of creating private spaces that the "other" subteam in their team could not access. Communication was not restricted to the PDT system although all deliverables had to be posted in the team space.

8.1.5 Procedures

All participants worked on the task, the intermediate deliverables, and completed a peer review at the end of the project. Participation in the experimental instruments (surveys and personal reflections) was voluntary and participants received extra credit for completing them. Intermediate deliverables were posted on the team PDT space and emailed to the researchers.

The first week the participants engaged in activities that prepared them for working in a PDT. They completed a system tutorial and introduced themselves to each other in the team space on the PDT system. The participants also completed the first of three tutorial modules, the goals of which were to clarify team expectations and responsibilities, to raise awareness of issues of working in PDTs, and to select leaders. The participants read scenarios that described issues of working in PDTs with instructions that guided them to complete a team contract which included selecting and identifying leaders and agreements on how often and through what media they would

communicate in their teams. As part of the process of preparing the contract, members read a description posted on the PDT system of leader and member responsibilities. The experiment participants also completed a background survey and a personal reflection. Personal reflections include survey questions and an open-ended question for the participants to reflect on their experiences the week before.

Active work on the final deliverable began in week 2. All participants completed a tutorial module (Module 2) which had two activities. The first was a team building exercise in which the participants interviewed members of their counterpart subteam and built a team page of member biographies in the PDT system team space. The second activity was a brainstorming exercise in which the teams generated and shared ideas regarding the proposed system. The participants in the experiment also completed a second personal reflection.

The beginning of week 3 marked the midpoint of the project. During this week the participants completed Module 3 which had two activities. The first activity was a team assessment activity designed to help the participants assess their team interaction and performance and reach agreement on an action plan to improve it. The second activity, which had no deliverables, was to continue to work on the final report. Participants in the experiment also completed a third personal reflection.

During the fourth and final week the teams completed their final deliverable using a proposal template provided to them on the PDT system. The participants also completed a peer evaluation form. Participants in the experiment completed another personal reflection, and two post surveys.

8.2 Quantitative Measures of Intervening Variables

The primary sources of data were the personal reflections and two post surveys.

8.2.1 Enactment of Leader Roles

The post survey had 18 items per leader type (subteam or team leader) relating to the eight leadership roles identified by Quinn (1988). The eight roles are innovator, broker, producer, coordinator, monitor, facilitator, and mentor (Denison et al., 1995). The participants were asked about the extent to which their leaders enacted each role behavior. Scale items were derived from Denison et al. (1995) with two 7-point semantic differential scale items per role and two additional new items (one for the director role and one for the monitor role).

8.2.2 Perceived Leader Effectiveness

Perceived leader effectiveness was measured by scale items asking the participants to rate the performance of their subteam and team leaders on 10-point semantic differential scales in the post survey.

8.2.3 Trust

Ten scale items for trust within a subteam (with the same ten items repeated for trust between subteams) were included in the post survey. The ten 7-point semantic differential scales for trust had four questions (8 total) adapted from Jarvenpaa, Knoll, and Leidner (1998) and six questions (12 total) adapted from Cummings and Bromily (1996) to measure affective trust in the dimensions of "keeps commitments," "negotiates honestly," and "avoids taking excessive advantage."

8.2.4 Communication Media

To capture what communication media teams used, the post survey had a series of questions asking the frequency of use of 13 different communication media (plus "other") on a scale of 1 (never) to 7 (to a great extent) for both communication within a subteam and communication between subteams. The communication media rated were wiki (PDT System), instant messaging, e-mail, text messaging, Facebook, phone, Internet phone (e.g., Skype), face-to-face meetings, FAX, video conferencing, teleconference calls, course management system, and external forums or bulletin boards.

8.3 Quantitative Measures of Dependent Variables

Perceived performance was measured in the post survey by six 7-point semantic differential scales each for perceived performance of the subteam and perceived performance of the team. The scale items were adapted from (Mortensen and Hinds, 2001). Each question asked about one of six dimensions of performance: efficiency, quality, creativity, adherence to schedule, coordination of member efforts, and communication between members.

Objective performance was measured at the team level in two ways. The final deliverable was graded by a research assistant designated by the researchers, using a rubric designed by the researchers. Also, two experts, experienced in emergency management and software development, evaluated the final reports using the same rubric as the research assistant. Two teams failed to hand in a final deliverable and one team was excluded from the analysis because, as discussed above, they were not a partially

distributed team. Therefore, there were 37 teams for which objective performance was measured.

Paired t-tests were performed for the research assistant's grades and each of the two expert's grades and the results indicated that each pair was significantly different (for the research assistant and expert1 $t=2.17$, $p=.0367$; for the research assistant and expert2 $t=7.19$, $p<.0001$). Additionally, a paired t-test of the two experts' grades suggested that they, too, were significantly different ($t=4.77$, $p<.0001$). However, additional tests were done to see how the rankings of the three sets of grades compared. Spearman rank correlation coefficients were obtained and showed that the research assistant and expert1 grades were significantly correlated ($r=.52393$, $p=.0009$); the research assistant and expert2 grades were significantly correlated ($r=.76211$, $p<.0001$); and the two experts' grades were significantly correlated ($r=.62433$, $p<.0001$). Therefore, the objective measure of performance is taken to be the average of the three grades generated by the grader and two experts. Note that objective performance, based on the evaluations of the final deliverable, is at the team level only.

It is also of interest to compare perceived team performance at the individual level with objective performance, measured as described above. Perceived team performance was not normally distributed and so a Spearman's r test was done to compare it to objective performance. The results indicate that perceived team performance and objective performance were significantly correlated ($r=.15085$, $p=.0159$, $N=255$).

8.4 Reliability and Validity of Scales

Reliability measures were taken for multi-item scales. When appropriate (i.e., on reflective scales), a factor analysis (principal components analysis with varimax rotation) was also performed. The statistical packages SPSS®, SAS®, and SmartPLS (Ringle, Wende and Will, 2005) were used to measure reliability of the scales and to perform factor analyses.

The items used to measure role enactments were modified from a previously validated scale (Denison et al., 1995) with the addition of two items. Prior research has suggested that factor analysis, a means of measuring validity, is not appropriate for all constructs (MacKenzie et al., 2005, Petter et al., 2007). Constructs may be classified as either reflective or formative. Reflective constructs are those for which the measures each are reflective of the entire construct; formative constructs are those for which the measures each reflect a part of the meaning of the construct and in total the measures define the construct. With formative constructs, the measures may correlate with each other yet to delete any may alter the meaning of the construct because it is the complete set, not the individual items, which define the construct. As such, factor analysis is not an appropriate analytic tool for formative constructs. Conceptually, the leader roles are a formative construct. That is, as a group, the roles define the construct. Therefore, a factor analysis was not performed on the roles as a single construct. However, there were multiple items per role (two or three). Those items are reflective of their particular role. Therefore, Cronbach's alphas, as shown in the table below, were calculated for the items by role (for subteam and team leader) and all were adequate at above .7.

Table 8.1 Cronbach's Alpha Reliability Measures for Leader Roles

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Team Leader	.923	.899	.944	.936	.909	.880	.847	.897
Subteam Leader	.934	.854	.951	.938	.910	.891	.736	.915

Perceptions of team and subteam performance were measured by six items each reflecting six dimensions of team and subteam performance (i.e. 12 items in all). For each of subteam and team performance as perceived by the participants, reliability measures were taken. Reliability was adequate with Cronbach's alphas of .920 for items measuring perceptions of subteam performance, and .912 for items measuring perceptions of team performance. Factor analyses resulted in loadings on one factor each for perceptions of subteam and team performance. Bernard (Bernard, 2000) suggests that .6 be the cutoff for unambiguous loading on a factor in factor analysis and that variables that load between .3 and .59 are worthy of consideration for accepting that a variable has loaded on a factor. All of the loadings were above .8, well above the .6 cut-off, indicating that in each case there is just one factor underlying the data. The factor analyses loadings are shown below in tables 8.2 and 8.3.

Table 8.2 Factor Analysis Loadings – Subteam Performance

	Component 1
Efficiency	.848
Quality	.883
Creativity	.811
Adherence to Schedule	.829
Coordination of member efforts	.877
Communication between members	.836

Table 8.3 Factor Analysis Loadings – Team Performance

	Component 1
Efficiency	.848
Quality	.840
Creativity	.801
Adherence to Schedule	.831
Coordination between subteams	.871
Communication between subteams	.821

Trust was measured by 10 items which, for this first study, were included only in the post survey. Four were modified from Jarvenpaa, Knoll, and Leidner (1998) and six were modified from Cummings and Bromiley (1996). The scale was repeated so that trust was measured for "my subteam" and for "other subteam." Reliability of the entire scale was adequate with Cronbach's alpha of .859 for the scale as applied to "my subteam" and .849 as applied to the "other subteam."

However, a factor analysis of the trust scale, with negative items reversed, uncovered two factors in each case, and the factors were not divided by the source, but rather by whether the items were positive or negative Additionally, an examination of communalities indicate that questions 5 and 10, with communalities of less than 4.5, should be removed. Hair et al. (2006) suggest that variables with communalities of less than 5.0 be removed but that the benchmark of 5.0 is not firm. As exploratory research, this research uses 4.5 as the cut-off for removing variables.

Table 8.4 Factor Analysis Loading for Trust in "My Subteam"

	Component 1	Component 2
1. I would have preferred if some members had less influence over important aspects of the project in my subteam	.244	**.726**
2. I wanted to more closely monitor the work of members in my subteam	.269	**.773**
3. I was comfortable when other members worked on a critical task or problem in my subteam	**.750**	.145
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in my subteam	**.805**	.223
5. I felt that members tried to get out of their commitments in my subteam	.239	**.646**
6. I felt that members kept their word in my subteam	**.735**	.222
7. I felt that members were honest with me in my subteam	**.762**	.257
8. I felt that members negotiated joint expectations fairly in my subteam	**.787**	.179
9. I felt that members tried to get the upper hand in my subteam	.098	**.713**
10. I felt confident that members would not exploit me in my subteam	**.590**	.287

Table 8.5 Factor Analysis Loadings for Trust for "Other Subteam"

	Component 1	Component 2
1. I would have preferred if some members had less influence over important aspects of the project in other subteam	.230	**.744**
2. I wanted to more closely monitor the work of members in other subteam	.177	**.736**
3. I was comfortable when other members worked on a critical task or problem in other subteam	**.731**	.225
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in other subteam	**.760**	.240
5. I felt that members tried to get out of their commitments in other subteam	.340	**.624**
6. I felt that members kept their word in other subteam	**.719**	.255
7. I felt that members were honest with me in other subteam	**.821**	.156
8. I felt that members negotiated joint expectations fairly in other subteam	**.831**	.113
9. I felt that members tried to get the upper hand in other subteam	.084	**.658**
10. I felt confident that members would not exploit me in other subteam	**.575**	.218

After removing questions 5 and 10, factor analysis was performed again using varimax rotation. The results of the factor analysis, and the resulting communalities, are shown below in Figures 8.6 to 8.9. Communalities for the variables of the reduced scale were adequate.

Table 8.6 Factor Analysis of Trust for "My Subteam"

	Component 1	Component 2
1. I would have preferred if some members had less influence over important aspects of the project in my subteam	.2611	**.7324**
2. I wanted to more closely monitor the work of members in my subteam	.2027	**.7714**
3. I was comfortable when other members worked on a critical task or problem in my subteam	**.7636**	.1367
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in my subteam	**.8119**	.2217
5. I felt that members tried to get out of their commitments in my subteam	----	-------
6. I felt that members kept their word in my subteam	**.7532**	.2153
7. I felt that members were honest with me in my subteam	**.7664**	.2569
8. I felt that members negotiated joint expectations fairly in my subteam	**.7855**	.1670
9. I felt that members tried to get the upper hand in my subteam	.0729	**.7866**
10. I felt confident that members would not exploit me in my subteam	--------	--------

Table 8.7 Communalities for Trust for "My Subteam"

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.605	.681	.602	.708	------	.614	.653	.645	.624	------

Table 8.8 Factor Analysis of Trust for the "Other Subteam"

	Component 1	Component 2
1. I would have preferred if some members had less influence over important aspects of the project in the other subteam	.2518	**.7424**
2. I wanted to more closely monitor the work of members in the other subteam	.2098	**.7520**
3. I was comfortable when other members worked on a critical task or problem in the other subteam	**.7473**	.2279
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in the other subteam	**.7788**	.2467
5. I felt that members tried to get out of their commitments in the other subteam	--------	----------
6. I felt that members kept their word in the other subteam	**.7423**	.2237

Table 8.8 Factor Analysis of Trust for the "Other Subteam" continued

	Component 1	Component 2
7. I felt that members were honest with me in the other subteam	**.8234**	.1325
8. I felt that members negotiated joint expectations fairly in the other subteam	**.8314**	.0990
9. I felt that members tried to get the upper hand in the other subteam	.0740	**.7050**
10. I felt confident that members would not exploit me in the other subteam	---------	----------

Table 8.9 Communalities for Trust for the "Other Subteam"

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.615	,610	.610	.667	--------	.601	.695	.701	.502	-------

An examination of the factors obtained in the factor analysis suggests that one factor (Questions 3, 4, 6, 7, and 8) can be termed "Personal Trust" as that is the trust that is based on the interactions the participants have had with each other. This trust is an individual trust that is based upon the observed behavior of the individual trustees. The other factor (Questions 1, 2, and 9) is termed in this research "Process Trust" as it is trust based upon inferences made from the process of the team working together. So, for example, monitoring members' work (Q2) is process related as is the notion that a member tries to "get the upper hand" (Q9).

Reliability measures were then taken to assess the reliability of each of the two kinds of trust. Cronbach's alpha was first performed but did not yield good reliability. Note that Cronbach's is sensitive to the number of items in a scale (Ocker, Kracaw, Hiltz, Rosson and Plotnick, 2009, Hair, Black, Babin, Anderson and Tatham, 2006, Cortina, 1993) and the dimensions of trust (especially process trust) have few items. Composite reliability, however, is not sensitive to the number of items in the scale (Ocker et al.,

2009). Therefore, composite reliability was assessed using SmartPLS (Ringle et al., 2005), a Structural Equation Modeling tool. SmartPLS also provides the average variance explained (AVE) which Chin (1998) says can be interpreted as a measure of reliability and should be over .5 for good reliability. The composite reliability, according to Hair et al. (2006), should be .7 or higher although scores of between .6 and .7 may be acceptable if there are other indicators of a model's good construct validity. The results are shown below in Table 8.10. All composite reliability scores were above .7 and AVE were above .5 thus indicating good reliability for Process Trust and Personal Trust for both "my subteam" and the "other subteam."

Table 8.10 Composite Reliability and AVE for Trust, Reduced Scales

Data Set	Type of Trust	Composite Reliability	AVE
Long term trust for "my" subteam	Personal Trust	.8999	.6429
	Process Trust	.8212	.6118
Long term trust for the "other" subteam	Personal Trust	.9029	.6506
	Process Trust	.7662	.5436

The extent of use of different means of communication (media used) was measured by a series of 7-point semantic differential scale items for 14 media used both within subteam and between subteam. The means of communication form a formative construct and therefore factor analysis was not performed. There was one question for each medium for use within a subteam and one for between subteams. The extent of use was asked about the following media: Wiki (PDT System), instant messaging, e-mail, text messaging, Facebook, phone, Internet phone, face-to-face meetings, FAX, video conferencing, teleconferencing, course management systems, external forums (bulletin boards), and "other."

The statistical software SAS® was used to conduct the quantitative analysis that is described in the rest of this chapter.

8.5 Research Question 1 – Leadership Roles : Quantitative Analysis

Research question RQ1 asks, "What do leaders in PDTs do and does leadership configuration affect what leaders do?"

8.5.1 Hypothesis 1a: Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs.

For each role (innovator, broker, producer, director, coordinator, monitor, facilitator, mentor), the values of the scale items that measured the role were averaged to arrive at a score (from 1 to 7) for the salience of that role enactment to members. Averaging was used because the number of items was not the same for each role. In some subteams the members had selected co-subteam leaders. In such cases, for each role, the scores (on a scale of 1 to 7) for the two leaders were averaged to arrive at a subteam leader role score. A total of 218 participants completed the items regarding subteam leaders; 65 participants completed the team leader role questions. Below, in Table 8.11, is a table of the means of the role enactment scores for each role for subteam and team leaders. Standard deviations are in parentheses.

Table 8.11 Means and Standard Deviations of Leader Role Enactment Scores

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Leader	5.372 (1.266)	5.638 (1.280)	5.654 (1.325)	5.555 (1.320)	5.722 (1.321)	5.323 (1.356)	5.206 (1.463)	5.509 (1.327)
Team Leader	5.200 (1.374)	5.462 (1.347)	5.408 (1.422)	5.338 (1.379)	5.323 (1.379)	5.226 (1.327)	5.092 (1.403)	5.300 (1.397)

For both subteam leaders and team leaders, the mean score for each role was greater than 5 out of 7, with a low of 5.092 for team leader as facilitator, to a high of 5.654 for subteam leader as producer. The generally positive ratings suggest that the

leaders did enact the leadership roles identified by Quinn (1988), thus lending support to Hypothesis 1a. The average values for team leaders were consistently a little lower than those for subteam leaders, but this is not surprising given the smaller distance from leader to member for subteam leaders.

8.5.2 Hypothesis 1b: Leadership configuration will influence role enactment.

Because of the way the data were collected, when there are co-leaders for a given subteam, it is not possible to ascertain which co-leader a question is being answered about. Therefore, the co-subteam leader scores are aggregated by taking the mean to arrive at a subteam leader score for that particular subteam.

Leader role enactment was not normally distributed and transformations (e.g., log, exp, various exponents and roots) have failed. However, the F-test is robust to issues of normality so both ANOVA and nonparametric (Kruskal-Wallis) tests were run to see if leader role enactment varied by leadership condition (Centralized, Decentralized, Hierarchical). It should be noted that, for all roles, model adequacy of the ANOVA was not achieved as the residuals were also not normally distributed, which is another reason for using the nonparametric tests.

The results of the ANOVA and Tukey tests, as seen below, suggest that the innovator, broker, producer, director, facilitator, and mentor role enactments varied by configuration, with leaders in teams that have local leaders (i.e. subleaders) having greater salience of role enactments to the participants than leaders in the condition without local leaders (i.e., Centralized condition). The only role that failed to show a difference in enactment based upon configuration was the monitor role, and that was

barely insignificant (p=.0571) at the .05 level of significance. Thus, the tests suggest that leadership configuration does affect leader role enactment.

Table 8.12 Results of ANOVA for Leader Role Enactments by Configuration (N=283)

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
8.36	**7.99**	**4.94**	**4.19**	**5.20**	2.89	**4.61**	**3.13**
.0003*	**.0004***	**.0078***	**.0162***	**.0061***	.0571	**.0107***	**.0451***

Table 8.13 Significant Results of Tukey Test of Roles by Condition

For Innovator: Hierarchical > Centralized Decentralized > Centralized Hierarchical == Decentralized
For Broker: Hierarchical > Centralized Decentralized > Centralized Hierarchical == Decentralized
For Producer Hierarchical > Centralized Decentralized > Centralized Hierarchical == Decentralized
For Director Hierarchical>Centralized Decentralized > Centralized Hierarchical==Decentralized
For Coordinator Hierarchical>Centralized Decentralized>Centralized Hierarchical==Decentralized
For Monitor Hierarchical>Centralized Decentralized==Hierarchical Decentralized==Centralized
For Facilitator Hierarchical > Centralized Decentralized > Centralized Hierarchical == Decentralized
For Mentor Hierarchical>Centralized Decentralized>Centralized Decentralized==Hierarchical

The results of the nonparametric tests also find that the innovator, broker, producer, coordinator, and facilitator roles vary by leadership configuration. However, unlike the ANOVA, the nonparametric test failed to detect a significant difference by condition for the enactment of the director role.

Table 8.14 Results of Nonparametric Test for Effects of Configuration on Roles

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Centralized Mean & SD (N=17)	4.15 (1.71)	4.44 (1.79)	4.62 (1.89)	4.61 (1.95)	4.65 (1.89)	4.55 (1.69)	4.18 (1.78)	4.68 (1.95)
Decentralized Mean & SD (N=165)	5.36 (1.31)	5.62 (1.29)	5.69 (1.31)	5.57 (1.32)	5.73 (1.33)	5.33 (1.36)	5.21 (1.47)	5.52 (1.37)
Hierarchical Mean & SD (N=101)	5.49 (1.07)	5.76 (1.12)	5.63 (1.25)	5.56 (1.19)	5.63 (1.19)	5.38 (1.23)	5.31 (1.30)	5.50 (1.13)
Chi-Square	11.0634	9.9917	6.0912	4.2346	7.2390	4.3864	6.3681	3.0243
Pr>Chi-Square	**.0040***	**.0068***	**.0476***	.1204	**.0268***	.1116	**.0414***	.2204

For each leader role, a comparison was made of subteam leader role enactment and team leader role enactment of that role. T-tests were performed but because leader role enactment was not normally distributed for any role, nonparametric tests (Kruskal-Wallis) were also run, even though the t-test is robust for the requirement of normality. While perceived leader role enactment is consistently higher for subteam leader than for team leader, the results indicate that there is a significant difference only for the coordinator role. The nonparametric tests showed a significant difference also for the monitor role.

Table 8.15 Results of t-tests: Subteam leader vs. Team Leader Enactment of Roles

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
t	.94	.96	1.29	1.15	2.12	.51	.56	1.10
p-value	.3481	.3370	.1977	.2513	**.0350***	.6114	.5780	.2714

Table 8.16 Kruskal-Wallis: Subteam Leader vs. Team Leader Enactment of Roles

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Leader Means & SD (N=218)	5.37 (1.27)	5.64 (1.28)	5.65 (1.33)	5.56 (1.32)	5.72 (1.32)	5.32 (1.36)	5.21 (1.46)	5.51 (1.33)
Team Leader Means & SD (N=65)	5.20 (1.37)	5.46 (1.35)	5.41 (1.42)	5.34 (1.38)	5.32 (1.38)	5.23 (1.33)	5.09 (1.40)	5.30 (1.40)
Chi-Square	.7101	1.0544	1.8189	.1.6006	5.9524	.4540	.5503	1.1289
p-value	.3994	.3045	.1774	.2058	**.0147***	**.5005***	.4582	.2880

Thus, although roles do vary by condition, there is not a significant difference for role enactment between subteam and team leaders except for the coordinator and monitor roles. Hypothesis 1b is partially supported.

8.5.3 Hypothesis 1e: Role enactment of leader behaviors will be positively associated with perceived team and subteam performance and objective performance.

Perceived team and subteam performance were measured by scales of six items each measuring efficiency, quality, creativity, adherence to schedule, coordination, and communication performance dimensions. Objective performance was measured by the team grade given for the final deliverable by a designee of the researchers. Additionally, the final deliverable was evaluated by two expert judges. For this analysis, objective performance was measured as the average of the three evaluations.

A correlation was done for each role behavior at the team level (mean for each team) and objective performance (Spearman rank correlation coefficients were used because the roles were not normally distributed). Both subteam and team leader role behaviors were included in the analysis. The results, shown below in Table 8.17 with the

correlation coefficient in the first row and the significance level in the second row, indicates that for all roles, leader role behavior was not significantly correlated with objective performance although it is very close for the broker role.

Table 8.17 Leader Roles vs. Objective Performance

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Objective	.07351	.32379	.12670	.18438	.06904	.11934	.08807	.23933
Performance	.6701	.0541	.4615	.2817	.6891	.4882	.6095	.1598

A correlation (Spearman rank correlation coefficient) was done for each role (again, as enacted by both subteam and team leaders) and perceived subteam performance, and each role and perceived team performance. Missing values were not used in the analysis so there were a total of 271 observations for each correlation. All correlations were significant at the .05 level of significance. That is, leader roles are significantly associated with perceived performance (team and subteam) for all roles. Results show that the correlations are highest for producer, director, and coordinator roles.

Table 8.18 Leader Roles vs. Perceived Performance (Spearman's r p) N=271

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Performance	**.3104 <.0001***	**.3271 <.0001 ***	**.4192 <.0001***	**.4103 <.0001 ***	**.4033 <.0001***	**.3738 <.0001 ***	**.2970 .0003***	**.3766 <.0001 ***
Team Performance	**.3524 <.0001***	**.2911 <.0001 ***	**.3711 <.0001***	**.3969 <.0001 ***	**.3774 <.0001***	**.3882 <.0001 ***	**.2763 <.0001***	**.3209 <.0001 ***

It is of interest to explore if, when one looks at only subteam leaders or only team leaders, the associations of the roles with perceived performance hold. Therefore, correlations were performed for each role vs. perceived performance for only subteam leaders and then also for only team leaders. For all subteam leader roles, as shown below in Table 8.19, the correlations were significant at the .0001 level. Team leader role

enactments are also significantly correlated with both perceived team and perceived subteam performance for all roles except for innovator with subteam performance and facilitator with subteam performance.

Table 8.19 Subteam Leader Roles vs. Perceived Performance (Spearman's r p) N=210

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Performance	**.32568 <.0001 ***	**.33026 <.0001 ***	**.41274 <.0001***	**.38288 <.0001 ***	**.38195 <.0001***	**.36104 <.0001 ***	**.31288 <.0001***	**.38494 <.0001 ***
Team Performance	**.35243 <.0001 ***	**.26469 <.0001 ***	**.32648 <.0001***	**.33534 <.0001 ***	**.33638 <.0001***	**.36255 <.0001 ***	**.26549 .0001***	**.29677 <.0001 ***

Table 8.20 Team Leader Roles vs. Perceived Performance (Spearman's r p) N=61

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Performance	.24525 .0568	**.29077 .0230***	**.43254 .0005***	**.48937 <.0001***	**.47223 .0001***	**.39273 .0017***	.20543 .1122	**.33631 .0080***
Team Performance	**.35819 0046***	**.37172 0032***	**.52259 <.0001***	**.60492 <.0001***	**.55215 <.0001***	**.47637 .0001***	**.29938 .0191***	**.42979 0005***

Thus Hypothesis 1e is supported for perceived performance but not for objective performance.

8.5.4 Hypothesis 1f: Role enactment will be associated with perceived leader effectiveness.

Participants were asked to rate the performance of their subteam leader(s) and team leader with a single item each. Correlations were taken of the role enactments for all leaders vs. the perceived leader performance (effectiveness). If a participant reported that his or her subteam had two subteam leaders (co-leaders), then the role and performance scores for subteam leader were determined by averaging the two subteam leader scores reported. The results of the correlations indicate, as shown in the table below, that for all roles, role enactment is highly correlated with perceived leader effectiveness.

Table 8.21 Correlations of Leader Roles vs. Perceived Leader Performance N=265

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.64268	**.62178**	**.63384**	**.64229**	**.66615**	**.64431**	**.53170**	**.54432**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

Correlations were also done for subteam leader role enactments vs. perceived subteam leader effectiveness and team leader role enactments vs. perceived team leader effectiveness. As shown in Tables 8.22 and 8.23 below, all correlations were highly significant. Thus, Hypothesis 1f is supported.

Table 8.22 Subteam Leader Roles vs. Subteam Leader Performance N=205

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.63294	**.61086**	**.62181**	**.62581**	**.65427**	**.64933**	**.54788**	**.54747**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

Table 8.23 Team Leader Roles vs. Team Leader Performance N =60

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.67788	**..66123**	**.66837**	**.68432**	**.69370**	**.61593**	**.46963**	**.52173**
<.0001*	**<.0001**	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**.0002***	**<.0001***

8.6 Research Question 2 – Trust: Quantitative Analysis

Research question 2 asks, "Does leadership configuration have an impact on the development of swift trust and longer term trust in PDTs and what are the effects of trust?" Swift trust will be examined using qualitative methods because in this study (Study 1), trust was not measured in a survey early on but was only measured at the end of the 4-week project.

8.6.1 Hypothesis 2a: Leadership configuration will impact trust such that teams with distributed leadership will develop higher levels of initial (swift) trust and longer lasting trust than teams with centralized leadership.

For longer term trust, the results of the trust scale in the post survey were used in the analysis. Trust was measured for "my subteam" (i.e., trust of the participant for the members of his or her collocated subteam) and for the "other subteam" (i.e., trust of the participant for the members of the distant subteam in the team). In both cases, both Personal Trust and Process Trust were not normally distributed and a number of transformations (e.g., log, exponential, various roots and exponents) failed to achieve normality. However, the F test (ANOVA) is robust to requirements for normality and therefore, both ANOVA and nonparametric (Kruskal-Wallis) tests were performed to see if trust varied by actual leadership configuration.

For trust for "my subteam" the ANOVA failed to find significant differences by leadership configuration for either Personal Trust (F=.38, p=.6848, N=268) or for Process Trust (F=.31, p=.7328, N=268). Similarly, for trust for the "other subteam" the results were insignificant for both Personal Trust (F=.09, p=.9104, N=268) and Process Trust (F=.53, p=.5865, N=268).

The results of nonparametric testing (Kruskal-Wallis) were consistent with the ANOVA results. For trust for "my subteam" the results were insignificant for both Personal Trust (X^2=.6037, p=.7394, N=268) and Process Trust (X^2=.6019, p=.7401, N=268). Similarly, for trust for the "other team" the test failed to find significant differences by leadership configuration for either Personal Trust (X^2=.2279, p=.8923, N=268) or for Process Trust (X^2=1.2794, p=.5275, N=268).

Thus, Hypothesis 2a is not supported. However, it is important to note that because of the adoption of the Decentralized condition by most of the teams, while there were 187 observations in the Decentralized condition, there were only 54 in the Hierarchical condition and 27 in the Centralized condition. With such small n's for the Hierarchical condition and Centralized condition, power is diminished. Therefore, it will be interesting to see if similar results are achieved in Study 2.

8.6.2 Hypothesis 2b: Trust within a subteam will be positively associated with perceptions of subteam performance.

Perceptions of subteam and team performance were measured, as described above, by a scale of six semantic differential items each. An aggregate score was calculated for both perceptions of subteam performance and perceptions of team performance.

Spearman's tests of correlation of perceptions of subteam performance with Personal Trust for "my subteam" and for perceptions of subteam performance and Process Trust for "my subteam" were performed because the variables were not normally distributed. The results of the correlation with Personal Trust was significant ($r=.47348$, $p<.0001$, $N=268$) as was the result for the correlation with Process Trust ($r=.27755$, $p<.0001$, $N=268$). Thus, Hypothesis 2b is supported.

8.6.3 Hypothesis 2c: Trust between subteams will be positively associated with perceptions of team performance.

Spearman's tests of correlation of perceptions of team performance with Personal Trust for the "other subteam" and with Process Trust for the "other subteam" were performed because the variables were not normally distributed. The results were similar for both

types of trust with significant results for correlation with Personal Trust (r=.51334, p<.0001, N=268) and significant results for correlation with Process Trust (r=.21928, p=.0003, N=268). Thus, Hypothesis 2c is also supported.

8.6.4 Hypothesis 2d: Trust will be associated with objective team performance.

In order to explore if trust is associated with objective team performance, the research hypothesis "Trust is associated with objective team performance" is tested with the expectation that there will be no support for that hypothesis.

Objective performance is measured at the team level. Therefore, correlations were performed for trust at the team level and objective performance. That is, correlations were performed for Personal Trust at the team level for the "other subteam" and objective performance, and for Process Trust at the team level for the "other subteam" and objective performance. Team trust measures for Personal Trust and Process trust were determined by finding the means, for each team, of the trust scores. Personal Trust and Process Trust for the "other subteam," and objective performance measured as the mean of the three grades for a team (research assistant, expert1, and expert2) were all normally distributed. Therefore, to ascertain the correlation between objective performance and Personal Trust of the "other subteam, and to find the correlation between objective performance and Process Trust of the "other subteam" tests for Pearson's r were made. The results indicate that neither Personal Trust for the "other subteam" and objective performance (r=.15603, p=.3564, N=37) nor Process Trust for the "other subteam" and objective performance (r=.05814, p=.7325, N=37) were significantly correlated. Thus, Hypothesis 2d is, as expected, not supported.

It is of interest to explore whether there were significant differences for trust for "my subteam" and trust for the "other subteam." For each leadership condition (Centralized, Decentralized, Hierarchical), paired t-tests were performed to compare the individual trust (Personal Trust and Process Trust) for "my subteam" scores with the individual trust (Personal Trust and Process Trust) for the "other subteam" scores. For the Centralized condition there was not a significant difference for either Personal Trust ($t=1.34$, $p=.1933$, $N=27$) or for Process Trust ($t=.56$, $p=.5832$m $N=27$). However for the Decentralized condition there were significant results for Personal Trust ($t=4.23$, $p<.001$, $N=187$) and for Process Trust ($t=3.07$, $p=.0025$, $N=187$). Similarly, significant results were found in the Hierarchical condition for Personal Trust ($t=3.71$, $p=.0005$, $N=54$) and for Process Trust ($t=2.65$, $p=.0106$, $N=54$). In each of the cases of significant findings the t was positive, indicating that trust for "my subteam" was higher than trust for the "other subteam." It may be that since there are subteam leaders in the Hierarchical and Decentralized condition, the subteams of those teams focused their work more at the subteam level than the team level. Thus they would have developed stronger subteam trust, while the Centralized condition teams, who did not have subteam leaders, worked primarily as a whole team and therefore developed team trust equal to their subteam trust. However, it must be noted that the Ns for the Centralized and Hierarchical conditions were small and so statistical power was diminished and the results must be treated with caution.

8.7 Research Question 3 – Leadership Effectiveness: Quantitative Analysis

Research question 3 asks, "Does leadership configuration have an impact on perceived leadership effectiveness in PDTs, and what are the effects of leadership effectiveness?

8.7.1 Hypothesis 3a: Leadership configuration influences perceptions of leader effectiveness such that perceptions of leader effectiveness will be higher for subteam leaders than for team leaders.

Perceived leader performance was measured for subteam leaders and team leaders by a single question each on the post survey. As noted in the methodology section of this dissertation, if a subteam had co-subteam leaders, then the scores for those leaders were averaged to obtain a single subteam leader score. This is because the way the data were collected, it is impossible to ascertain which rating was referring to which co-subteam leader. Therefore, if a subteam had two subteam leaders, a single perception of subteam leadership performance was obtained by taking the mean of the two scores.

Perceived leadership performance (effectiveness) was not normal and attempts at transformations to achieve normality failed. Therefore, a nonparametric test (Kruskal-Wallis) was performed to test this hypothesis. The result was not significant (X^2=1.1941, p=.2745, N=67(team leader), N = 229 (subteam leader)). Therefore, Hypothesis 3a is not supported.

8.7.2 Hypothesis 3b: Perceived leader effectiveness will be positively associated with team and subteam performance.

Perceived leader performance and perceived team performance were significantly, positively correlated (Spearman's r=.37504, p<.0001, N=296) supporting this hypothesis.

Perceived leader performance and perceived subteam performance were also significantly, positively correlated (Spearman's r=.49084, p<.0001, N=296) thus supporting this hypothesis.

A team measure of perceived leader performance was obtained by taking the average, for a team, of the perceived leader performance scores. This measure was normally distributed as was the measure of objective team performance. A correlation test to obtain Pearson's r did not result in a finding of a significant correlation between leader performance measured at the team level and objective team performance (Pearson's r = -.01185, p=.9445, N=37). Thus, Hypothesis 3b is not supported for objective team performance.

Therefore, Hypothesis 3b is supported for perceived performance of team and subteam but is not supported for objective team performance.

8.7.3 Hypothesis 3c: Effective team leadership will be more positively associated with team trust than with subteam trust.

Perceived team leader performance was significantly positively associated with Personal Trust for "my subteam" (r=.36929, p=.0021, N=67), with Process Trust for "my subteam" (r=.25404, p=.0380, N=67), with Personal Trust for the "other subteam" (r=.40433, p=.0007, N=67), and with Process Trust for the "other subteam" (r=.26789, p=.0284, N=67). For Personal Trust, the correlation was stronger between team leader performance and Personal Trust for the "other subteam" (p=.0007) than for team leader performance and Personal Trust for "my subteam" (p=.0021). Similarly, for Process Trust, the correlation was stronger for team leader performance and Process Trust for the

"other subteam" (p=.0284) than for team leader performance and Process Trust for "my subteam" (p=.0380). Therefore, Hypothesis 3c is supported.

8.7.4 Hypothesis 3d: Effective subteam leadership will be more positively associated with subteam trust than with team trust.

Perceived subteam leadership performance was significantly positively associated with Personal Trust for "my subteam" (r=.38136, p<.0001, N=228), with Process Trust for "my subteam" (r=.25443, p=.0001, N=228), with Personal Trust for the "other subteam" (r=.30167, p<.0001, N=228), and with Process Trust for the "other subteam" (r=.17869, p=.0068, N=228). Perceived subteam leader performance was more strongly correlated for both Personal Trust for "my subteam" (r=.38136) than for the "other subteam" (r=.30167) and Process Trust for "my subteam" (r=.25443) than the "other subteam" (r=.17869) Thus, Hypothesis 3d is supported.

8.7.5 Hypothesis 3e: Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership.

Effective leadership as measured by perceived leader performance was positively correlated for both team and subteam leaders vs. team and subteam Personal Trust and Process Trust. Table 8.24 below shows the results of the correlations of leader performance and trust.

Table 8.24 Perceived Leader Performance vs. Trust (Spearman r p)

	Personal Trust for "my subteam"	Process Trust for "my subteam"	Personal Trust for the "other subteam"	Process Trust for the "other subteam"
Perceived Subteam Leader Performance	.38136 <.0001*	.25443 .0001*	.30167 <.0001*	.17869 .0068*
Perceived Team Leader Performance	.36929 .0021*	.25404 .0380*	.40433 .0007*	.26789 .0284*

As can be seen in the table above, for all correlations, the correlation of perceived subteam leader performance with trust is stronger than the correlation with perceived team leader performance. Thus, Hypothesis 3e is supported.

8.8 Research Question 6 – Patterns of Leader Role Enactments: Quantitative Analysis

Research question 6 asks, "Are there different patterns of enactment of leadership roles in different leadership structures?"

The results of the quantitative analysis done for Hypothesis 1b, described above, suggest that there is a difference in the enactment of the roles by leadership configuration. For most roles (innovator, broker, producer, director, coordinator, facilitator, and mentor), the enactment is more salient in the Hierarchical and Decentralized conditions than in the Centralized conditions. Only the monitor role had an insignificant difference of salience of enactment by leadership configuration. However, the results were only barely insignificant (p=.0571) at the .05 level and so patterns of leadership enactment will also be considered for it in this analysis.

The patterns of leadership role enactment that are of interest are those patterns for which leadership role enactment is associated with team or subteam performance. It is of interest to examine the association with performance by condition to uncover possible differences. Therefore to examine the association with perceived performance, correlations (Spearman rank correlation coefficients) with subteam and team performance were performed by condition with results as shown in Table 8.25 below. Note that all correlations are positive.

Table 8.25 Leader Roles vs. Perceived Performance by Condition (Spearman's r p)

		Innovator	**Broker**	**Producer**	**Director**
Centralized N=16	Subteam performance	**.77604 .0004***	**.66393 .0050***	**.68582 .0034***	**.67911 .0018***
	Team performance	**.71021 .0021***	**.59207 .0157***	**.63575 .0081***	**.68512 .0034***
Decentralized N=160	Subteam performance	**.30668 <.0001***	**.29328 .0002***	**.38388 <.0001***	**.31010 .0001***
	Team performance	**.37080 <.0001***	**.27409 .0005***	**.34103 <.0001***	**.30635 <.0001***
Hierarchical N=95	Subteam performance	**.31014 .0022***	**.41056 <.0001***	**.49022 <.0001***	**.59875 <.0001***
	Team performance	**.31961 .0016***	**.32925 .0011***	**.41608 <.0001***	**.53653 <.0001***
		Coordinator	**Monitor**	**Facilitator**	**Mentor**
Centralized N=16	Subteam performance	**.70691 .0022***	**.65175 .0062***	.38819 .1373	**.64382 .0071***
	Team performance	**.62510 .0096***	**.63827 .0078***	.42954 .0968	**.62509 .0096***
Decentralized N=160	Subteam performance	**.34876 <.0001***	**.30784 <.0001***	**.24991 .0014***	**.33572 <.0001***
	Team performance	**.33092 <.0001***	**.33164 <.0001***	**.21365 .0067***	**.26359 .0008***
Hierarchical N=95	Subteam performance	**.50131 <.0001***	**.50938 <.0001***	**.44754 <.0001***	**.45451 <.0001***
	Team performance	**.46012 <.0001***	**.48841 <.0001***	**.43332 <.0001***	**.43150 <.0001***

The Centralized condition has only team leaders. Therefore, the results show that in the Centralized condition team leader enactments of the innovator, broker, producer, director, coordinator, monitor, and mentor roles are associated with both subteam and team performance. Of those, for all but the director role, the significance is greater

(smaller p value) for the association with the subteam performance than with the team performance. The facilitator role is not significantly associated with either subteam or team performance. However, given the low N in this condition, results should be considered exploratory.

The Decentralized condition has only subteam leaders. Therefore, results suggest that all roles as enacted by subteam leaders in the Decentralized condition are all significantly associated with both subteam and team perceived performance.

The Hierarchical condition has both subteam and team leaders. The results of the correlations that do not distinguish between the two types of leaders suggested that all leader role enactments in the Hierarchical condition are significantly associated with perceived subteam and team performance. However, to understand leadership patterns in this condition it is necessary to ascertain the patterns for the two types of leaders and how they might differ. Therefore, the correlations were performed separately for team and subteam leaders and the results are shown below in Table 8.26. Although all Hierarchical teams had both team and subteam leaders, not all respondents answered all questions about their leaders. Therefore, the n for subteam leaders is slightly more than the n for team leaders. Note that all correlations are positive.

Table 8.26 Leader Roles vs. Perceived Performance – Hierarchical Condition

		Innovator	**Broker**	**Producer**	**Director**
Vs. Subteam Leader N=50	Subteam performance	**.39939** **.0041***	**.47516** **.0005***	**.53623** **<.0001***	**.68407** **<.0001***
	Team performance	.27779 .0508	.34879 .0815	**.29555** **.0372***	**.46155** **.0007***
Vs. Team Leader N=45	Subteam performance	.21988 .1467	**.30876** **.0390***	**.43783** **.0026***	**.49916** **.0005***
	Team performance	**.35682** **.0161***	**.41621** **.0045***	**.54633** **.0001***	**.62204** **<.0001***

Table 8.26 Leader Roles vs. Perceived Performance – Hierarchical Condition continued

		Coordinator	Monitor	Facilitator	Mentor
Vs. Subteam Leader N=50	Subteam performance	.52837 <.0001*	.62158 <.0001*	.54789 <.0001*	.57617 <.0001*
	Team performance	.38131 .0063*	.52360 <.0001*	.46897 .0006*	.47483 .0005*
Vs. Team Leader N=45	Subteam performance	.45715 .0016*	.40454 .0058*	.31452 .0354*	.32831 .0277*
	Team performance	.54732 <.0001*	.47154 .0011*	.39004 .0081*	.40794 .0054*

The results show that there is a significant correlation for the Hierarchical subteam leader's enactment of all roles and subteam performance. All subteam leader role enactments are also significantly correlated with team performance except for the innovator and broker roles. Recall that the Hierarchical condition has both team and subteam leaders. It may be that going outside the team (e.g., to the instructor or researcher) which is a characteristic of the Broker role and facilitating change (Innovator role) are perceived by members as being in the domain of team leader responsibilities and so the effects on performance would be ascribed to team leader actions. The team leaders' role enactments are all significantly correlated with team performance. However, the correlations with subteam performance did not show significant association for the innovator role for the team leaders. Interestingly, the subteam leader roles' association with subteam performance has higher significance than the team leader roles' association with subteam performance when the results are significant. The team leader roles' significant associations are greater for team performance than for subteam performance. As with the observations made for the Centralized condition above, this observation may reflect the focus of leader behaviors. That is, the team leader is likely to be focused more on whole team performance, while the subteam leader is likely to be focused more on subteam performance than team performance.

There do appear to be differences in patterns across the three conditions. For example, while team leader role enactments are generally more strongly associated with subteam performance than team performance in the Centralized condition, in the Hierarchical condition (the only other condition that had team leaders), the association with team performance was stronger in general than that with subteam performance. It may be that when there is only a team leader (Centralized condition), the leader focuses on the subteams, while when there is also a subteam leader (Hierarchical condition) who can "take over" that subteam focus, the team leader primarily focuses on the team as a whole.

It is difficult to compare results for the different conditions because of the small and disparate Ns. Future research may add to the results above if sufficient sample sizes can be obtained for each leadership configuration.

In this study, all teams were comprised of a subteam from a U.S. university and a subteam from a Netherlands university. Of the 11 teams with team leaders, seven had a team leader from the U.S. (64%) and four had a team leader from the Netherlands (36%). There are a number of possible reasons that the majority of leaders were from the U.S. The sample size is too small to draw conclusions, but conjectures may be made that may be supported in the next study. English was the language used by the teams for the task and other activities in the study. The leaders were self-selected by the team members. It is possible that members who were more fluent in English were preferred for leadership positions or may have had more comfort in offering their services as leader. Communication is key to leadership and just as emergent leaders tend to communicate

more early on (Yoo and Alavi, 2004), when leaders are selected by the team it may be that the early communicators are preferred.

8.9 Research Question 7 – Communications Media Use: Quantitative Analysis

Research question 7 asks, "Is there an effect on communications media use by leadership configuration and/or distance and are there relationships between communications media used and trust and/or the technology used and enactment of leader roles?"

Media use was measured for 14 media on a scale of 1 (never) to 7 (to a great extent) for both communication within a subteam and between subteams in the post survey. For purposes of description, ratings of 2-3 are considered to be "low" frequency, 4-5 "moderate" frequency, and 6-7 "high" frequency. Ratings of between 1 and 2 are considered to be "nearly never," while ratings of 1 indicated that the medium was never used.

An examination of the data showed that some answers were clearly erroneous. All teams were composed of one U.S. subteam and one NL subteam. Therefore, communication between subteams by face-to-face meetings was, with almost certainty, not possible. Similarly, communication between subteams by course management systems, which were used within classes, not between classes, was with high certainty not possible. Therefore, respondents who answered questions about communications media use by indicating at least some use of face-to-face and/or course management systems between subteams were assumed to have erred in their answers, perhaps because they misunderstood the difference between "between subteams" and "within subteams." The responses from those 77 respondents were not used in the data analysis concerned with

communications media used. Additionally, for the next study the survey was modified to include explanations of the terms "within subteam" and "between subteams" as pertains to communications media used.

The media for which respondents indicated the frequency of use were the PDT System, instant messaging, email, text messaging, Facebook, Internet phone (e.g., Skype), face-to-face meetings, FAX, video conferencing, teleconferencing, course management system (e.g., Angel, Webboard), and bulletin boards or forums. As the list could not be all inclusive, the participants also rated the frequency of use of "other."

The frequency of use of the media over all conditions is shown below in Table 8.27. Overall, for within subteam communications, FAX was never used; Facebook, Internet phone, video conferencing, teleconferencing, and bulletin boards were "nearly never" used; the PDT System, text messaging, phone, and course management systems were used with "low" frequency; instant messaging, email, and face-to-face meetings were used with "moderate" frequency; and no medium was reported to be used with "high" frequency. Of note, however, is that the use of email was 5.95 on the 7-point scale, and the mean for frequency of face-to-face meetings was 5.85 which are "nearly high" means for frequencies.

For communications between subteams, face-to-face meetings, FAX, and course management systems were never used. Of those, only FAX was actually possible to use for between subteam communications. The PDT System, instant messaging, and email were used with "moderate" frequency and the rest of the media were "nearly never" (i.e., ratings of greater than 1 but less than 2). Again, it is of note that the frequency with

which email was used was "nearly high" at 5.81 although no medium was rated as having "high" frequency of use.

Thus, overall, the teams appeared to choose email and instant messaging for both between and within subteam communications. Face-to-face meetings were used for within subteam communication and, since the subteams were from the U.S. and the Netherlands, not possible for between subteam communications. The PDT system was used for between subteam communications but not, with any notable frequency, for within subteam communications.

Table 8.27 Means and Standard Deviations for Use of Communication Technology

N= 193	Within Subteam	Between Subteams
PDT System	3.41 (2.17)	4.27 (2.49)
Instant messaging	4.92 (1.86)	4.31 (2.30)
Email	5.95 (1.34)	5.81 (1.55)
Text Messaging	2.80 (2.11)	1.48 (1.30)
Facebook	1.53 (1.21)	1.46 (1.23)
Phone	2.99 (2.03)	1.08 (0.62)
Internet phone (e.g., Skype)	1.40 (1.33)	1.32 (1.20
F2F meetings	5.85 (1.66)	1.00 (0)
FAX	1.00 (0)	1.00 (0)
Video conferencing	1.05 (0.41)	1.03 (0.36)
Teleconferencing	1.10 (0.63)	1.07 (0.55)
Course Management System	2.19 (1.96)	1.00\ (0)
Bulletin Board or Forum	1.41 (1.22)	1.40 (1.30)
Other	1.44 (1.26)	1.32 (1.09)

8.9.1. Hypothesis 7a: There is a relationship between leadership configuration and communications media used.

None of the communication media options data were normally distributed and attempts at transformations to achieve normality failed in all cases. Therefore, nonparamentric tests (Kruskal-Wallis) were performed for each option to see if the use varied by leadership configuration. Table 8.28 below shows the results for frequency of communication media use within a subteam, and Table 8.29 below shows the results for frequency of communication media use between subteams.

For communication media use within a subteam, significant results were found only for face-to-face meetings, with the Decentralized team members using face-to-face meetings less than did the Centralized and Hierarchical members. All other results were not significant at the .05 level. For communication media use between subteams, significant results were found for frequency of use of the PDT System, teleconferencing and Facebook (a social networking site) with the Centralized members using Facebook and the PDT System more than the other two conditions, and the Hierarchical members using teleconferencing most. However, both Facebook and teleconferencing were used "never" to "nearly never." Therefore, it is a result that does not have much impact in a description of media use by the PDTs. For all other communication media, there were no significant differences in frequency of use by leadership configuration for communication between subteams.

Table 8.28 Kruskal-Wallis Results for Media Use WITHIN a Subteam

Media	Centralized Mean (SD) N=18	Decentralized Mean (SD) N=132	Hierarchical Mean (SD) 43	Chi-Square	Pr>Chi-Square
PDT System	3.333 (1.75	3.348 (2.20)	3.628 (2.26)	0.5558	.7574
Instant Msg	5.556 (1.65)	4.773 (1.86)	5.070 (1.94)	3.7216	.1556
Email	6.278 (0.83)	5.841 (1.47)	6.163 (1.07)	1.5537	.4598
Text Msg	3.500 (2.57)	2.659 (2.01)	2.953 (2.18)	1.8596	.3946
Facebook	1.611 (1.54)	1.523 (1.23)	1.512 (1.01)	0.3428	.8425
Phone	3.278 (2.16)	2.811 (2.03)	3.419 (1.93)	5.4222	.0665
Internet phone	2.000 (2.30)	1.341 (1.18)	1.349 (1.19)	0.9807	.6124
Face-to-face	6.167 (1.25	5.598 (1.84)	6.488 (0.86)	8.8815	**.0118***
FAX	1.00 (0)	1.00 (0)	1.00 (0)	0.0000	1.0000
Video Conferencing	1.00 (0)	1.030 (0.25)	1.116 (0.76)	0.4614	.7940
Teleconference	1.056 (0.24)	1.083 (0.57)	1.186 (0.88)	0.9679	.6163
Course management system	1.833 (1.58)	2.129 (1.96)	2.534 (2.12)	2.9769	.2257
Bulletin Boards/ forums	1.056 (0.24)	1.402 (1.18)	1.581 (1.53)	1.4682	.4799
Other	1.22 (0.73)	1.477 (1.34)	1.395 (1.18)	0.1482	.9286

Table 8.29 Kruskal-Wallis Results for Media Use BETWEEN Subteams

Media	Centralized Mean (SD) N=18	Decentralized Mean (SD) N=132	Hierarchical Mean (SD) N=43	Chi-Square	Pr>Chi-Square
PDT System	5.389 (2.52)	4.106 (2.44)	4.302 (2.56)	6.2784	**.0433***
Instant Msg	3.722 (2.27)	4.242 (2.26)	4.767 (2.43)	3.9479	.1389
Email	6.222 (1.11)	5.780 (1.49)	5.744 (1.85)	1.5334	.4646
Text Msg	1.519 (1.45)	1.603 (1.37)	1.500 (1.41)	0.8939	.6396
Facebook	2.778 (2.62)	1.227 (0.78)	1.630 (1.13)	15.4264	**.0004***
Phone	1.00 (0)	1.061 (0.54)	1.186 (0.93)	3.0033	.2228
Internet phone	1.833 (2.01)	1.288 (1.13)	1.209 (0.94)	1.8376	.3990
Face-to-face	1.00 (0)	1.00 (0)	1.00 (0)	0.0000	1.0000
FAX	1.00 (0)	1.00 (0)	1.00 (0)	0.0000	1.0000
Video Conferencing	1.00 (0)	1.00 (0)	1.116 (0.76)	3.4884	.1748
Teleconference	1.00 (0)	1.038 (0.44)	1.209 (0.89)	6.5032	**.0387***
Course management system	1.00 (0)	1.00 (0)	1.00 (0)	0.0000	1.0000
Bulletin Boards/ forums	1.333 (1.19)	1.417 (1.30)	1.395 (1.37)	0.2063	.9020
Other	1.389 (1.24)	1.356 (1.20)	1.163 (0.57)	0.0907	.9557

For the few media for which frequency of use was different depending upon the leadership configuration, it would be informative to ascertain for which conditions frequency was greater. Although the media use data were not normally distributed, ANOVA is robust with regard to normality. Therefore, for the media for which the nonparametric tests were significant at the .05 level, ANOVAs were run with Tukey's tests to determine in which configurations the media were used more frequently. It should be noted, however, that in each case model adequacy was not achieved as the residuals were not normally distributed nor had constant variance. However, because of the robustness of the F-test, the results are reported here.

For frequency of face-to-face meetings within subteams ($F=5.27$, $p=.0059$, $N=193$), the Tukey's test indicated that use in the Hierarchical condition (6.488) was significantly greater than the use in the Decentralized condition (5.598). The frequency in the Centralized condition was 6.167. Therefore, face-to-face meetings were held with "moderate" to "high" frequency within subteams.

For frequency of use of Facebook between subteams ($F=1503$, $p<.0001$, $N=193$), the Tukey's test indicated that the Centralized condition (2.778) use was higher than in both the Decentralized (1.227) and Hierarchical (1.630), while there was no significant difference between use in the Decentralized and Hierarchical conditions. However, in all conditions the use of Facebook was "low."

The ANOVA failed to find significant differences in use of teleconferencing between subteams ($F=1.73$, $p=.1793$, $N=193$) although the nonparametric test found the use to be significantly different ($X^2=6.5032$, $p=.0387$) by leadership configuration. Therefore, we cannot determine in which leadership configurations the differences

detected by the nonparametric test lie. The frequency of use of teleconferencing ranged from never (Centralized condition) to "very low" for the Decentralized (1.038) and Hierarchical (1.209) condition.

Finally, the ANOVA also failed to detect differences in use of the PDT System between subteams (F=2.13, p=.1218, N=193). The use of the PDT System was "moderate" for all conditions (Centralized 5.389, Decentralized 4.106, and Hierarchical 4.302).

For communications within subteams, therefore, "low" frequency of use was reported for the PDT System, text messaging, phone, and course management systems. Use of FAX, Facebook, Internet phone, video conferencing, teleconferencing, bulletin boards, and "other" ranged from "never" to "nearly never." Instant messaging was used at a "moderate" level. There was "moderate" to "high" use of email and face-to-face meetings for communication within a subteam. Thus, for communications within a subteam, members relied primarily on instant messaging, email, and face-to-face meetings.

For communications between subteams, text messaging, phone, Internet phone, video phone, video conferencing, teleconferencing, bulletin boards, and "other" were reported to have been used "nearly never." In all conditions, face-to-face meetings, FAX and course management systems were never used. Facebook use was "nearly never" to "low" frequency. Instant messaging was used from "low" to "moderate" frequency and the PDT System was used with "moderate" frequency. Email was used with "moderate" to "high" frequency. Thus, to communicate between subteams, members relied primarily on the PDT System, instant messaging, and email.

Therefore, instant messaging and email were relied on by members for both communications within and between subteams. Because the subteams were collocated groups, face-to-face was also relied upon by members for within subteam communication. The PDT System was also used for between subteam communications with moderate frequency.

Therefore, in most cases frequency of communications media used does not vary by leadership configuration and Hypothesis 7a is only supported for the use of face-to-face meetings within subteams and use of the PDT System, Facebook, and teleconferencing between subteams. Therefore, Hypothesis 7a is partially supported.

8.9.2 Hypothesis 7c: There is a relationship between communications media used and enactment of leader roles.

Correlations (Spearman rank correlation coefficient) were performed between the eight leadership roles and the fourteen media for which respondents in the post survey rated the frequency of use. This was done for both communications within a subteam and between subteams. Tables 8.30 and 8.31 below show the results of these correlations. Note that correlations were not performed when one of the variables was a constant as the correlation coefficient, r, is undefined when either variable takes on just one value (e.g., a communication medium never used will have value of 1 for all observations).

Table 8.30 Correlations of Leader Roles and Media Used WITHIN Subteams

N=191	Innovator	Broker	Producer	Director
PDT System	-.1415 .0509	-.1116 .1243	-.0850 .2425	.-.0382 .5995
Instant Message	**.1891** **.0088***	.1359 ..0608	**.1651** **.0224***	**.1598** **.0273***
Email	**.2496** **.0005***	**.2793** **<.0001***	**.2457** **.0006***	**.2949** **.0001***

Table 8.30 Correlations of Leader Roles and Media Used WITHIN Subteams continued

N=191	Innovator	Broker	Producer	Director
Text Message	-.0381 .6007	-.0390 .5825	-.0569 .4346	-.0098 .8930
Facebook	.0890 .2209	.0940 .1959	.1188 .1017	.1196 .0994
Phone	.0087 .9051	.0246 .7353	-.0418 5663	.-.0150 .8365
Internet Phone	.0818 .2604	.0667 .3586	.0426 .5583	.0426 .5585
FTF Meetings	**.1728** **.0168***	**.1758** **.0150***	**.1601** **.0269***	**.1966** **.0064***
FAX	---	---	---	---
Video Conference	.1169 .1074	.0780 .2837	.0751 .3016	.0763 .2940
Tele-Conference	.1220 .0928	.0896 .2176	.0655 .3683	.0942 .1951
Course Management	**.2661** **.0002***	**.2953** **.0044***	**.1627** **.0246***	**.1977** **.0061***
Bulletin Board	-.0558 .4436	-.0361 .6197	-.0959 .1868	-.0560 .4415
Other	.0706 .3316	.1053 .1471	.1217 .0935	.0964 .1849
N=191	Coordinator	Monitor	Facilitator	Mentor
PDT System	-.0895 .2185	-.0712 .3280	-.0766 .2923	-.0512 .4815
Instant Message	.0954 .1891	.1310 .0709	**.1620** **.0252***	.1082 .1363
Email	**.2987** **<.0001***	**.2971** **<.0001***	**.3499** **<.0001***	**.3236** **<.0001***
Text Message	-.0939 .1966	-.0342 .6390	.0169 .8166	.0476 .5136
Facebook	.1083 .1361	.0646 .3747	.0564 .4386	.0534 .4635
Phone	-.0642 .3779	-.0606 .4049	-.0175 .8101	.0192 .7924
Internet Phone	-.0247 .7350	.0412 .5712	.0957 .1880	.0622 .3930
FTF Meetings	**.1922** **.0077***	**.1444** **.0463***	.0979 .1779	**.1603** **.0267***
FAX	---	---	---	---
Video Conference	.0738 .3100	.1136 .1176	.1324 .0679	.0941 .1954
Tele-Conference	.0673 .3533	.1216 .0939	.1306 .0718	.1334 .0657
Course Management	**.1970** **.0063***	**.1628** **.0244***	**.1771** **.0142***	**.2334** **.0012***
Bulletin Board	-.0421 .5627	-.0685 .3467	-.0948 .1922	-.0620 .3939
Other	.0470 .5185	.1063 .1433	.0268 .7122	.0304 .6779

Table 8.31 Correlations of Leader Roles and Media Used BETWEEN Subteams

N=191	Innovator	Broker	Producer	Director
PDT System	-.1251 .0848	-.1377 .0575	-.0908 .2116	-.0998 .1694
Instant Message	**.2155** **.0028***	**.1473** **.0420***	.1292 .0749	**.1542** **.0331***
Email	**.1478** **.0414***	**.1751** **.0154***	**.1470** **.0424***	**.1605** **.0265***
Text Message	-.0590 .4176	-.0824 .2572	-.0604 .4067	-.0390 .5923
Facebook	.0232 .7505	.0963 .1849	.0943 .1945	.1191 .1007
Phone	**.1987** **.0059***	**.1888** **.0089***	.1356 .0615	**.1506** **.0376***
Internet Phone	.1059 .1448	-.0862 .2357	-.0973 .1806	.0579 .4265
FTF Meetings	---	---	---	---
FAX	---	---	---	---
Video Conference	.0667 .3582	.0260 .7214	.0218 .7647	.0202 .7816
Tele-Conference	**.1539** **.0336***	.0912 .2098	.0658 .3658	.0468 .5202
Course Management	---	---	---	---
Bulletin Board	-.0459 .5283	.0185 .7996	-.0649 .3726	-.0344 .6367
Other	-.0250 .7319	.0828 .2550	**.1445** **.0461***	.0637 .3816
N=191	Coordinator	Monitor	Facilitator	Mentor
PDT System	-.1215 .0941	-.0969 .1823	-.1270 .0801	-.0768 .2907
Instant Message	.1182 .1034	.0896 .2179	.0968 .1829	.0911 .2098
Email	**.1597** **.0274***	**.1433** **.0479***	**.1902** **.0084***	**.1701** **.0186***
Text Message	-.0780 .2834	-.0110 .8801	-.1117 .1241	-.0433 .5516
Facebook	.0610 .4019	.0430 .5546	.0461 .5268	.0402 .5812
Phone	.1188 .1017	**.1747** **.0156***	**.2196** **.0023***	**.1826** **.0115***
Internet Phone	-.0086 .9057	.0225 .7576	.0645 .3758	.0823 .2299
FTF Meetings	---	---	---	---
FAX	---	---	---	---
Video Conference	.0185 .7999	.0605 .4058	.0860 .2370	.0424 .5601
Tele-Conference	.0343 .6378	.0860 .2368	.1162 .1095	.1236 .0886

Table 8.31 Correlations of Leader Roles and Media Used BETWEEN Subteams continued

N=191	Coordinator	Monitor	Facilitator	Mentor
Course Management	---	---	---	---
Bulletin Board	.0003 .9963	-.0573 .4314	-.0668 .3583	-.0245 .7362
Other	.0376 .6059	.0357 .6243	-.0265 .7162	.0195 .7890

For both correlations of roles and media used within subteams and between subteams most correlations are not significant. However, there are some exceptions. Of note is that there are more significant correlations of leader roles and communications media used within subteams than correlations of leader roles and communications media used between subteams. It may be that communication between subteams was, in general, less frequent than communication within subteams and therefore leader(s) behavior(s) had more of an influence over the frequency of communication within subteams than between subteams.

For communications within a subteam, significant correlations were detected for frequency of use of instant messaging and the innovator, producer, director, and facilitator roles; for use of email and all roles; for the use of face-to-face meetings and all roles except for the facilitator role; and for the use of a course management system and all roles. Curiously, although instant messaging, email, and face-to-face meetings were used with "moderate" to "high" frequency, course management systems were used with "low" frequency and yet there is an association with all leader roles. For the media used with at least "moderate" frequency (instant messaging, email, and face-to-face meetings), it may be that the correlations are a result of leader behaviors that encouraged communication and participation in the subteam activities. The correlations of salience

of leader role behaviors and course management systems are more difficult to understand and cannot, with the data available, be adequately explained.

For correlations of leader role behaviors and frequency of communications media used between subteams, there were significant associations detected for instant messaging and the innovator, broker, and director roles; for use of email and all roles; for the use of the telephone and the facilitator, broker, director, monitor, and mentor roles; for the use of teleconferencing and the innovator role; and for the use of "other" and the producer role. Interestingly, of all of the media for which significant associations were detected only instant messaging and email were used with at least moderate frequency. Of all the choices in media used, only the PDT System, instant messaging and email were used with at least moderate frequency for between subgroup communications. It is curious that although there is a significant correlation between some or all roles and two of those media, there is not a significant correlation between use of the PDT System and any role. It is possible that the communication that took place on the PDT System was largely that which was required by the tasks and therefore leader behaviors were not associated with it, while the use of instant messaging and email were encouraged by the leaders, thus associating their frequency of use with leader role enactments.

Therefore, Hypothesis 7c is partially supported.

8.9.3 Hypothesis 7d: There is a relationship between communications media used and trust.

To investigate whether or not there is a relationship between technology used for communication and trust, correlations were performed. Because of a lack of normality for the variables, Spearman rank correlation coefficients were obtained. For media used

for communication within a subteam, correlations were done with Personal Trust and Process Trust for members of a subteam ("my subteam"). For media used for communication between subteams, correlations were done between the fourteen media and Personal Trust and Process Trust between subteams ("other subteam"). The results are shown below in Tables 8.32 and 8.33. Note, once again, that correlations were not performed in the case that the frequency of media used was constant (i.e., never used).

Table 8.32 Trust for "My Subteam" vs. Media Use Within a Subteam

	Personal Trust			Process Trust	
N= 192	r	p		r	p
PDT System	-.13623	.0595		-.10779	.1367
Instant Message	.02664	.7138		.01446	.8422
Email	.12230	.0910		.03388	.6409
Text Message	.07150	.3244		.08059	.2665
Facebook	.08084	.2650		-.00376	.9587
Phone	.00583	.9360		.00888	.9027
Internet Phone	-.02741	.7059		-.06235	.3902
F2FMeetings	**.22323**	**.0019***		**.15756**	**.0291***
FAX	----------	---------		----------	---------
Video Conference	.10051	.1654		-.09747	.1786
Course Mgmt. System	.11380	.1160		.03869	.5941
Bulletin Board	-.04347	.5494		-.03043	.6752
Other	-.00870	.9046		.08272	.2540

Table 8.33 Trust for the "Other Subteam" vs. Media Use Between Subteams

	Personal Trust			Process Trust	
N= 192	r	p		r	p
PDT System	.09859	.1737		-.02835	.6963
Instant Message	.11242	.1205		.00208	.9772
Email	.12050	.0959		-.00763	.9164
Text Message	-.01666	.8186		-.02972	.6824
Facebook	**.16806**	**.0198***		.09409	.1942
Phone	-.03252	.6543		-.02516	.7290
Internet Phone	-.00941	.8970		.00304	.9666
F2FMeetings	----------	--------		----------	--------
FAX	----------	--------		----------	--------
Video Conference	.05174	.4761		-.04589	.5273
Teleconference	.01324	.8554		.01292	.8588
Course Mgmt. System	----------	--------		----------	--------
Bulletin Board	.06909	.3410		.07793	.2826
Other	-.03954	.5861		.04612	.5253

The only correlations significant at the .05 level were that between both Personal Trust and Process Trust for "my subteam" (collocated subteam) and use of face-to-face meetings for within a subteam and for Personal Trust between subteams and use of Facebook for communication between subteams. It should be noted that, as discussed above, Facebook was used with "low" frequency for communication between subteams. Therefore, no causality is proposed for this relationship. However, it is of interest to note that there is a significant correlation for face-to-face meetings in a subteam and trust within that subteam. The richer communication medium of face-to-face meetings (Daft and Lengel, 1986) allows for more cues that can promote the development of traditional trust. This is consistent with findings in the literature (DeRosa et al., 2004) that suggest that trust in virtual teams is more difficult to achieve than trust in collocated teams. Therefore, the more face-to-face encounters, the more opportunities for developing and maintaining trust. Thus, Hypothesis 7d is unsupported with those exceptions.

8.10 Summary of Results of Quantitative Analysis for Study 1

Table 8.34 below is a summary of the results of the quantitative analysis of Study 1:

Table 8.34 Summary of Results of Quantitative Analysis for Study 1

Hypothesis	Result
H1a: Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs.	Supported
H1b: Leadership configuration will influence role enactment.	Partially Supported
H1e: Role enactment of leader behaviors will be positively associated with perceived team and subteam performance and objective performance.	Supported for perceived performance; Not supported for objective performance
H1f: Role enactment will be associated with perceived leader effectiveness.	Supported
H2a: Leadership configuration will impact trust such that teams with distributed leadership will develop higher levels of longer term trust than teams with centralized leadership.	Not Supported

Table 8.34 Summary of Results of Quantitative Analysis for Study 1 continued

Hypothesis	Result
H2b: Trust within a subteam will be positively associated with perceptions of subteam performance.	Supported
H2c: Trust between subteams will be positively associated with perceptions of subteam performance.	Supported
H2d: Trust will be associated with objective team performance.	Not Supported
H3a: Leadership conditions influence perceptions of leader effectiveness such that perceptions of leader effectiveness will be higher for subteam leaders than for team leaders.	Not Supported
H3b: Perceived leader effectiveness will be positively associated with team and subteam performance	Supported for perceived performance; Not supported for objective performance
H3c: Effective team leadership will be more positively associated with team trust than with subteam trust.	Supported
H3d: Effective subteam leadership will be more positively associated with subteam trust than with team trust.	Supported
H3e: Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership.	Supported
H7a: There is a relationship between leadership configuration and communications media used.	Partially Supported
H7c: There is a relationship between communications media used and enactment of leader roles.	Partially Supported
H7d: There is a relationship between communications media used and trust.	Partially Supported

CHAPTER 9

STUDY ONE QUALITATIVE ANALYSIS

9.1 Overview

A full scale study (Study 1) was undertaken in the fall semester of 2007. The independent variables were leadership configuration and distance (cultural, geographic, and temporal). However, although leadership configuration (Centralized, Decentralized, and Hierarchical) was varied through manipulation, distance was held constant. All teams were comprised of students from a university in the Netherlands and one of two universities from the east coast of the USA.

The previous chapter describes the results of quantitative analysis of data obtained from surveys in Study 1. This chapter, through qualitative analysis of personal reflections in which participants discussed their experiences, gives further insight into some of the major results described in the previous chapter. For example, quantitative analysis suggested that, in fact, the leader role behaviors identified by Quinn (1988) are enacted in PDTs. Qualitative analysis can give insight into how those leadership roles actually are enacted in PDTs, particularly, in terms of the kinds of activities that comprised roles such as "producer" or "coordinator." Not all constructs in the model were measured in the surveys in Study 1 (although those missing in Study 1 surveys are included in Study 2 surveys). Therefore, the personal reflections were also coded for those constructs (e.g., satisfaction with a leader, satisfaction with a team/ subteam) to provide some understanding of them in the context of this study. Additional themes of interest were also coded (e.g., communication problems and successes, "bad" leadership) and the results are described in this chapter.

This chapter first describes the qualitative methodology used and inter-coder reliability. Then, each major theme coded for in the personal reflections is described and the results of the analysis of the coding are discussed. The final set of codes is listed in Appendix F. Finally, the chapter ends with a discussion of overall results and conclusions.

9.2 Methodology

The participants completed a total of four personal reflections (one per week of the study) in which they wrote about their experiences during the previous week working in a partially distributed team. Two coders (a researcher and her colleague) coded all of the leaders' reflections and the reflections of members from two teams in each leadership configuration. A total of 126 participants met the criteria for coding although not all completed personal reflections as the personal reflections were part of the experimental instruments and not required for members from U.S. universities. Of the 126 participants in the sample, 83 were leaders (four in the Centralized condition; 60 in the Decentralized condition; and 19 in the Hierarchical condition). Forty-three of the sample participants were members who were not designated by their teams as leaders (16 in the Centralized condition; 14 in the Decentralized condition; and 13 in the Hierarchical condition). The number of Decentralized leaders was much larger than any other group because, as described in the previous chapter, most of the teams chose to ignore leadership selection instructions and selected leaders that placed them in the Decentralized condition regardless of the assigned leadership condition. A number of those teams also chose to have two subteam leaders per subteam (co-leaders) instead of the one subteam leader per

subteam as instructed for the Decentralized condition. As a result of this imbalance in numbers, it would be inappropriate to compare frequency counts for themes coded by condition. However, insight may be gained by analyzing the content of passages coded. Coding was done using Atlas.ti®, a software application designed for qualitative analysis.

Initial codes were based on theory in the literature as it applied to the hypotheses that test the research model. As coding progressed, additional codes were added to reflect themes that arose and the reflections were iteratively recoded to include those items. The final set of codes is listed in Appendix F.

To achieve inter-coder reliability, first the two coders coded 10 passages together. For the purpose of this analysis, a passage is considered to be one entry into the personal reflections by a participant. Then the coders separately coded ten passages and then met to discuss and resolve differences. After each round of ten passages, inter-coder reliability was calculated by determining percentage of agreement and Cohen's kappa for the most commonly occurring themes in those passages. This process was repeated until percentage of agreement was, on all themes checked, greater than 80% and Cohen's kappa was greater than .6. The coders then divided the remaining passages and coded them separately, meeting once to check one set of 20 passages that they both coded. At that time, inter-coder reliability was at 95% agreement with $k>.77$. For the purpose of this analysis, also, a quotation refers to the sentence, or sentences, coded within a passage for a particular theme. It is possible, in some cases, that more than one quotation is coded for a single theme within a passage.

9.3 Leadership Roles

9.3.1 Leadership Roles as Described by Quinn (1988)

Quinn (1988) described eight roles that leaders may enact when leading teams: innovator, broker, producer, director, coordinator, monitor, facilitator, and mentor. The innovator pays attention to environmental changes and responds to them; the broker coordinates and negotiates with people outside of his or her group; the producer motivates members to reach goals and improve production; the director sets objectives, establishes rules and policies, and clarifies expectations; the coordinator sets schedules, handles crisis and addresses logistical and technical issues; the monitor monitors the team and its activities to check for compliance with rules and whether the team is meeting its objectives; the facilitator works to build cohesion and collaboration, and manages interpersonal conflict; and the mentor develops people in a helpful and considerate way (Quinn, 1988).

The analysis of the personal reflections revealed that all roles were reported in the four personal reflections as enacted at least once by leader participants as shown below in Table 9.1. This supports the quantitative analysis, described in the previous chapter, which found support for the hypothesis (H1a) "Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs."

Table 9.1 Number of Quotations Coded in the Personal Reflections for Leader Roles

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
1	2	84	31	82	66	21	14

As can be seen in Table 9.1 by far most reports were for the producer, coordinator, and monitor roles. There were very few reports of innovator and broker role enactments and moderately many reports of director, facilitator and mentor role enactments. Although Kayworth and Leidner (2001/2002) concluded that mentoring is a primary characteristic

of leaders in virtual teams, in this study it was only moderately reported. This may be because of the differences in PDTs or because the subjects were students with actively involved instructors who may have taken the mentoring role.

9.3.2 Innovator Role

There was only one passage, in the fourth personal reflection, coded for the Innovator role. A leader in the Centralized condition was inventive as he "tried to inspire my team to think outside the box, and place themselves in the position as if it was really happening, and they were part of the management team." That there was only one reference to innovator behavior is contrary to the quantitative results that found that the score for Innovator behavior was, for all conditions, over 5 on a 1 to 7 scale. This disparity may reflect the participants taking for granted such behavior and, therefore, not bothering to mention it in their personal reflections.

9.3.3 Broker Role

Two Decentralized subteam leaders reported that they engaged in broker role behavior in the personal reflections. One, at the end of the third week (personal reflection 3) reported about how he went to the instructor to solve a technical problem. He said:

> *...we have had some problems with the technology which basically meant that we could not upload files to the wiki anymore. I've addressed our teacher and she provided another way for us to submit things."*

The other subteam leader noted, in the fourth personal reflection, how a problem between the subteams in his/her team was solved after a conversation with the instructor.

> *This week served as a HUGE surprise in terms of my team. After an interesting conversation with the professor, we started to work together very well. The UVT subteam managed to finish all their work and even do a little extra, ...*

9.3.4 Producer Role

There were 84 quotations coded for the producer role in the four personal reflections. Most frequently occurring references were to dividing the tasks and delegating them, keeping people "on task," and conducting meetings and keeping them on topic. For example, in personal reflection 4 a Decentralized subteam leader wrote:

> *I made sure that we stayed on task, on time, completed high quality assignments and was responsible for a lot of the work*

A Hierarchical leader wrote that "As leaderI have kept both subteams on the same path and kept them updated on what is due." Keeping the members informed was another producer task reported. A Centralized leader noted that s/he "informed my groups of the deadlines and who should mail the assignments before that deadline."

Another Decentralized subteam leader noted that s/he "made sure my sub team stayed motivated and completed a well written deliverable." A non-leader member wrote, at the end of the first week, that the leader "is doing a good job of finishing everything on time and keeping everyone enthusiastic." Most succinctly, a Centralized leader, at the end of week 2, reported that "I have been responsible for motivating and informing my team members about deadlines."

Many references were made to the delegation of tasks, such as the Centralized non-leader member who wrote "Our group leader is good at distributing work and making sure everything is getting done." A Hierarchical subteam leader felt that his "major role has been to maintain project scope and delegate tasks." A team leader also in the Hierarchical condition wrote that "I also try to divide work as evenly as possible, but it's difficult to do and I often wind up giving too much or too little work to one team." Thus, in the Hierarchical condition, which has both team and subteam leaders, the team

leader may have assigned tasks to the subteams and then the subteam leaders would further break down the tasks and assign them to individuals within their subteams. A Decentralized leader wrote in his/her first personal reflection that his/her initial tasks were to "set up Google Docs, I assigned some basic tasks, and I got in contact with just about everyone."

9.3.5 Director Role

There were 31 quotations coded for the director role in the four personal reflections. A Hierarchical subteam leader noted, in his/her second personal reflection that, "I try to make clear what is expected from our group." Another leader, in the Decentralized condition noted as well, "...my task as a leader is mainly communicating and making sure everyone knows what needs to be done and by when."

As part of setting goals and making expectations clear, leaders kept their members updated. A Hierarchical team leader explained, in his/her third personal reflection,

> *I'm a team leader and the main action I do to help my group is to keep everyone updated. I like to send out e-mails 2-3 times a week that explain what's been done, what's currently going on, and what we have to get done for the week. I feel it helps to put everyone on the same page and allows team members to think ahead.*

Some leaders were reported to believe, or self-reported, that clarifying expectations and goals was an important part of their responsibilities. One Decentralized subteam leader noted, "As a leader I have worked with my team to understand what is needed for each module." A Hierarchical subteam leader reported in the fourth personal reflection that, "A lot of the time I will clarify when I think people didn't understand everything."

9.3.6 Coordinator Role

There were many (82) quotations coded for the coordinator role. This suggests that coordination was seen by leaders as an important part of their responsibilities. Frequently, reference was made to the task of coordinating meetings as noted by a Hierarchical member who wrote, "Both our subteam leader and the overall team leader have been doing a good job with coordinating the meetings, making sure we stay on track, and keeping everyone informed." Another Hierarchical member also praised his/her leaders for meeting coordination and management when s/he said, "Our leaders are doing a great job at keeping our meetings productive and on time." A Centralized team leader noted, at the end of the project, "As the leader, I have mediated activities within the group for meetings and making deadlines for project milestones."

Although these meetings usually involved leaders and members, there were also meetings of just leaders noted in reflections from participants in the Hierarchical and Decentralized conditions. A Decentralized subteam leader noted, "I think the main objective I have is to stay in contact with the other team leader." In the fourth personal reflection, a Hierarchical leader noted, "As a leader, I had to meet with the other leaders outside of class to discuss the final details of the GRRR project."

Coordination between subgroups was another task undertaken by leaders, sometimes in the leader meetings described above. But, leader contact with the other subteam was not always in organized meetings. A Decentralized leader noted, "I'm responsible for the communication with the other subteam." Another subteam leader in the Decentralized condition related a similar process for his/her team. S/he said, "We layed a lot of responsibility on (sub) team leaders to maintain contact between both

teams." A Hierarchical team leader summed up this responsibility when s/he wrote, "Another function as sub-team leader is to act as liaison between both subteams."

The distance between teams created challenges for the leaders in terms of coordinating meetings across time zone differences and making meeting times clear. A Decentralized leader noted, "I'm trying to convert things to CET as often as I can, so that I'm not giving out times that don't make sense."

Setting schedules was another coordination task undertaken by PDT leaders as noted by a Decentralized subteam leader when s/he wrote, "I am also the one that gives a schedule as to when everything is due." Another Decentralized leader noted, in the first personal reflection, that "as a leader, I have had to set up schedules and create our own deadlines..."

9.3.7 Monitor Role

There were 66 quotations in the four personal reflections that were coded for the monitor role. As monitors, the leaders were frequently reported to have checked the work of the members as noted by a Centralized member when s/he wrote, "Our leader is also making sure that we are getting the activities and deliverables done that need to be done." Another Centralized member praised his/her team leader for "doing a good job ... making sure we stay on top of our work." Many leaders noted that monitoring was part of their activities. A Decentralized subteam leader remarked, "As a leader, I have been responsible for .... and ensuring assignments get done on time and get done well." A Hierarchical subteam leader echoed that responsibility when s/he said, "As a leader I had to check the final result of our projects before they were e-mailed to our friends overseas." A Centralized team leader monitored activities "to make sure they are done

properly and in a timely manner." Another Decentralized subteam leader noted that s/he checked that submissions were made in time. S/he wrote, "As a leader, I have checked to make sure that our updated project was on the PDT by the 5 p.m. deadline."

Thus, checking that tasks were done, and done correctly, and that schedules were met were the monitoring activities most frequently mentioned in the personal reflections. The monitor role also includes making sure that rules are being followed. There were no mentions of that in the reflections but that is not surprising. As students in a class under the aegis of an instructor, it would likely be the instructor who would monitor for rule-following.

9.3.8 Facilitator Role

Twenty-one quotations in the personal reflections were coded for the facilitator role. Building group cohesion through communication was a focus for many of the leaders. A Decentralized subteam leader noted, "As the team leader I have been trying to ferment (sic) communication between the two teams..." One subteam leader, also from a Decentralized team, noted that s/he handled interpersonal conflict involving the "other" subteam and him/herself when s/he wrote, "I actually talked to some of the members of the Tilburg subteam. I expressed that I was sorry if they felt that I was controlling everything." But, by and large, facilitation took the form of promoting communication within and between subteams.

9.3.9 Mentor Role

There were only 14 quotations coded in the personal reflections for the mentor role. This may be due, in part, to the fact that the project was only four weeks in duration and/or that the participants were students who saw each other as peers regardless of the role taken in the team. However, some leaders clearly saw the need to mentor by assisting other members and by being sensitive to the individual needs of the members.

For example, a Decentralized member noted that when s/he was ill, the leader "kept me up to date with emails and sms' saying what I could do from my home computer. He also redistributed some work I couldn't do being sick..."

A Decentralized leader felt responsible for helping his members when he said, "I have to be more tolerant and try to help the other members." A Centralized team member praised his/her leader for being "willing to help everyone with their part."

Some leaders expressed the importance of treating people fairly, and making certain they felt comfortable coming to the leader when there are problems. For example, a Decentralized leader noted that s/he urged his members to come to him/her when s/he said, "I do say that if they have any questions, concerns, or comments to let me know." Another subteam leader expressed how important this was to him/her when writing, "Since I take everyone into consideration and try to treat everyone fairly, I think I have been successful in my position."

9.4 Emergent Leadership

Leaders were selected by team members as part of the initial first week's tasks. The teams specified who their leaders were to be in the team contracts submitted at the end of the first week. Yoo and Alavi (2004) identified three behaviors commonly found in emergent leadership: initiator, scheduler, and integrator. In a study of self-managed teams, Yoo and Alavi (2004) found that as initiators, members sent out the first or second messages and are the first to send out messages that are task related. Integrators compile the final documents by integrating the work of others. Schedulers coordinate the meetings. Of interest for this analysis are two aspects of emergent leadership. First, did leaders not identified in the team contract (i.e., not officially chosen as leaders as part of the first week's activities) emerge to be recognized by the team as leaders? Second, did leaders or members not recognized as titular leaders enact the three emergent leadership roles as identified by Yoo and Alavi (2004)?

There was at least one report of a non-leader emerging as a leader in each of the three leadership conditions (Centralized, Decentralized, and Hierarchical). Recall that in the Centralized condition there is an appointed team leader and no subteam leaders; in the Decentralized condition there are appointed subteam leaders but no team leader; and in the Hierarchical condition there is an appointed team leader but no subteam leaders.

In the Centralized condition there were two reports of member-recognized emergent leadership, although the level of leadership (subteam or team) was not specified in either case. In one case, a member who was not reported in the contract to be a leader referred to him/her self as a leader when s/he wrote, "As a leader, I have been mediating these activities to make sure they are done properly and in a timely manner." A member

from a different Centralized team wrote that s/he took on a leadership role when s/he was paired with another member to work on a task. The member delegated tasks to his/her partner and informed the partner of what needed to be done. The member wrote,

> *I felt that I took on a leadership role when A and I took one section. I believe that my leadership was effective in that I informed A of what I have done and what else needs to be done. And also delegating work in between the two of us, I felt was an equal amount.*

In the Decentralized condition, there were two reports of emergent leadership. One subteam leader noted that, "Even though I am only a subteam leader, I have been made the de facto team leader." Thus, the subteam leader filled the void present in the Decentralized condition of no team leader. Another subteam leader described how leadership roles rotated through team members when s/he wrote, "As for leadership, the subteam has ended up with a general leadership, or everyone will take on a leadership role every once in a while."

In the Hierarchical condition a co-team leader emerged as noted by a subteam leader who wrote, "We have pointed out one member to be a leader, but actually two members of our team are kind of team leader. Not just one person."

Thus, emergent leadership was not frequently reported but did occur in all three leadership conditions. Leaders emerged to co-lead, and to fill the void when a leadership position was not filled by leader selection in the beginning of the project.

However, there were more frequent references to the enactment of the emergent leader roles identified by Yoo and Alavi (2004). There were six quotations coded for initiator, four for scheduler, and 15 for integrator. Most of these (all but one) were in reference to designated leaders enacting the roles. For example, in the first personal reflection, a Decentralized subteam leader wrote, "I did take the initiative to post severl

forum topics and try to push everyone a little to begin communicating and break the ice." It is impossible to ascertain whether that action occurred before or after the subteam leader was selected as a leader. Another Decentralized leader acted as a scheduler when he "organized meetings and activities." But, the most frequent references (15) were to leaders integrating deliverables into one document to be submitted. There were 11 quotations in the Decentralized condition, 4 in the Hierarchical condition, and none in the Centralized condition coded for integrator. A Hierarchical subteam leader "compiled our whole web page," and a Decentralized subteam leader "took the responsibility of collecting the work and formatting it into one document."

There was one references to a non-leader enacting an emergent leader role, although the member was not referred to as "leader" and therefore may not have been recognized as such by his/her teammates. A Centralized member acted as initiator when s/he "sent out emails about what we should try to do in our meetings on the modules."

The most commonly reported emergent leader behavior, then, was that of integrator. This is not surprising as the leadership instructions posted on the PDT System did include the task of compiling and submitting documents. Still, given that, one might wonder why there were not more references to integrating work into final documents in the personal reflections. It may be that the task was seen as routine and not, therefore, significant enough to write about.

9.5 Ineffective Bad Leadership

The leader role identified by Quinn (1988) and the emergent leader behaviors identified by Yoo and Alavi (2004) are all positive behaviors. That is, they are enacted with a goal of improving some aspect of the team (e.g., performance, cohesiveness, process). But, not all leadership is "good." There are cases of "bad" leadership as described by Kellerman (2004) who identified two types of "bad" leadership: ineffective and unethical. Unethical leadership is unlikely to occur in student teams and, if it does occur, is likely to be brief and arrested by the instructor interceding. Therefore, this research looks only at whether or not ineffective bad leadership was evident. Research question 5 asks about ineffective bad leadership. In Study 2 survey questions are used to ascertain whether ineffective bad leadership is salient to the study participants. But, for this study (Study 1), there were no survey questions about bad leadership and so the personal reflections were coded to reveal insights as to its presence and, if present, its effects in PDTs. Kellerman (2004) identifies three dimensions of ineffective bad leadership: incompetent, rigid, and intemperate and we coded the personal reflections for those dimensions.

There was only one passage coded for ineffective bad leadership. A Decentralized subteam leader lamented his inability to keep his charges attentive and on task and wrote "My subteam seems to have an issue with getting distracted. I wish there was a better way to keep them on track." That is, the subteam leader felt that s/he lacked the skill to effectively address this issue (incompetent dimension of ineffective bad leadership).

Thus, overall, the personal reflections suggest that the participants did not believe that their leaders were ineffective bad leaders. In the following sections the results of coding for reports of effective leadership and satisfaction with a leader are discussed. Those results may provide further insights into how the participants felt about their leadership.

9.6 Effective Leadership

As noted in the section above, there is evidence in the personal reflections that the leaders were not perceived as ineffective. The question remains, then, if leaders were perceived as effective, and if so, why. A total of 49 quotes in the personal reflections were coded for effective leadership. There does not seem to be a pattern of perceptions of effectiveness over time as 14 quotes were coded in the first personal reflection, 13 quotes in the second, 11 in the third, and 11 in the fourth personal reflection. That is, in the personal reflections there is no evidence that perceptions of leader effectiveness changed over time.

This lack of pattern is also suggested when looking at perceptions of team leader effectiveness and perceptions of subteam leader effectiveness separately. For team leader effectiveness, there were two quotes coded in the first personal reflection, four in the second, one in the third, and none in the fourth personal reflection. For perceptions of subteam leader effectiveness, there were ten quotes coded in the first personal reflection, 11 in the second, ten in the third, and nine in the fourth personal reflection. Four quotes did not specify which type of leader was being referred to and, since the quotes came from Hierarchical participants, it is impossible to ascertain which type of leader is being

discussed. That there are many more quotes coded for subteam leader effectiveness than for team leader effectiveness is a reflection of the imbalance in the number of members and leaders in the leadership condition with many more in the Decentralized condition. Recall that the Decentralized condition has subteam leaders and no team leaders, the Centralized condition has team leaders and no subteam leaders, and the Hierarchical condition has both a team leader and subteam leaders.

Many (21) of the expressions of perceptions of leader effectiveness were general in nature, and did not specify why the respondent thought the leader was effective. For example, a Hierarchical subteam leader wrote, "I feel that my leadership has been very effective" without further explanation. A Decentralized member wrote, "Our leader is doing an effective job. Everything is running smoothly so far."

However, the remaining 28 reflections referred to specific reasons why the leaders were considered effective. The most frequent reference (10) was to leader effectiveness evidenced by deliverables being successfully submitted on time. A Hierarchical subteam leader wrote, "I think my leadership is rather effective, because otherwise maybe some things would not be finished on time and no clear agreements would be made about the assignments." A Decentralized subteam leader noted, "I think that my leadership is very effective since my group is getting its work done on time." It should be noted that all of the references to success in submitting deliverables as evidence of effective leadership were written by leaders referring to themselves. Nonetheless, that the frequency of such references was relatively high suggests that the hypothesis (H3b) "Perceived leader effectiveness will be positively associated with team and subteam performance" may be

supported for perceived performance. This hypothesis will be tested quantitatively in Study 2.

The next most frequent reference (5) was to effective leaders promoting awareness of task and status in their members. A Hierarchical team leader, referring to his/her leadership, wrote in the second personal reflection, "I think this is effective because I feel like everyone knows where our team as a whole stands." A Centralized team leader noted, "As the team leader, I feel that my leadership has been effective as I have clearly let everyone know meeting times and how deliverables will be submitted."

Other references were made to leaders effectively managing meetings and keeping them on track, leader responsiveness, meeting individual needs, and creating consensus and cohesiveness in the team. For example, a Hierarchical member wrote in the fourth reflection, "Our leaders were very effective and I felt they did their best to keep us focused ..." A Decentralized subteam leader, in the first personal reflection, wrote that he felt he was effective because he "balances the concerns of team members while ensuring that deliverables are met."

Thus, while, as noted in the previous section of this chapter, there was not evidenced that leaders were ineffective, coding for effective leadership provided results that suggested that leaders and members did feel that leadership was effective.

9.7 Satisfaction with a Leader

Satisfaction with a leader will be measured in Study 2 by three survey items. However, for the analysis of this study (Study 1), it is through qualitative analysis of the personal reflections that insight can be gained as to whether or not participants were satisfied with

their leadership. For this analysis, what is of particular interest is whether or not satisfaction with a leader, if it was present, changed over time and why the participants felt the way they did about their leadership.

Ninety-seven (97) quotations in the personal reflections were coded for satisfaction with a leader. This suggests that participants did experience satisfaction with their leadership. Some (four) of the quotations mentioned satisfaction with both subteam and team leader. In total, 57 quotations were in reference to satisfaction with a subteam leader, 23 were in reference to satisfaction with a team leader, and 21 did not specify the type of leadership. Again, because there were so many more Decentralized leaders (subteam leaders) than team leaders, inferences cannot be drawn based upon the difference in numbers of quotations for each type of leader.

Recall that at the end of each of the four weeks the participants completed personal reflections. Graphing the number of quotations coded for satisfaction with a leader by time suggests, as seen in Figure 9.1 below, that expressions of satisfaction with a leader declined in frequency over time.

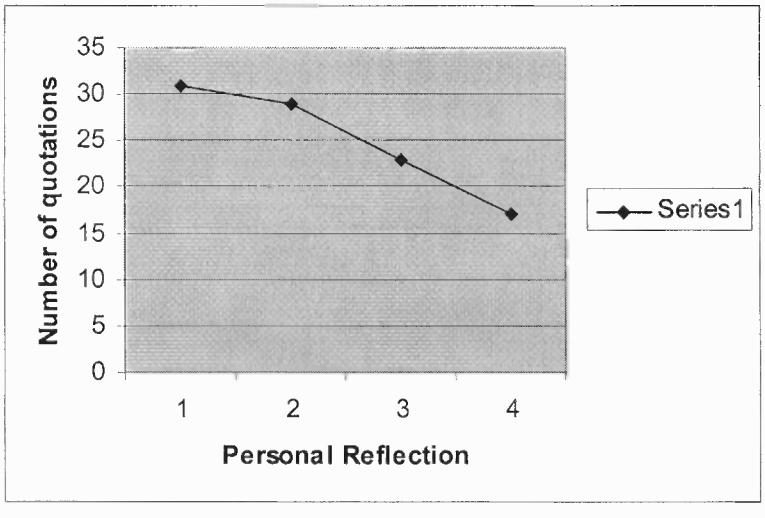

Figure 9.1 Satisfaction with a leader over time.

The pattern of decline in references to satisfaction with a leader is repeated when, as shown in Figure 9.2 below, an analysis is done of the frequency of references to subteam leaders.

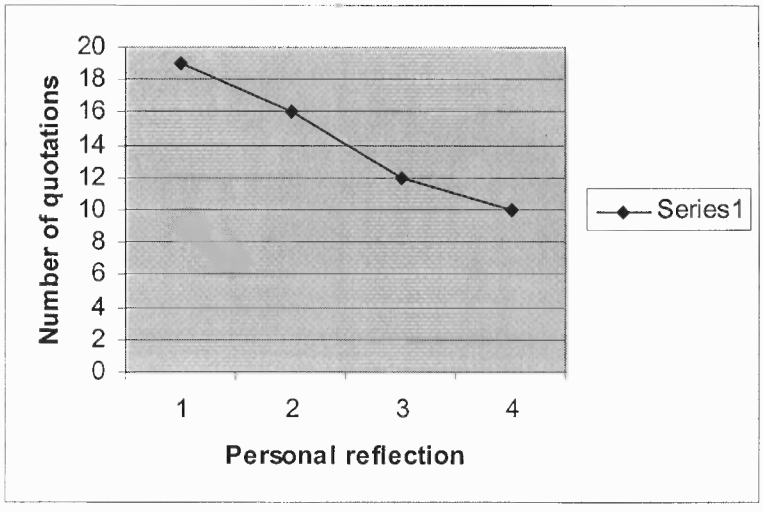

Figure 9.2 Satisfaction with a subteam leader over time

However, the frequency of references to satisfaction with a team leader does not show that pattern. Rather, the frequency is constant for personal reflections 1 and 2 (six quotations each), peaks at personal reflection 3 (seven quotations), and drops to 4 quotations at personal reflection 4. The number of references to team leaders and the differences between the frequencies over time are too small to draw conclusions.

Thus, while it is suggested by the frequency counts that satisfaction with a leader declines over time, it is inconclusive. If references to dissatisfaction with a leader were to increase in frequency over time, it would lend support to the observation that there is a decline in satisfaction. Dissatisfaction with a leader will be discussed in the next section. However, suffice it to say that with only 17 quotations coded for dissatisfaction with a leader, and an almost constant spread in frequency of quotations over time, the numbers

are too small to draw conclusions about frequency over time. Of course, satisfaction is not binary. That is, one can be neither satisfied nor dissatisfied with a leader.

It is possible, albeit inconclusive, that participants were less satisfied with their leadership over time. It may be that the excitement of a new project amplified participants' benevolent feelings towards their leaders which then might have paled over time as leaders made decisions that were not universally lauded and the task became more complex. It is also possible that actual satisfaction did not decline but that the frequency of references to it did because the participants were more focused on the increasing complexity and challenge of the task as the project progressed.

Of perhaps greater interest for this analysis, are the reasons cited by the participants for their satisfaction with leadership. Most of the references coded for satisfaction with a leader were statements that the leadership was good because of beneficial actions of the leader(s). That is, the participant was satisfied because the leadership was effective.

For example, a Hierarchical subteam leader commented, "Our team captain, E, rocks and she is doing a very good job managing the team." A Hierarchical member who did not hold a leadership position wrote, "Our main team leader was great and organized the meetings very well." Similarly, a Hierarchical member felt satisfied with the leaders because the results of the leadership meetings were that whole team meetings ran better. S/he wrote, "I also like the leadership on both our side and the Netherlands side. I think the team leader meetings make a big difference in helping to organize and plan the meetings." A Centralized member expressed satisfaction with his/her leader because the leader "is still working as hard as ever to keep the team on track and updated with

emails." A Centralized member from another team felt that the fact that the team was able to "get all of our work done on time and very effectively" was "due to our great team leadership that our team leader possesses." A Decentralized leader was satisfied with his/her leadership because "we are working on the project smoothly and everyone is participating." Another Decentralized leader expressed satisfaction with his/her counterpart from the other subteam because "he was online with me for hours while I was developing the website trying to make sure I had all the information I needed and asking if I needed any help." A Decentralized member noted about his/her team's leaders that they "have been performing well and keep the subteams updated regularly."

Some of the leaders, when expressing satisfaction with their own leadership, based their satisfaction on the positive feedback they received from their members. For example, a Centralized team leader remarked in his/her third personal reflection, "My leadership was rated good in the team assessment, which gives me a good feeling about being the leader." A Decentralized subteam leader felt "quite honored when my subgroup members expressed support for me being the leader of this subgroup." Similarly, another subteam leader from a Decentralized team felt that "my leadership is going well" because, in part, "my subteam members told me that I was a good leader and handled all the situations in a good way."

For teams with subteam leaders, satisfaction with leadership also was generated by the observation that the leadership communicated well between subgroups. For example, a Hierarchical member noted, "The entire team seems to be working well together, especially the leaders. The leadership between the teams seems to be one of the strongest aspects." Only one of the reflections noted satisfaction with the leader because

the leader was likeable. A Centralized member wrote, "Overall I enjoy our leader. He is laid back and easy to get along with but knows when to turn the switch when it comes time to do work."

Finally, there were a number of references to satisfaction with a leader for which no explanation was given. A Decentralized member noted simply, "The leadership is great" and a Hierarchical member remarked, "Leadership is going very well."

Thus, there were many expressions of satisfaction with a leader. For the most part, when explanations were given for this satisfaction, it was because the respondent felt that the leader was being effective. A few leaders took satisfaction in their leadership based upon member feedback and only one participant based satisfaction, at least in part, on the personality of the leader.

9.8 Dissatisfaction with a Leader

As noted in the section above, there were only 17 quotations coded for dissatisfaction with a leader. There were four in the first, second, and third personal reflections, and three in the final reflection. Thus, the personal reflections do not suggest a changing pattern of dissatisfaction with a leader over time. Most of the expressions of dissatisfaction were from leaders themselves. A Hierarchical subteam leader had difficulty establishing regular meetings and therefore, "This week I was not content with my efforts." Another Hierarchical subteam leader simply noted that "...there are possibilities for improvement." A Decentralized subteam leader felt that his/her leadership was ineffective because "I really have not done a good job communicating with my team."

In two instances, leaders blamed their leadership failures on members not listening to him/her. One Decentralized leader concluded, "In this project leaders were a complete waste of time. No one really wanted to listen to the leader and no one really wanted to tell everyone else what to do."

Only six of the quotations coded as dissatisfaction with a leader were from members not in a leadership position. A Centralized member from the Netherlands wrote of the team leader, "he could be doing a better job making sure the US subteam is doing their part." This member gave constructive criticism when s/he continued, "He needs to communicate a little more and make it clear on deadlines and what everyone needs to get done." Lack of communication was also seen as a problem by a Decentralized member who noted, "... the group leader did the work well, but I got so limited information from him." A Hierarchical member was angry with his/her subteam leader for completing a task him/herself without the collaboration of the subteam. "I felt like he didn't include the rest of the team as we were waiting to collaborate together, and then he was like, 'I'm done with it.'" A Decentralized member was unhappy with the leadership because "sometimes he (the leader) thinks that whatever we do it is never enough." The other member references to dissatisfaction with a leader were more generally stated such as when a Decentralized member wrote, "the leadership could have been better..."

Thus, there were few mentions of dissatisfaction with a leader. Most of them were from leaders critiquing their own efforts. Given the large number of references to satisfaction with a leader, as noted in the previous section, these results suggest that participants were largely satisfied with the leadership in their teams.

9.9 Work Process

During the coding process it quickly became apparent that many respondents referred to their team and subteam leaders dividing the tasks and delegating them to the members. It is of interest if this "divide and conquer" approach to task management was pervasive and so an additional code was added for the theme of "work process" and the coding resumed, iteratively, to include this code.

Seventy four quotations were coded for "work process." Of those 74, 22 were from members or leaders of Hierarchical teams, 42 from Decentralized teams, and 10 from Centralized teams. Again, as discussed above, there was an imbalance in the number of members of Decentralized teams because so many teams chose to place themselves in that condition and so one cannot draw conclusions from a comparison of the number of quotations in each condition. However, it is indicative that a sufficient number of respondents from each condition discussed their team work process to gain insight into how the teams approached the tasks at hand.

Divide and conquer was an approach used by teams in all three conditions. A Hierarchical team respondent noted, "We all are trying to work together as much as possible, which means evenly dividing the work." Another Hierarchical member explained, "We split up tasks and get it done." A Decentralized respondent echoed that when writing, "We ...have delegated work evenly between the members." In a Centralized team, they "all divide(d) up the work evenly and if someone needs help, that person will receive help almost immediately." Another Decentralized member noted that they "divided the work based on each other's skills for the final project" thus maximizing the potential for the approach to be effective.

But the divide and conquer approach created some issues including lack of collaboration or imbalance of workload for some. A Hierarchical participant complained, "We didn't collaborate much on the team page, actually we didn't collaborate at all – they sent us their bios and pictures and that was that." A Decentralized respondent complained, "that the team in the Netherlands has pushed all the work onto my subteam."

But, more passages in the reflections referred to collaboration as the norm for their teams, concomitant with the divide and conquer approach. Class time was allocated for subteams to work together and meetings were held both by subteams alone and teams as a whole. A member of a Decentralized team explained, "This week we were able to utilize in-class time very effectively. We arrived in class early and were able to collaborate on the assessment." One approach was to divide the work between the subteams and then within subteams collaborate on the assigned tasks. Subteams shared their work in meetings and by using the PDT system. A Centralized member noted that they "posted forums on the wiki so that everyone can see the work both subteams have been doing that week."

The use of divide and conquer with collaboration was also found between subteams as seen in the remarks of a Hierarchical respondent who said, "We divided the parts so that every Dutch girl worked together with an American guy to do one part."

Another form of collaboration mentioned was that the subteams would vet each other's work. A Decentralized leader described this process when he said,

> *"We agreed that Penn State would develop the team page and Tilburg would develop the brainstorming first. Each would then switch work and offer our own insights to develop the final parts of Module 2."*

Meetings were often mentioned as important parts of the process. Meetings were held weekly (or twice a week) and some teams in the Decentralized and Hierarchical conditions also had separate leader meetings. A Hierarchical participant noted "The team leaders meet once a week and both sub-teams also meet once a week to discuss upcoming assignments." Meetings were used for collaboration and to assign tasks. For example, a Decentralized team planned a team-wide meeting, "so we can figure out all the deliverables and what we need to do a week in advance..." Another Decentralized team had a meeting in which they "distributed the work and made sure everyone was on the same page." But the time difference between subteams made collaboration between subteams a challenge and the team-wide meetings even more important. One Hierarchical respondent noted,

> *"What is difficult is communication. We as a group at PSU, we're all on the same time and can just call each other if there's an emergency. With the Netherlands group we don't get their e-mails for hours, and don't respond to their PDT post for a few days. Communication mainly happens at meetings."*

Thus, the teams did seem to use an approach that combined divide and conquer with collaboration. Most reflections were positive about the work process. That is, the members appear to have felt that they found ways to work effectively and efficiently.

9.10 The Effects of Distance

For this study (Study 1), distance was held constant with all teams comprised of a subgroup from a university located in the Netherlands and a subgroup from one of two universities in the eastern portion of the U.S. Thus each team had subgroups with a 6 hour difference in time between them and a geographic distance of about 3,700 miles (3,682 miles from one U.S. university to the university in the Netherlands and 3,825

miles from the other U.S. university to the university in the Netherlands). Although cultural distance was dropped from the quantitative analysis bcause of issues of collinearity, it was included in the qualitative analysis of Study 1. Personal reflections were coded for mention of those differences and analysis of the personal reflections may provide insight into whether the participants found that distance (cultural, geographic and time) presented any challenges that needed to be overcome.

Only one participant, in the first reflection, mentioned geographic distance. This participant felt that it was difficult to get equal participation without having face-to-face contact. S/he said, "We found it was hard to get everyone to do a fair share when they did not have to meet in person."

There were five quotations coded for cultural distance. Two of the five reflections mentioned language difficulties. Although English was the language of communication and the students from the Netherlands knew English, the participants found that the English used by the Dutch was not American English and that the some Dutch students were not as fluent in English as expected. One participant wrote, "the way the Dutch students wrote in English was very different from the way we write." The other participant who mentioned language said that "the team from the Netherlands does not seem to understand English as well as we thought they did which makes it very hard to explain things to them." Interpretation of language was also mentioned as a potential problem by a U.S. participant who wrote in the third personal reflection, "As Americans we may say things that we would not think of as being bad or mean but the folks in the Netherlands may have a very different view on those types of things." Culture was blamed by a Dutch participant for a misunderstanding in the work process. S/he said,

"This week some problems occurred due to the inappropriate use of some data...The American subteam tried to blame us for the problem but it was more a cultural issue." Finally, a Dutch participant found, at times, the U.S. subteam "strange." Thus, cultural issues, although infrequently mentioned, did occur.

But the most frequent mention of challenges of distance was for issues of time zone difference. Thirty-one quotations were coded for time difference issues. The participants found it difficult to meet synchronously as a team because of the 6-hour time difference. One Centralized member wrote, "A problem that probably will keep showing up during this project is the time difference, since that is what is making it hard to actually get together on the same time." A Decentralized subteam leader expressed similar sentiments when s/he wrote in the first personal reflection, "Communication still tends to be a problem. The six hour time difference does not help." Another Decentralized subteam leader noted that it was critical to not put work off at all "because of the time difference you can really lose a whole day just by waiting a few hours."

A Hierarchical member noted that to accommodate the time zone difference required compromise when s/he said, "There have been some snags working with a group in a different time zone, getting up early to have a group meeting." Similarly, a Hierarchical member noted that "Because of the time difference, some had to leave during the meeting because they had an exam..." But, the teams did compromise. One Decentralized team met at a time that was late for the U.S. subteam so that they could have synchronous meetings with their other subteam. The U.S. subteam leader wrote, "...it's difficult with the time difference. That's why we always have to meet up at 10p.m. (our time) which is not ideal." Another U.S. subteam leader had a similar

experience and found that "it is already 9 or later by the time everyone can get online to talk."

Communicating times to meet, for deliverables, etc. also proved to be a challenge. If it is not clear whose local time is being referred to, misunderstandings can easily arise. Two participants mentioned how their teams handled that. One Decentralized subteam leader from the U.S. tried "to convert things to CET as often as I can, so that I'm not giving out times that don't make sense." While that team tried to consistently refer to Netherlands local time, another Decentralized team chose to refer to U.S. time as noted by the U.S. subteam leader when s/he wrote, "The Dutch subteam is great about putting all times in the Eastern Time Zone." That subteam leader felt that it helped "overcome the six hour time difference."

Time zone differences did create challenges but by agreeing on how to express time, and by having flexibility in meeting times, the participants were able to communicate with their distant team members.

9.11 Trust and Distrust

Trust is important for team effectiveness, and may be even more important in virtual teams where leaders are not always present to supervise (Mayer et al., 1995). Because the subteams of a PDT are collocated yet distant from each other, in-group/out-group effects (Huang and Ocker, 2006) may challenge the team to develop overall team trust. In this study (Study 1), trust is measured for between subteams and within subteams at the end of the project in the post surveys. Quantitative analysis, as described in the

previous chapter, was done to analyze this long-term trust. However, insights can be gained as to why participants felt trust or distrust by analyzing the personal reflections. Additionally, swift trust, a form of trust that develops quickly and is based on cues other than actual experience with the trustee (Meyerson et al., 1996) is not measured quantitatively in Study 1. Swift trust is measured in Study 2 by survey questions in the first personal reflection. The personal reflections may reveal if, and when, swift trust developed in the Study 1 teams. It is of interest, then, for this analysis to examine personal reflections coded for trust for evidence of swift trust, long-term trust, and any patterns of trust development that may be revealed. The qualitative data was analyzed and then later on trust was explored with a more quantitative method to identify factors. By examining the survey data for both Study 1 and Study 2, factors of trust were identified (Personal Trust, Process Trust, and for early trust, Expertise Trust). See Chapters 8 and 10 for details. However, the quotes found in the personal reflection tend to be more general and do not break out into different kinds of trust. Therefore, the qualitative analysis of the personal reflections just looks at the general themes of trust and distrust.

There were 44 references coded for trust in the four personal reflections. Of those, 14 made reference specifically to trust within a subteam, 19 made reference to trust between subteams, and 20 were more general statements of trust for which it was not possible to ascertain which team members (collocated or distant) were the referents. Note that there were some quotations that were coded for both trust within and between subteams and so the totals do not add up to 44. For all references to trust there were 12 in the first personal reflection, 17 in the second personal reflection, ten in the third, and nine

in the fourth. While the pattern seems to have peaked at the end of the second week and then declined, the numbers are too small to draw conclusions. However, this is indicative that there was trust in the PDTs.

In Study 1 the subteams were all collocated members of the same class in a university. Therefore, the students in a subteam had experiences with each other prior to the start of the PDT project. Swift trust, then, would not be a factor for within subteams trust but might occur between subteams as the distant subteams in each team had no prior experience with each other. There were three references coded in the first personal reflection (written at the end of the first week) for trust between subteams which gives evidence to the existence, at least for some teams, of swift trust. While there were only three references, it should be noted that the total number of quotations coded for trust between subteams was also small (19). One Hierarchical member wrote, "So far there seems to be a lot of trust in both the subteam and the overall team." A Decentralized subteam leader also felt trust quickly and noted, "I feel that I can trust all of my team members both here and in the Netherlands." A Centralized member had a similar experience and concurred, "I trust all of my team members here in the U.S. and over in the Netherlands…." It is interesting that there were expressions of swift trust between subteams in each of the three leadership conditions.

There were five mentions of trust between subteams in the second reflection, six in the third, and five in the fourth. In his/her second personal reflection a Hierarchical subteam leader, AJ, said, "Everyone seems to trust everyone else, even between subteams." The Centralized member who experienced swift trust continued to experience trust and noted in the second personal reflection, "I trust that my team members, of both

the U.S. and Netherlands will get the jobs that are required of them done." A Centralized member from another team remarked that trust was building by the end of the second week. S/he wrote, "We are building a nice foundation of trust between the two sides right now, which is vital in this type of work." By the end of the third week (personal reflection 3), there were mentions of strong trust between subgroups, suggesting that trust had developed and strengthened over the first three weeks. AJ, the Hierarchical subteam leader quoted above noted, "The trust and the relationships between our team members are very strong. We trust each other to get work done and handed in on time and there has been no conflict between team members." A Decentralized subteam leader, RM, noted that "There is still trust between subteams, conflicts have not been an issue up until now." RM, in the fourth personal reflection, mentioned again the lack of conflict in relationship with trust when s/he said, "There is a solid basis of trust between team member and subteams. Up until now there has been no sign of any conflicts." JW, a Hierarchical team leader, in his/her third personal reflection also concomitantly mentioned trust and lack of conflict when s/he noted, "We all have trust in each other and have not had any conflicts." Thus, trust between subteams was evident and, at least for some members, the lack of conflict may have been an important result or precursor to that trust.

There were 14 references coded for trust within a subteam. The lack of conflict appears to have been important for trust within a subteam as well. A Hiearchical subteam leader, in his/her second personal reflection wrote, "In my subgroup everyone seems to naturally trust one another... We haven't run into any conflicts." Trust grew as conflicts were resolved. A Centralized member noted in the fourth personal reflection, "The trust

in our group has grown a lot since we first began this project. We have solved many of the conflicts that came up during the project and we have prevented many other conflicts from forming...." Other references were more general in nature. A Hierarchical subteam leader wrote, "I have developed a deep trust with my subteam."

There were also 20 references to trust that could not be identified as being specifically either about trust within a subteam or about trust between subteams. A Decentralized subteam leader simply noted in the first personal reflection that, "The trust between the team members is good." Trust was not always ubiquitous. A Decentralized subteam member, in the first personal reflection, wrote, "While there is some trust among team members I am personally afraid to say I don't trust every team member..." Similarly, another Decentralized subteam member wrote, "I only trust one member from the UVT (Netherlands) side and two from the PSU (US) side." However, most mentions of trust were less guarded. For example, in the second personal reflection a Decentralized member wrote, "I think our group is pretty trusting of each other and there have not been any conflicts yet." Again, as time went on, some participants noted the growth of trust. A Hierarchical subteam leader wrote that "The trust has grown over the last weeks, because we made every deadline and everyone delivers good work." The leader went on to note that "there are no conflicts until now."

Thus, trust is evident both between and within subteams. There is some evidence of swift trust between subteams and that trust grew over time despite the declining numbers of references coded for trust over time. The lack of conflicts seemed to have been an important element in the development of trust although it is not clear from the reflections whether it is a result of trust or a precursor to trust.

The reflections were also coded for distrust. The literature reviewed does not have empirical evidence that the lack of trust is necessarily distrust and the personal reflections did not suggest that. It is plausible that trust can be absent without distrust. For example, when there is apathy one can neither trust nor distrust another. It would be fruitful to investigate the notion of trust and distrust to ascertain if, in fact, they are polar opposites on a continuum or the antithesis of each other. However, that data is not available in this study. Yet, it is useful to code for distrust as the presence of distrust is likely to impede team functioning. There were only nine references coded for distrust. One was coded for distrust within a subteam, four were coded for distrust between subteams, and four were general statements of distrust for which it could not be ascertained whom the referent was. In the first personal reflection there were a total of four references coded for distrust, there were four in the second reflection, 1 in the third reflection, and none in the fourth reflection. While the numbers are too small to be conclusive, it is possible that distrust was reduced over time as the teams developed working relationships and trust grew.

A Decentralized subteam leader, in the first personal reflection succinctly stated, "There was a definite lack of trust." Another Decentralized subteam leader wrote of distrust generated by a lack of participation within the subteam. S/he asked, "...can we trust people that aren't going to show up for class?" Distrust was also present when the subteams didn't work well together. For example, distrust between subteams was expressed by a Centralized member in the second personal reflection who found the distant subteam "hard to work with." Still another Decentralized subteam leader spoke of distrust developing when "the subteams definitely don't like each other." Therefore,

distrust was present for reasons that seemed to be behavioral such as lack of participation and personality conflicts. It may be that personality conflicts, present in distrust between subteams, emanated from cultural differences. But, it is important to note that overall, mentions related to trust/distrust were more likely to be references to trust than to distrust. That is, while distrust clearly existed, the analysis of the personal reflections suggests that it was infrequent and more likely to occur at the beginning of the project than at the end of the project.

9.12 Satisfaction with a Group

It is of interest to investigate whether participants were satisfied with their subteams, their distant partner subteams, and/or their teams as a whole. In Study 2 satisfaction with a group will be measured quantitatively and so relationships between satisfaction and, for example, trust will be able to be uncovered if they exist. For Study 1, however, items for satisfaction with a group were not included in the surveys and so it is through qualitative analysis of the personal reflections that insights into whether the participants were satisfied, and if so why, can be made. It is also of interest whether satisfaction changed over time. For example, if satisfaction with a team increased over time, it could be indicative of the development of whole team identity.

There were, in total, 245 passages coded for satisfaction with a group. Some passages referred to satisfaction with the local subteam, some to satisfaction with the other subteam, some to satisfaction with the whole team, and some were general in nature and it was not possible to ascertain who the referent group was. Some of the passages were coded for more than one group. For example, a Decentralized subteam leader

referred to satisfaction with both the local subteam and the whole team when s/he wrote, "We have still been working very well as a subteam and a team as a whole." The large number of passages coded for satisfaction with a group suggests that participants were largely satisfied with their subteams and teams. There were 95 references to satisfaction with the local subteam, 33 references to satisfaction with the distant "other" subteam, and 80 references to satisfaction with the whole team. Again, these numbers do not add up to the total number of passages coded because some passages were coded for more than one theme and some passages were too general to ascertain which group was being referenced.

Figures 9.3 to 9.5 below show the number of references to satisfaction over time for the local subteam, distant "other" subteam, and for the whole team. While the number of references to satisfaction to subteams ("my" subteam and the "other" subteam) generally declined over time, it cannot be concluded that satisfaction decreased. Satisfaction with the whole team rose, with a dip in the third personal reflection, then a dramatic rise in the fourth reflection. This may indicate that the participants made fewer references to satisfaction with subteams at the end of the project, not because they were less satisfied, but because they had moved towards having a whole team identity and therefore focused their feelings of satisfaction on the entire team, not the subteams. It is interesting that the lowest number of references in all three cases was in the third personal reflection. The reflections do not yield clues as to why that was, but speculations can be made. In the third week the participants prepared an outline of functional requirements and completed a team assessment. It may be that completing the team assessment, which required, in part, the members to assess team weakness, focused

the participants' attention somewhat away from positive feelings about the team. Or, it may be that the intensity of nearing completion of the project focused attention towards task more than team or subteam.

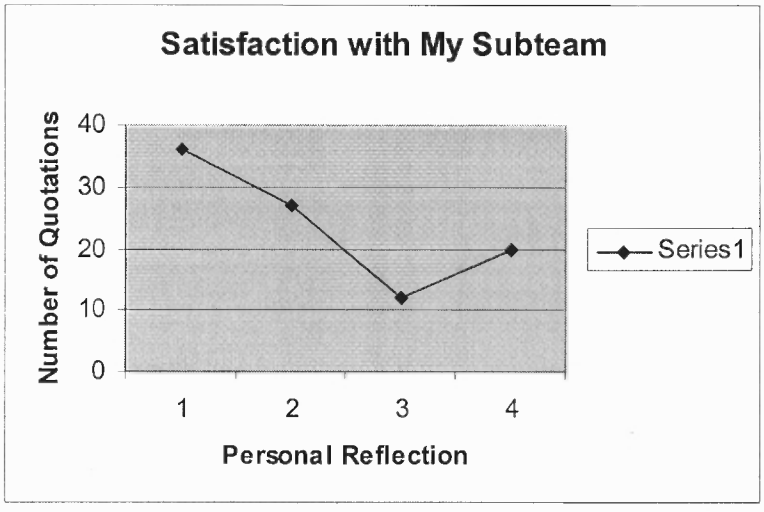

Figure 9.3 Satisfaction with "my" subteam over time.

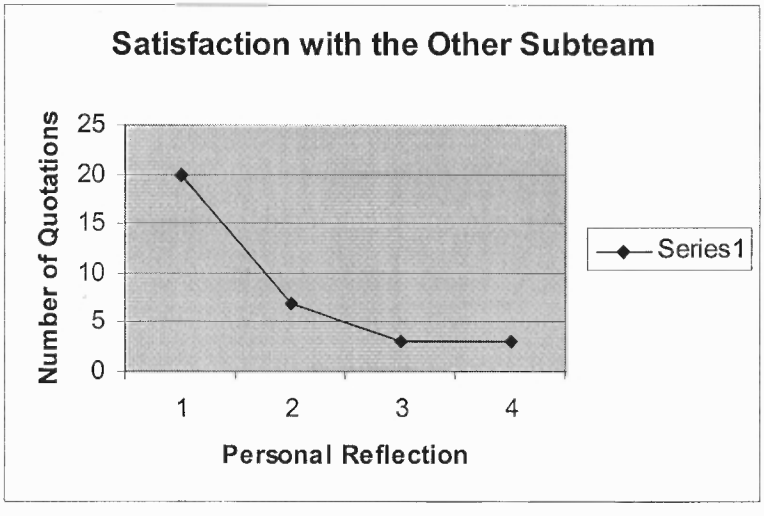

Figure 9.4 Satisfaction with the "other" subteam over time.

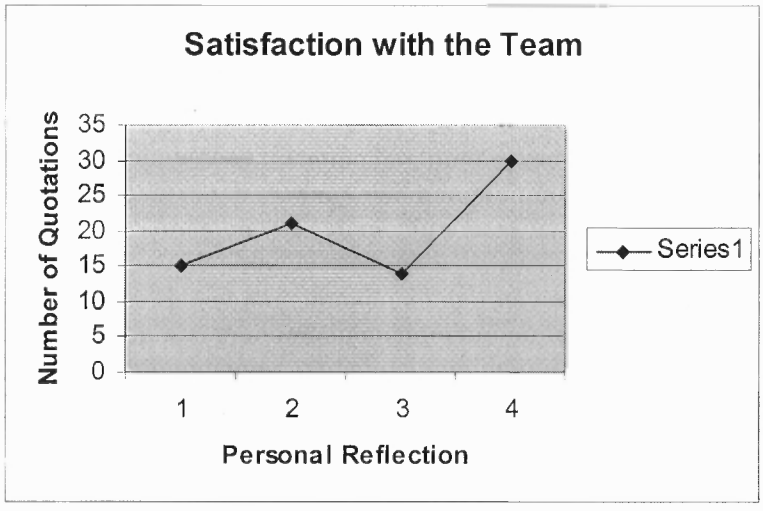

Figure 9.5 Satisfaction with the team over time.

Respondents referred to a number of reasons for their satisfaction. Table 9.2 below lists the major reasons cited along with the number of references to each reason.

Table 9.2 Counts for Reasons Given for Satisfaction with a Group

Reason	"My" Subteam	"Other" Subteam	Team	Nonspecific	Total
Members work well together	23	0	42	33	98
Everyone participates	15	3	10	15	43
Good output / success	16	1	4	13	34
Good communication	3	0	6	4	13
Good relationships	4	0	5	0	9
Other	40	38	14	31	123

By far, the most prevalent reference was to satisfaction with the members working well together. A Hierarchical subteam leader noted that "our subteams work well together." A Hierarchical member expressed similar feelings when s/he wrote, in the second personal reflection, "At this point I am very happy with how my team here and the team in America are working together." Cooperation was seen as strengthening the team by a Decentralized subteam leader from the Netherlands who wrote, in the second personal reflection, "Our team keeps getting stronger and cooperation with PSU is

going even better than before." Within a subteam, working well together was praised by a Centralized leader who wrote, in the first personal reflection, "Our subteam is working well together." A Decentralized member, in the second personal reflection, concurred about his/her subteam when noting, "Our subteam is really good and we work well together." By the fourth personal reflection, many of the expressions of working well together referred to the team as a whole. For example, a Decentralized member wrote, "We have pulled together and worked really well with each other on the final deliverable." A Decentralized subteam leader was concurred for his/her team when noting, in the fourth personal reflection, "Considering that we were an ocean away I think that the two sub-teams worked very well together." Working well together did not always mean having friendly relationships. In the third personal reflection, a Decentralized subteam leader noted that "The local team works together very well and while the two teams do not have a lot of rapport due to a lack of contact, the teams work very efficiently together."

Still, there were expressions of good relationships (9) between members, including members of distant subteams. In describing his/her experiences, a Decentralized subteam leader in the fourth personal reflection wrote, "I am pleased with the way in which we have worked together. The relationship with the other team members has always been friendly." A Centralized member, in the third personal reflection, noted that, "Both subteams have pretty much become great friends." Similarly, a Hierarchical team leader wrote of his/her team, "...and the relationship between the members has been positive." That there were "nice" people was important to some respondents. For example, a Hierarchical subteam leader wrote that "overall it

has been a good experience so far since the other distributed subteam involves nice people, and the team we have here is good as well."

The second most frequent reason for satisfaction with a group was when members were motivated and participated in the team and/or subteam work. A Hierarchical subteam leader from the Netherlands was pleased with his/her American counterparts and wrote, in the first personal reflection, "I have a feeling the groupwork with our American colleagues is working out very well. They are also interested in getting a good grade and put a lot of effort into their work." A Decentralized subteam leader was pleased that "everyone participated in the project..." A Centralized member said, "My experience so far has been a positive one. Our team dynamic has been excellent, with good group participation, and good communication and relationships between teammates." Within team participation was important to a Decentralized subteam leader who wrote, "In my opinion, the subteam has functioned well. All subteam members have been active and responded quickly and accurately." Those sentiments were echoed by another subteam leader who wrote that his/her "subteam works well" and that "everybody does his work..." Motivation was also important. A Decentralized subteam leader from the Netherlands said in the first personal reflection that s/he had "very positive experiences so far" because "we have a motivated subteam and the Penn State team is very hard working and motivated."

Other reasons were also cited by participants for satisfaction with a group. Participants felt satisfied when their group was successful in producing work. A Hierarchical team leader wrote, "As a team, I think we have been doing a good job turning deliverables in on time and getting things done." A Decentralized subteam leader

was "happy with how our team handled the first deadline." A Centralized member was pleased by his/her team for "getting work done by the deadlines."

Communication between members was seen as important for satisfaction as well, particularly between distant subteams. A Decentralized subteam leader was pleased with how his/her subteams worked together and noted in the second personal reflection that, "Communication is great and we are experiencing very little of the 'us' vs. 'then' problem."

There were also general statements of satisfaction with a subteam and/or team. For example, a Hierarchical subteam leader simply wrote, "I am very happy with my team." A Decentralized subteam leader noted, "...and we have done a good job as a team." A Centralized member exclaimed, "We are a great team."

Thus, there was a preponderance of expressions of satisfaction with both team and subteam in the personal reflections. Although the frequency of references to satisfaction with a subteam declined over time, the rapid rise at the end of the project of expressions of satisfaction with a team suggests that the decline may be due to a shift in focus from subteam identity to whole team identity. Satisfaction with a team was often a result of the members working well together and/or participating fully. But, other reasons, such as good communication and quality output, were also cited. In the next section dissatisfaction with a group is discussed. Taken together, these two sections can give insights into the affect of the participants towards the teams and subteams of which they were a part.

9.13 Dissatisfaction with a Group

Coding of the personal reflections for dissatisfaction with a group was also performed. As with satisfaction with a group, it is of interest to investigate whether participants were dissatisfied with their subteams, distant partner subteams, and/or their teams as a whole and if the level of dissatisfaction changed over time.

There were a total of 69 passages coded for dissatisfaction with a group. This is far fewer than the 245 passages coded for satisfaction with a group, lending support to the suggestion that participants were, on the whole, satisfied with their subteams and teams. Some passages referred to dissatisfaction with the local subteam, some to dissatisfaction with the other subteam, some to dissatisfaction with the whole team, and some were too general in nature to determine who the referent group was.

Only two passages were coded for dissatisfaction with the entire team. Therefore, in analyzing dissatisfaction over time, only dissatisfaction with my subteam and with the other subteam are analyzed. Figures 9.6 and 9.7 below graphically show the number of references coded for those groups. Recall that satisfaction with "my subteam" and with the "other subteam" both dipped at personal reflection 3. It is interesting to note that dissatisfaction with the other subteam rose at that same time although it then dropped at the end of the project. This adds evidence to the possibility that week 3 may have provided challenges that adversely affected satisfaction. It is interesting to note that, although the numbers are too small to be conclusive, dissatisfaction with the local team was highest the first week and then dropped to a level of only three references per week. It is also noteworthy that, with a total of 18 references to dissatisfaction with my subteam and 38 references to dissatisfaction with the other subteam, there are many more

references to dissatisfaction with the other subteam than to dissatisfaction with my subteam. This may be a result of in-group/out-group effects.

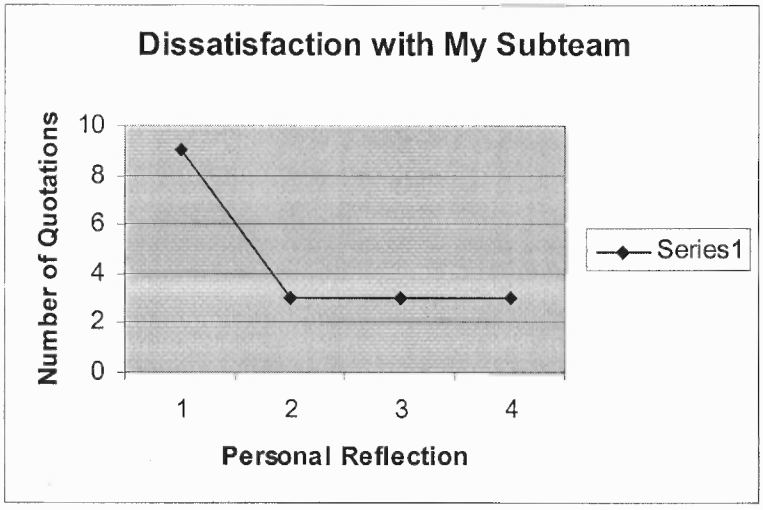

Figure 9.6 Dissatisfaction with "my" subteam over time.

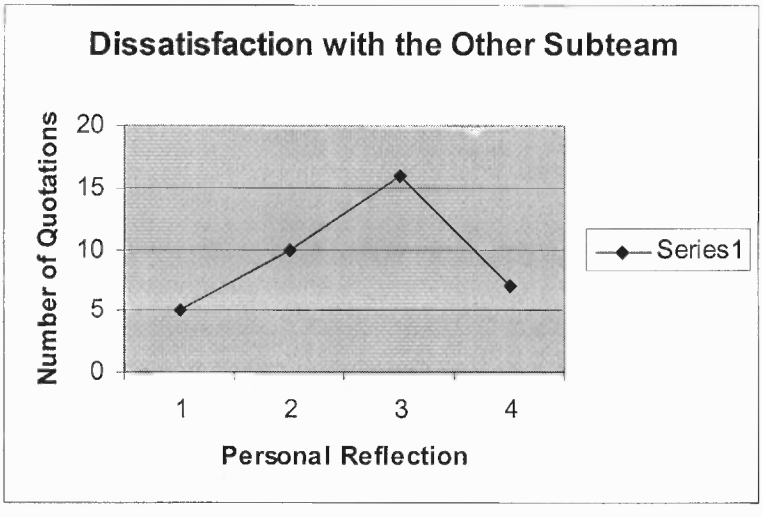

Figure 9.7 Dissatisfaction with the "other" subteam over time.

Respondents referred to a number of reasons for their dissatisfaction. Table 9.3 below lists the major reasons cited along with the number of references to each reason. Note that a quotation may cite more than one reason and so the numbers do not add up to the total number of references coded.

Table 9.3 Counts for Reasons Given for Dissatisfaction with a Group

Reason	"My" Subteam	"Other" Subteam	Team	Nonspecific	Total
Lack of participation or motivation	11	15	1	6	32
Conflict	0	7	0	1	8
Not stay on task	4	1	0	1	6
Unresponsive	0	6	0	0	6
Other	2	12	1	5	20

The most prevalent reason for dissatisfaction with a subteam or team was lack of participation and/or lack of motivation of other members. For example, a Decentralized subteam leader complained, "One set back, though is the lack of work from some of the members of the subteam." A Centralized member was descriptive in how his/her subteam members failed to meet participation expectations when s/he wrote, in the first personal reflection, "Our subteam could improve on the point of being a bit more active, logging on more often and checking everything a little more ahead ..." S/he noted that it wasn't fair to others not to participate fully. "It would also be more fair towards the others to be more active because they seem to be very active." Participants were also dissatisfied with the "other" subteam when they felt that their distant partners were not doing their fair share of work. A Hierarchical member who held both team and subteam leader roles wrote in the second personal reflection, "We have major us vs. them issues. We feel we do the majority of the work." Similarly, even in the first week, a Decentralized subteam leader had "experienced difficulties with our partners in the Netherlands. The group we're working with over there currently has (only) one active member and that has made their participation in this contract very minimal." When subgroups do not think they are participating equally, discontent can brew. One can sense a thinly veiled annoyance in the first personal reflection of this Decentralized

subteam leader, LD: "The other group is not really doing much and thinks they can have us do a larger portion of the work since we have more people." By the end of the third week, there were still complaints of lack of participation by some participants. LD still found that "The other subteam does not really do much. We do 90% of the work and they just comment on it." A subteam leader from a different Decentralized team also found that his/her distant subteam "still has yet to get in the loop with everything going on and what is due when" by the end of the third week. There were only a few mentions (4) of lack of participation in the fourth personal reflections. For example, a Hierarchical member felt that his/her subteam "wanted to meet more often than the other side and that we were putting more effort as well."

Far fewer comments made, but still of note, were references to conflict between subteams. For example, a conflict, described earlier in the discussion of the broker role, arose that ultimately involved the instructors. A Decentralized subteam member describes the conflict as "some problems with the other subteam which ranged from inappropriate comments to angry emails." A Decentralized subteam leader from that team also noted "the conflict between their team and ours and the involvement of the professors." But, other teams had less rancorous conflict as well. A Decentralized subteam leader wrote, in the third reflection, "Everything was fine until we came together to discuss the final team action plan. The conflicts started when we were talking about what should go in the red area." Conflicts arose over work distribution as well. A Decentralized subteam leader was "annoyed" that "the team in the Netherlands has pushed all the work onto my subteam. Even when we tried to make them do some of the

final project, they pushed it back onto us." Thus, conflicts were few, but, at least in one case serious enough to require intervention of the professors.

There were few references for each of the other subthemes. These problems mostly occurred between subteams. Lack of responsiveness was one such issue. A Decentralized member noted, "We had problems with our other subteam, though, as they weren't answering as soon as we hoped. They also canceled one of our planned meetings." Synchronous meetings required compromise because of the time difference and members were dissatisfied when they felt that their subteam did all of the compromising and the other subteam lacked flexibility in meeting times. A Decentralized member said, "There is some frustration in the fact that we are more flexible than the other subteam in scheduling times to meet with the time zone difference." Members not staying on task, disliking members of the other subteam, and poor work output were also mentioned in the reflections as issues of dissatisfaction.

Thus, although, by and large, members were satisfied with their team and subteams, there is evidence that there was some discontent and that the primary reason for dissatisfaction was a perception that members were not participating fully.

9.14 Communication Media Used

The teams were each provided with private space on the PDT system, an asynchronous communication system. However, they were not restricted to the PDT system although deliverables were to be posted there. The surveys asked questions about what technologies were used, as discussed in the previous chapter. But, it is of interest to understand when and why certain technologies were used, as well as what technologies

not asked about in the surveys were used. There were 89 quotations coded for communication media used. Table 9.4 below shows the frequencies with which different communication media were mentioned in the personal reflections. Note that some quotations mentioned more than one communication medium and so the totals do not add up to 89.

Table 9.4 Communication Media Used

Medium	# Quotes
E-mail	40
Instant Messenger	38
PDT System	22
Facebook	5
Phone/sms	5
Skype	5
Google Docs	3
Meetings (Unspecified)	3
Chat	2
Course Management System	2
Face-to-face meeting in class	2
Blogs	1
Unspecified system	1

E-mail and instant messenger were, by far, the most commonly referred to communication media. It is interesting that one is a synchronous technology while the other is asynchronous.

Email was often used by leaders for reminders and other managerial tasks. For example, a Hierarchical subteam leader had difficulty getting members to attend meetings and so, "I wrote an email around stressing the point of group meetings." A Decentralized subteam leader "was constantly sending out email reminders to those individuals mentioned earlier to please submit their work." A Centralized leader "sent out emails about what we should try to do in our meetings or the modules."

Even when communication was primarily through other media, emails were used for updating, etc. A Decentralized subteam leader noted, "...we check our websites on which we communicate every day, and send each other emails whenever there are big updates." Email was a tried and true standard of communication. A Decentralized subteam leader noted that "The communication has been via email only." Another Decentralized subteam leader wrote that, "the only thing that seems to continually work is email." Another Decentralized subteam leader noted that "We don't really have a good communication other than emails and forum posts." But, for at least one participant, when email was the primary mode of communication the quantity of emails received could be overwhelming. A Decentralized member wrote, "Everyone gets along with one another well and there are no communication problems except maybe too many emails once in a while."

Instant messenger, a synchronous communication tool, was also commonly used. However, it initially created problems for the teams. In Europe, MSN is the instant messenger most commonly used while AOL is used most often in the U.S. Most teams chose to solve this inconsistency by using MSN. A Decentralized member remarked on this issue when writing, "The only problem occurred due to the use of different messengers but could be solved easly by deciding on one messenger." A Decentralized subteam leader from the U.S. wrote, "I've also signed up for an MSN account since all of the Netherlands team use this." A Hierarchical subteam leader appreciated that, "They (U.S. subteam) switched over to MSN for us, and we already set meeting times for both the entire teams and the captains." But, at least one team chose to use AIM instead. A Decentralized subteam leader remarked that, "This week the interaction between the

members has become better. This happened because the UVT (Netherlands) members started to use AIM to keep in direct contact with our American colleagues."

Whole team meetings were held using instant messenger. A Hierarchical member wrote, "We have a meeting on MSN twice a week and we have experienced no problems." A Hierarchical team leader was pleased that, "Our team meetings on MSN messenger are going great." A Decentralized subteam leader organized meetings the second week and wrote, "This week as a leader I have been quite active in arranging everyone to come together on MSN." Instant messenger was also used for more informal communication. For example, a Decentralized subteam leader wrote in the second personal reflection that, "Everyone is communicating and contacting everyone else very easily. Everyone is on MSN messenger at least once a day which gives us a chance to check in and make sure things are going okay."

The other communication media referenced were mentioned far fewer times. It is interesting that of the media mentioned, only blogs and Google docs were not in the list of choices given to the participants in the survey questions about communication media use. That is, quantitative results, described in the previous chapter, are available for most of the communication media referenced in the personal reflections.

Facebook was referenced five times. Facebook was seen as an "effective and convenient" way to communicate, according to one Decentralized subteam leader. For one team it was seen as an alternative to instant messenger. A Centralized team leader noted, "The communication usually takes place on Facebook, as AIM does not always work for them." But for others it was part of a suite of technologies used for

communication. A Centralized member wrote, "We communicate through Skype, Facebook, and email."

Phone and SMS were also referred to five times. Although the team used MSN, one Decentralized subteam leader noted that they also used the telephone when s/he wrote, "The MSN has proven to be a really good tool for us to communicate, but we'll also use the phone to call each other and ask each other questions." When one Decentralized member was unable to be active for a while, s/he was able to keep up with the team because "they kept me up-to-date with emails and sms's."

Also used were in-class meetings for subteams, the PDT system, blogs, course management systems (Angel), and Google docs. Google Docs was used to communicate changes in deliverables and integrating documents. A Hierarchical subteam leader wrote, "I talk with the subteam leaders and make appointments on MSN, and help with combining documents with Google Docs." The PDT system was used to by leaders to communicate schedules and status. A Decentralized subteam leader, JS, noted, "I created a forum post regarding everything that we had done and everything that was coming up in the future." In one case, a misunderstanding was cleared up by postings on the PDT System. JS wrote, in the second personal reflection, "Ater a few comments on the Wiki site (PDT System) we finally got everything figured out." When synchronous technologies proved problematic, asynchronous ones, including the PDT System proved to be robust. A Centralized member wrote, in the first personal reflection, "One problem is that my Internet connection has not been working well for me, so I am not able to communicate through AIM or Skype as often as I would like. But I still communicate through the PDT Website and through email as well."

The six-hour time difference made synchronous communication difficult. While many of the teams did adjust their schedules to communicate synchronously, email, Facebook, blogs, and the PDT system, all asynchronous tools, were used frequently. One Centralized member wrote, "Through the third week of working on the PDT project we have had great communication between our team here at PSU, but we could do a little better trying to contact the subteam in the Netherlands. It is hard to do with the six hour time difference. The only contact we are receiving from then is via Facebook or on the PDT website."

Thus both synchronous and asynchronous communication media were used with instant messenger and email being the most common technologies used. Teams found that rather than relying on just one technology, a suite of media served their communication needs best.

9.15 Communication Problems

Eighty-one quotations were coded for communication problems. It is of interest whether there was a pattern of issues over time; what the most prevalent problems were; and whether problems occurred within subteams, between subteams, or both. As can be seen in Figure 9.8, communication problems over time were relatively stable with the highest number of reported problems occurring at the beginning of the project (personal reflection 1) and in the middle of the project (personal reflection 3). It is not surprising that communication problems occurred at the beginning of the project. Teams had to work out issues such as how often to communicate and respond and what technologies to use for their communication. For example, a Decentralized subteam leader, in the first

personal reflection, wrote, "It was a bit difficult to find a proper way of communicating with the other subteam, but I guess we're getting there." A Hierarchical member noted, "It's taken a bit to get the communication down, figuring out what IM to use and who's going to be doing what." A Centralized member noted the difficulty in establishing a rhythm of communication when s/he wrote, "The only problems or concerns I have so far involving the project is the lack of contact from our members from the Netherlands."

There were fewer references to communication problems in the second personal reflection and then the number rose, almost to the level of the first personal reflection, in the third reflection. It is interesting to note that the third personal reflection also, as described above, had the fewest number of references to satisfaction with a group. It may be that the two are related. That is, it is possible that communication problems increased with the demands of the task and that contributed to a dip in the satisfaction with the group. In the third reflection a common issue of communication was lack of adequate communication frequency. For example, a Decentralized subteam leader from the Netherlands wrote, "I would have liked more often to communicate with the US subteam." A Hierarchical team leader wrote that communication between subteams was infrequent and had delays when s/he noted, "What is difficult is communication. … With the Netherlands group we often don't get their emails for hours, and don't respond to their PDT post for a few days." The time difference, as noted above, was cited as a cause of the communication frequency and delay problems in a number of personal reflections. A Centralized member wrote, "…we could do a little better trying to contact the subteam in the Netherlands. It is hard to do with the six hour time difference."

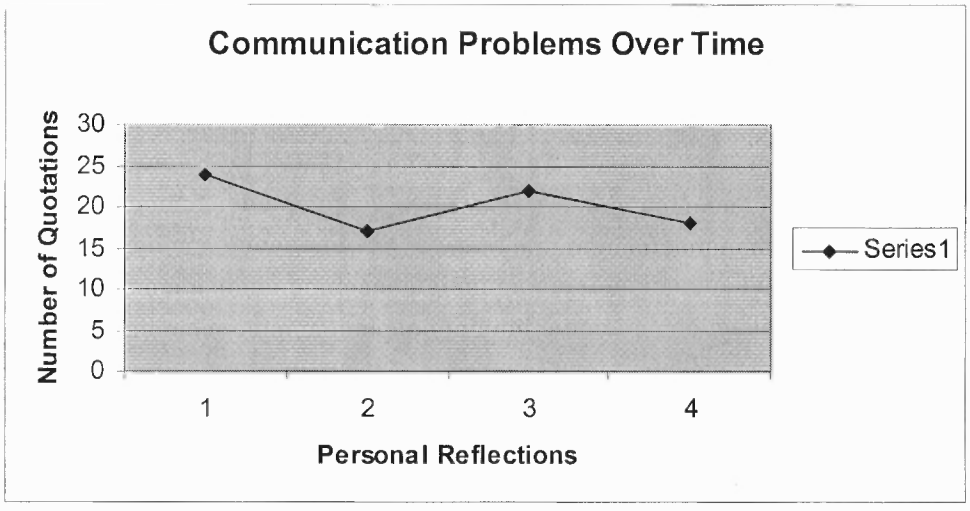

Figure 9.8 Communication problems over time.

The majority of the 81 quotations coded for communication problems were for issues of communication between subteams (57). Only four quotations were coded for problems within subteams. Twenty (20) were too generally stated to determine the groups the communication issues involved. Thus, it was the distance and the need to use electronic communication media to communicate that created communication problems.

Within a subteam communication problems included issues of gossiping, infrequent communication, a general need for improvement, and a member not understanding the norms for communication protocol. One Decentralized subteam leader was concerned that she overheard another member state that, "she hated the group and really didn't like the girl in the group (me)." A Decentralized member called for an improvement in subteam communication without specifying why there was such a need when s/he wrote, "Within our subteam communication is ok but could be improved." Another Decentralized subteam leader noted that "We had only little trouble with communication and not between the teams but within the subteam for the UVT. One of our team members is not used to working in a team and somehow forgot to use 'reply all'

instead of just 'reply'. Finally, a Hierarchical member noted a need to improve the level of communication within the subteam when s/he wrote, "We could still improve our communication within our subteam as we often sit in class and don't work together as much as we should."

Communication problems between subteams were primarily cited as being the result of time and language distance. A Decentralized subteam leader, in the fourth personal reflection, described communication problems brought about by language differences. S/he remarked, "Our team communication has been breaking down dramatically the past few weeks. Partly because the team from the Netherlands does not seem to understand English as well as we thought they did which makes it very hard to explain things to them." A Hierarchical subteam leader had difficulty with the time difference and wrote in the first personal reflection, "Communicating delays is a hurdle due to class schedule conflicts and time zone differences."

Response delays were also cited frequently as an issue in communication between subteams. Of course, some of that was accounted for by the time difference. In the first reflection, as teams were settling on a communication rhythm and media to use, response delays were a problem. A Decentralized subteam leader, in the first personal reflection, noted, "The only thing that was a problem was the length of time it took for the other subteam to communicate back with us." S/he felt, however, that "that will not be a problem in the future." However, for some teams, response delays continued to be an issue. In the second personal reflection, a Centralized team leader wrote, "At this point we are still having problems communicating in a good amount of time. We are getting things together and then waiting for the other half of the team to get back to us." One

team had an issue with response delays caused by the fact that one of the subteams did not have good computer access. A Decentralized subteam leader, in the second personal reflection, wrote "It is a little bit annoying because it does not seem that the UVT students have access to computers all the time. It has been exceedingly difficult to get hold of them and they usually email me back on the Thursday before the module is due." A Decentralized member from a different team also experienced a communication problem due to the difference in accessibility of the other subteam. S/he wrote, "We've had communication problems in never thinking that the other team had any conviction (sic) in the project. They only work on the project on Fridays in class and we had attributed their lack of effort to pure laziness but in reality it's because they only work Friday morning." Thus, a misunderstanding arose due to differences in the work habits and computer accessibility of the distant subteam.

Other misunderstandings arose as well. A Netherlands Decentralized subteam leader wrote about a duplication of effort that resulted from a lack of communication. S/he wrote in the first personal reflection that they had not discussed how to divide the work so, "This week the Penn State students and us did the same things so actually it is done twice." That team learned from the experience and "from now on we communicate regularly (so) these inefficiencies will not happen again." The misunderstanding that arose between subteams which had to be mediated by the professor, discussed above, was cited by the Decentralized leader of one of the subteams as generating a misunderstanding in communication that was able to be resolved. S/he wrote in the third personal reflection, "From there communication took a turn for the worse. We grafted (sic) a document to the UVT subteam telling them of what happened. Apparently, we

came off as blaming all our problems on them, which is not what we meant to do. We started a dialogue with them and think we now have everything worked out." Differences in language were the source of some of these communication problems. A Centralized member, in the second reflection, in describing communication problems, recounted an instance where "one student misunderstood us and disconnected us. We were able to resolve it though and he understood it was a misunderstanding."

A lack of high enough level of communication between subteams was considered to be the cause of degradation in performance by one Hierarchical subteam leader. S/he wrote in the third personal reflection, "So far throughout the project, the issues that we have had were communication issues and work efficiency. As a team as a whole we could have definitely communicated more. Due to the lack in this area, most of our assignments were not completed to the best of our team's ability. I would have to say that the only time that we 'communicated' was when we had to email each other for the survey questions." Limited communication was seen as a problem by others, as well. For example, a Decentralized subteam leader wrote, "I think the main problems in our team are that emails aren't read very often. Team contact only goes between team leaders and non-leaders don't contact (each other) very much." Another Decentralized subteam leader from a different team wrote, "We could improve the communication between our teams and then, most important, how often we communicate."

Technical problems in communicating were also discussed in the reflections. As described in the section about media used, subteams had to agree on the technologies to use and resolve the difference in the IM used most frequently by the two countries. In the first personal reflection, a Decentralized subteam leader described the trouble

"communicating with the other subteam for the first meeting. Because we were assuming that the other subteam was also familiar with MSN messenger, but this was unfortunately not the case. They are all using AIM ....it was a bit difficult to get all into the same chatroom. But after that everything worked fine...." Other technical difficulties were more difficult to resolve. A Centralized member had Internet problems and so, in the first reflection, noted that "I am not able to communicate through AIM or Skype as often as I would like. But I still communicate through the PDT Website and through email as well. But I have also heard that some of our team members in the Netherlands have also had Internet troubles, so now it has become a concern...." A Centralized member of the same team noted in the third reflection that communicating electronically across distance was still a problem for that team. S/he wrote, "Primarily our communication with the Dutch team needs to really improve. During our meetings we struggle to communicate with them because of software issues." Other teams struggled as well. A Centralized member of another team wrote in the fourth reflection, "From time to time it was hard to communicate because of the time difference of course, and the fact that the synchronizing of technologies used for it took a while."

Thus, the personal reflections suggest that communication between subteams was a much graver issue than communicating within subteams. Restricted to electronic media and having to cope with time, language and cultural differences presented challenges. A Hierarchical member of a Netherlands subteam summed it up nicely when s/he wrote, "Since the means to communicate with our American counterparts are limited it can be really frustrating from time to time."

9.16 Communication Success

Despite the communication problems discussed in the previous section, there were also reports of communication successes in the personal reflections. Ninety-seven (97) quotations were coded for communication success. Again, as with communication problems, it is of interest whether or not there was a pattern over time. As shown in Figure 9.9 below, reports of communication success were highest in the first personal reflection, then dropped in the second reflection and then again in the fourth reflection.

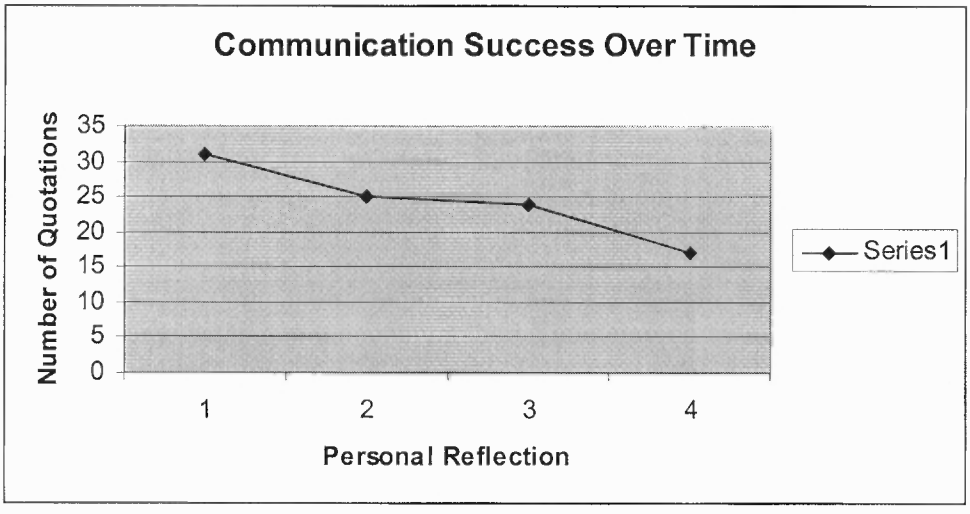

Figure 9.9 Communication success over time.

However, it cannot be inferred that communication degraded after the first personal reflection as the graph of the communication problems (Figure 9.8 in section 9.15) indicates that reports of communication problems also peaked in the first personal reflection. It may be that communication was most salient and important to the participants at the beginning of the project as they acquainted themselves with their distant team members and began to plan and organize their activities.

Many of the comments in the personal reflections were general statements of communication success such as the Hierarchical member who wrote in the first personal

reflection, "Communication has been fine in the subteam" and the Decentralized subteam leader who noted, "There have been no major conflicts in our team and we are communicating very well." Similarly, a Centralized member simply wrote, "Communication is ok."

Other comments were more descriptive. A Decentralized subteam leader wrote about how good communication increased his/her subteam members' understanding of their distant team mates. S/he wrote, "In general, it was a constructive meeting which gave an insight into the thoughts of the American subteam on the project. .... Generally speaking, the group is functioning well and the Skype meeting certainly contributed to the group dynamics." Successful communication in meetings was also noted by the Hierarchical member who remarked in the second personal reflection, "We communicate very well, in fact we have meetings twice a week and if someone is not able to make it there, we always know beforehand and we always make sure to communicate the plans to them ..."

Many of the reflections commented on the communication between subteams. A Centralized member wrote in the second personal reflection, "We have been able to communicate well with the people from the Netherlands." A Decentralized member said, "We use MSN to communicate with our American team members; this is going well." A Hierarchical subteam leader remarked, "Overall I think our communication between members and leaders as well as the communication between subteams has been great so far." A Decentralized subteam leader lauded his/her team's communication success when s/he wrote in the first personal reflection, "As far as things my subteam is doing well, communication seems to be our strong point. The team as a whole has great

communication now...." Frequency of communication was good for many of the teams. A Decentralized subteam leader remarked, "Furthermore, we communicate very often and the coordination between the groups is going great."

There were also mentions of communication successes within a subteam, albeit fewer of them than the comments about communication between subteams. Even when between subteam communication wasn't going well, communication within subteams could be successful as in the case of the Decentralized subteam leader who wrote, "Communication between subteams is sometimes unreliable. Communication on a subteam level is excellent." Within subteam communication was also reported as good by a Centralized member who wrote in the third personal reflection, "For this week our subteam has been communicating fairly well."

After the first personal reflection, there were reports of communication improvements. In the second personal reflection, a Decentralized subteam leader remarked on this when s/he wrote, "Our team has had a lot more interaction this week especially through IM and Facebook." In the third personal reflection a Hierarchical member wrote, "Overall, I would have to say that our communication and coordination have improved since last week's meeting." In the third personal reflection, a Decentralized member wrote of how planning communication improved it and the improvement helped the team function better. S/he wrote, "At first, our communication with the other subteam wasn't going too well, but after setting a plan of how and when to communicate, we began to adjust well to working with them." A Centralized member, in the fourth personal reflection, summed up the experience of his/her team by saying, "As

the project is ending, our team dynamic has improved enormously from the beginning. Our work is getting done much more smoothly, and communication is better."

The building of relationships between members was seen by one Centralized member as promoting good communication. S/he wrote, "My relationship with the rest of my team mates of both Dutch and US subteams has grown over the last few weeks, and so because of this new found relationship the communication and coordination has gotten a lot better." Thus, there was a synergy between good communication and good team relationships.

Good communication was seen as crucial to resolving misunderstandings. A Decentralized subteam leader discussed how conflict was settled with communication. S/he wrote in the first personal reflection, "So far the only real problem is that we seem to have stepped on their toes so to speak in our team contract. They were clear in letting us know of their displeasure, which I believe is good. This means that communication is open and problems are being discussed." Another team found that communicating on the PDT System resolved a problem. "After a few comments on the Wiki site we finally got everything figured out," wrote another Decentralized subteam leader in the first personal reflection.

Thus, there is evidence in the personal reflections that many teams had good communication and that communication improved and was able to help resolve misunderstandings and conflicts. Communication is vital as was summed up by a Centralized member who wrote in the third reflection "This has been a great experience and both teams have been able to communicate successfully." A Decentralized subteam

leader expressed similar feelings when s/he wrote in the fourth personal reflection, "On a final note, our team was very fortunate to have great communication and work ethic."

9.17 Summary and Conclusions

Qualitative analysis of the personal reflection provides insight into the functioning of the teams and the perceptions and feelings of the participants. The analysis suggested how leaders enacted the leader roles described by Quinn (1988) and that there were a few instances of emergent leadership. Significantly, the analysis answers the research question of whether or not the Quinn (1988) roles are enacted in PDTs in the positive. Evidence was provided for the enactment of the roles in the study PDTs. Although there were some references to members being dissatisfied with their leadership and/or group, most members were satisfied with their leaders and with their teams, subteams, and partner subteams. Teams generally took a work approach that combined "divide and conquer" and collaboration. The teams preferred, generally, to use a suite of communication tools that combined asynchronous and synchronous media. Communication problems often had to do with the challenges of distance, yet many teams were able to overcome these problems through planning and flexibility. The personal reflections were rich with details of the experiences of the participants and through finding ways of overcoming the challenges of working in PDTs they not only were able to produce deliverables of high quality but also learn much about how to work in a partially distributed team.

CHAPTER 10

STUDY TWO QUANTITATIVE ANALYSIS

10.1 Introduction

During the spring semester of 2008, a second full scale study was undertaken. The independent variables were leadership configuration and distance (cultural, geographic, and temporal). All relationships in the model were tested using quantitative analysis of surveys.

Study 2 follows Study 1, described in the previous chapter, which was conducted in the fall semester of 2007. Although the basic procedures were the same for the two studies, there were changes made in response to the lessons learned from Study One and to gather additional data. The major changes were:

- The task was similar to the Study 1 task in scope and requirements but the details, as described below, were changed.
- Training was provided to the instructors of the participating classes. The training included an overview of the study requirements and guidance for instructing the students each week.
- An additional guided learning task, to create an outline of the functional requirements for the proposed system (task), was added in the third week.
- Team self-selection of the leaders was moved to the first sub-task in the first week so that the leaders would be chosen before other first week activities were undertaken. In Study One the leadership manipulation failed in that teams chose leaders contrary to the instructions. Moving the leadership selection to the start

of the first week activities was successful in that in Study Two leaders were chosen as per the instructions.

- Leadership and member responsibilities given to the participants were rewritten to be more comprehensive and clearer.
- Some survey instructions were clarified (e.g., definitions of "between subteams" and "within subteams" were added when appropriate).
- Additional survey questions were added:
    - Background survey
        - To ask if the participant had ever been employed in a management position.
    - Personal Reflection 1 (week 1)
        - Trust scale
    - Personal Reflection 2 (week 2)
        - Questions to ascertain the media used for communication both between and within subgroups.
    - Post Leadership Survey
        - Satisfaction with a subteam/team scale (3 items)
        - Question to determine if the subteam/ team had emergent leadership
        - Satisfaction with a subteam/ team leader scale (3 items)
        - Ineffective bad leadership scale (3 items)

This chapter describes first the subjects, conditions, and task. Then, quantitative analysis results are reported.

10.1.1 Subjects

Two hundred and eight undergraduate students from five universities in four countries (USA, Spain, UK, and China) were placed into 21 teams of eight to 12 members each. Four students failed to complete the task and were removed from the data set so that the total number of subjects was 204. Each team consisted of two subteams. For each team, with the exception of one team, each subteam was from a different university and country. One team was a "zero-distance" team comprised of two subteams from different classes from the same U.S. university. The other 20 teams had one subteam from the US and one from Spain, UK, or China. Each subteam was from the same collocated or hybrid class so members of the subteam were collocated with each other while distant (with that one exception) from their teammates belonging to their team's other subteam.

10.1.2 Conditions

Teams were assigned each to one of three leadership conditions: Centralized, Hierarchical, and Decentralized. In the Centralized condition the team self-selected one overall team leader and no subteam leaders; in the Hierarchical condition, the team selected one overall team leader and a subteam leader (2) for each subteam; and in the Decentralized condition there was to be no overall team leader but a subteam leader was selected for each subteam. Each team PDT System private space included a link to a description of the leadership they were to choose along with leader responsibilities for each type of leadership in the assigned condition. Member responsibilities were also

described in the private PDT System team space. Teams selected their leaders as part of the first week's activities to create a team contract. There were eight teams in the Centralized condition; seven teams in the Hierarchical condition; and six teams in the Decentralized condition.

Subteam assignments were made prior to the start of the study by the class instructors. The researchers paired countries based upon the logistics required to run the study and then randomly paired subteams (by using a random number table) to create the teams such that each team (with the one exception noted above) had subteams from different countries. Leadership condition was randomly assigned using simple random sampling. However, after the assignments, one team randomly assigned to the Hierarchical condition was switched within the first week to the Decentralized condition because the team lost two members which made having three leaders (Hierarchical condition) not feasible.

After the team contracts were submitted at the end of the first week, a manipulation check was made by examining them. The analysis of the contracts indicated that the subjects followed the instructions and selected leadership that placed them in their assigned leadership condition. This is quite different from the Study One experience in which most teams self-selected leaders that placed them in the Decentralized condition. The difference was that for Study Two, the instructions were clarified and the leadership selection was moved to being the first task as part of developing the team contract.

Distance is operationalized as time zone distance and is measured at the team level for the distance between the two subteams in a team. Although the intention was to include cultural distance as well, preliminary analyses indicated that the measures for cultural distance suffered from issues of multicollinearity and so it was not appropriate to use the measures in quantitative analysis. Culture was measured as the culture of the country in which the university of the subteam resides. This measurement did not take into account individual or regional cultural distances within a country. Culture was measured using Hofstede's indexes (Hofstede, 2001) but, again, was dropped from the analyses.. Table 10.1 below shows the temporal indexes and temporal distance scores for the countries and structures of teams that participated in Study 2. Note that the study took place during Daylight Savings Time (DST).

Table 10.1 Temporal Indexes and Distances

Country	**Time Zone (GMT +)**
USA	-4
UK	1
Spain	2
China	8
Team Configuration & Number of Teams	**Time Zone Distance**
USA – UK (8))	5
USA – Spain (3)	6
USA – China (9)	12
USA – USA (1)	0

Geographic distance can impact how easily face-to-face meetings are held. For this study all teams (except for the one with zero distance) were comprised of subteams that had east-west distance and were separated by at least one time zone. Therefore, for

this study, geographic distance and the issues it raises are captured by the time zone differences. Thus, for this study's analysis, only cultural and time zone distances are measured. Time zone distance is measured by the number of time zones between the two subgroups of a team.

10.1.3 Task

The task was to determine the functional requirements and related decisions for an emergency management information system. The primary deliverable was to prepare a written report in response to a Request for Proposal (RFP) for a Bioterrorism Management and Planning System (BTMAPS) which was to be an emergency preparedness system for the country of Switzerland supporting resource management and detection of bioterrorist threats to Zurich. The subjects were to prepare the report as if they were analysts bidding on the RFP. The final report was to specify the functional requirements of BTMAPS as well as who the users would be, what policies would be needed to manage it, and what next steps would be needed for the project. This task, although for a different country and purpose, was similar in scope and requirements to the task used in Study One.

All teams worked on the same task and the final report was due at the end of the four-week study period. Intermediate deliverables were designed to help the participants work well in a PDT and guide them in the process of preparing the final report. Final reports were graded for course credit by a designee of the researchers and one of the researchers (each taking half of the papers) using a grading rubric to ensure grading consistency. Then the papers were all graded, using the same grading rubric, each by two experts.

10.1.4 Communication Media

Each team was provided with private space on the PDT System, a customized wiki that does not function as a wiki as open editing is not provided. Participants were able to post to discussion forums, create discussion forums, upload files, and create pages. Subteams also had the capability to create private spaces that their "other subteam" could not access. Communication was not restricted to the PDT System although all deliverables were posted to the team space as well as emailed to the researchers.

10.1.5 Procedures

All participants worked on the task and the intermediate deliverables. Those participants whose instructors required it also completed a peer review at the end of the project. Participation in the experimental instruments (surveys and personal reflections) was voluntary for U.S. students and required for all others, and participants received extra credit for completing them. Intermediate deliverables were posted on the team PDT System space and emailed to the researchers.

The first week the participants engaged in activities that prepared them for working in a PDT. They completed a system tutorial and introduced themselves to each other on the PDT System team space. The participants also completed the first of three tutorial modules, the goal of which was to get the team off to a good start by clarifying team expectations and responsibilities, raising awareness of issues of working in PDTs, and by selecting leaders. The participants read scenarios that described issues of working in PDTs with instructions that guided them to complete a team contract which included selecting and identifying leaders and agreements on how often and through which media they would communicate in their teams. Module One was similar to Module One used

in Study One. However, in Study Two, the activity of choosing the leaders was moved to be the first activity of the module. As part of preparing the contract, the participants read a description posted on the PDT System of leader and member responsibilities. The participants in the experiment also completed a background survey and a personal reflection. Personal reflections include survey questions and an open-ended question for the participants to reflect on their experiences the week beore.

Active work on the response to the RFP (final deliverable) began in week 2. All participants completed Module 2 which had the goal of moving the teams from an "us vs. them" mindset to one of "we" (i.e., a whole team identity). Module 2 had two activities. The first was a team building exercise in which the participants interviewed members of their counterpart subteam and built a team page of member biographies and information about the team members (e.g., the five favorite foods of team members). Links to the web pages were emailed to the researchers and posted on the PDT System team space. The second activity was a brainstorming activity to generate a list of functionality for the proposed BTMAPS system. The participants in the experiment also completed a second personal reflection.

The beginning of week 3 marked the midpoint of the project. The goal of Module 3, completed during this week, was to establish a positive team trajectory. Module 3 had two activities. The first activity was a team assessment activity designed to help the participants assess their team interaction and performance and reach agreement on an action plan for improvement. The second activity was to produce a detailed outline of the functional requirements, using the brainstorming list as a foundation, for BTMAPS. The

outline activity was added to this module for Study Two. Participants in the experiment also completed a third personal reflection.

During the fourth and final week the teams completed their final deliverable using a proposal template provided to them on the PDT System. There were no team building exercises this week. Those students required to do so by their instructors completed a peer evaluation and the participants in the experiment completed another personal reflection and two post surveys at the end of the week. The final deliverable was emailed to the researchers by the team.

10.2 Quantitative Measures of Intervening Variables

The primary sources of data were the personal reflections and post surveys. There were two post surveys: one with items specifically related to leadership, and the other with the remainder of the questions. Two post surveys were used because, in total, the number of items was too large to be accommodated by a single survey. However, for convenience, this discussion will refer to both post surveys as "the post survey." This research, as part of the larger study of PDTs, uses a subset of data collected from the experimental instruments.

10.2.1 Enactment of Leader Roles

The post survey had 18 items per leader type (subteam or team leader) relating to the eight leadership roles identified by Quinn (1988). The eight roles are innovator, broker, producer, coordinator, monitor, facilitator, and mentor (Denison et al., 1995). The participants were asked about the extent to which their leaders enacted each role behavior. Scale items were derived from Denison et al. (1995), with two 7-point

semantic differential scale items per role and two additional new items (one for the director role and one for the monitor role).

For each role, the values of the scale items that measured that role were averaged to arrive at a score (from 1 to 7) for the salience of that role enactment to members. Averaging was used because the number of items was not the same for each role. Experience with Study One showed that although the teams who were to have subteam leaders were instructed to select one subteam leader per subteam, some selected co-subteam leaders. In such cases, for each role, the scores (on a scale of 1 to 7) for the two co-subteam leaders were averaged to arrive at a subteam leader role score. This was necessary because the way the data were collected, it was not possible to know which subteam co-leader was being referred to for any set of role behavior questions.

10.2.2 Perceived Leader Effectiveness

Perceived leader effectiveness was measured by one 10-point semantic differential scale item each for team and subteam leader in the post survey.

10.2.3 Trust

Ten scale items for trust within a subteam (with the same ten items repeated for trust between subteams) were included in both the post survey and first personal reflection. The ten 7-point semantic differential scales for trust had four questions (8 in total) adapted from Jarvenpaa, Knoll, and Leidner (1998) and six questions (12 total) adapted from Cummings and Bromily (1996) to measure affective trust in the dimensions of "keeps commitments," "negotiates honestly," and "avoids taking excessive advantage."

10.2.4 Communication Media

To capture what communication media teams used, both the second personal reflection and the post survey had a series of questions asking the frequency of use of 13 different communications media (plus "other" for which a text field was provided) on a scale of 1 (never) to 7 (to a great extent) for both communication within a subteam and communication between subteams. The communications media rated were PDT System, instant messaging, e-mail, text messaging, Facebook, phone, Internet phone (e.g. Skype), face-to-face meetings, fax, video conferencing, teleconferencing calls, course management system, and external forums or bulletin boards.

10.3 Quantitative Measures of Dependent Variables

10.3.1 Performance

Perceived Performance was measured in the post survey by six 7-point semantic differential scale items each for perceived performance of the subteam and perceived performance of the team. The scale items were adapted from (Mortensen and Hinds, 2001). Each question asked about one of the six dimensions of performance: efficiency, quality, creativity, adherence to schedule, coordination of member efforts, and communication between members. Perceived performance was measured as the sum of the responses to the six questions.

Objective performance was measured by the grades given to the final deliverable by designees of the researchers, using a rubric designed by the researchers. Each team report was graded by a single grader. Also, two experts experienced in software development evaluated the final reports using the same rubric as the graders. Thus,

objective performance, based upon the evaluations of the final deliverable, is only at the team level. Spearman rank correlations were taken between the graders' grades and each expert's grades, between the experts' grades and between the graders' grades and the average of the experts' grades. The graders' grades were not (barely) significantly correlated with the grades of Expert1 (r=.430, p=.0519), but were significantly correlated with the grades of Expert2 (r=.610, p=.0033). Additionally, although the two experts' grades were not significantly correlated with each other (r=.3520, p=.1177), the graders' grades were significantly correlated with the average of the experts' grades (r=.58361, p=.0055). Therefore, for consistency with how objective performance was measured in Study 1, for objective performance in this analysis, the average of the three grades (graders, Expert1, Expert2) is used.

As with Study 1, it is of interest to measure perceived team performance at the individual level with objective performance, measured as above. Note that perceived team performance was not normally distributed (D = .113512, p<.0100). Therefore, a Spearman's rank correlation test was done and the results indicate that, unlike the results in Study 1, perceived team performance and objective performance were not significantly correlated (r=.07009, p = .3216, N = 202).

10.3.2 Satisfaction with a Leader

Satisfaction with a leader (subteam or team) was measured on the post survey with 3 semantic differential scale items that asked the participants to rate their overall satisfaction with the leader. Through an oversight, the first two questions were 7-point semantic differential items and the third question was a 10-point item. For analysis, therefore, the third question answers are normalized to fit in the range of a 7-point scale.

10.3.3 Satisfaction with a Group

Satisfaction with a group (collocated subteam or "other" remote subteam) was measured on the post survey with three 7-point semantic differential scale items adapted from (Fuller et al., 2006-7). That is, each question was answered for both "my subteam" and for the "other subteam." Satisfaction with a group was measured as the sum of the responses for the three questions for that group.

10.3.4 Ineffective "Bad" Leadership

Ineffective "bad" leadership, although not in the model, is measured for analysis by three newly designed survey items in the post survey, one each to measure incompetence, rigidity, and intemperance which are the three dimensions identified by Kellerman (2004) as characterizing bad leadership which is ineffective.

10.4 Reliability and Validity of Scales

Reliability measures (Cronbach's alpha) were taken for multi-item scales. In cases where Cronbach's alpha was inadequate (trust) and the number of scale items was small, composite reliability measures were taken because Cronbach's alpha is sensitive to the number of items. When appropriate (i.e. on reflective scales), a factor analysis (principal components with Varimax rotation) was also performed. The statistical package SAS® was used to measure reliability of the scales and to perform factor analysis. SmartPLS (Ringle et al., 2005) was used to compute composite reliability.

10.4.1 Leader Roles

The items used to measure role enactments were modified from a previously validated scale (Denison et al., 1995) with the addition of two items. Prior research has suggested that factor analysis, a means of measuring validity, is not appropriate for all constructs (MacKenzie et al., 2005, Petter et al., 2007). Constructs may be classified as either reflective or formative. Reflective constructs are those for which the measures each are reflective of the entire construct; formative constructs are those for which the measures each reflect a part of the meaning of the construct, and in total the measures define the construct. With formative constructs, the measures may correlate with each other yet to delete any may alter the meaning of the construct because it is the complete set, not the individual items, which define the construct. As such, factor analysis is not an appropriate analytic tool for formative constructs. Conceptually, the leader roles are a formative construct. That is, as a group, the roles define the construct. Therefore, a factor analysis was not performed on the roles as a single construct. However, there were multiple items per role (2 or 3). Those items are reflective of their particular role. Therefore, Cronbach's alphas (standardized), as shown in the table below, were calculated for the items by role (for subteam and team leader) and all were adequate at above .7.

Table 10.2 Cronbach's Alphas for Leader Role Enactments

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Leader N=80	.8869	.8718	.9489	.9040	.9039	.8493	.7899	.8817
Team Leader N=86	.9112	.9089	.9584	.9576	.9314	.9015	.8293	.8945

10.4.2 Perceptions of Team/ Subteam Performance

Perceptions of team and subteam performance were measured by six items, each reflecting six dimensions of team and subteam performance (i.e. 12 items in all). For each of subteam and team performance as perceived by the participants, reliability measures were taken. Reliability was good with Cronbach's alphas of .9188 for items measuring perceptions of subteam performance, and .9369 for items measuring perceptions of team performance. Factor analysis resulted in loadings on one factor each for perceptions of subteam and team performance. Bernard (Bernard, 2000) suggests .6 as a cutoff for unambiguous loading on a factor and that variables that load between .3 and .59 can be considered for acceptance as loading on a factor. All of the loadings were above .8 with the exception of one variable loading that was above .75, well above the .6 cut-off, indicating that in each case there is just one factor underlying the data. The communalities for each variable, in each case, were adequate with values of above .7, well above the .5 recommended by Hair et al. (2006). The factor analyses loadings are shown below in Tables 10.3 and 10.4.

Table 10.3 Factor Analysis Loadings – Subteam Performance

	Component 1
Efficiency	.8601
Quality	.8871
Creativity	.7785
Adherence to Schedule	.8448
Coordination of member efforts	.8491
Communication between members	.8407

Table 10.4 Factor Analysis Loadings – Team Performance

	Component 1
Efficiency	.8881
Quality	.8886
Creativity	.8259
Adherence to Schedule	.8754
Coordination between subteams	.8950
Communication between subteams	.8585

10.4.3 Satisfaction with a Leader

Through an oversight, the first two of three questions asking about satisfaction with a leader (repeated for subteam and team leaders) were 7-point semantic differential scale items while the third item was a 10-point question. Rather than throw out the third item, the response values were multiplied by 7/10 to normalize them to the range of the 7-point scale. In the event that a team had two subteam leaders for one of the subteams (co-subteam leaders), the scores for the two subteam leaders were averaged because the way the data were collected it is not possible to ascertain for which co-leader a score was given.

For each of satisfaction with a subteam leader and satisfaction with a team leader, reliability measures were taken. Reliability was good with Cronbach's alpha of .915978 for satisfaction with a subteam leader and .953439 for satisfaction with a team leader. Factor analysis resulted in loadings on one factor each, with loadings all above .9 which is well above the .6 cut-off recommended by Bernard (2000). All communalities were also adequate at above .8. The factor analysis loadings are shown below in Tables 10.5 and 10.6.

Table 10.5 Factor Analysis of Scale for Satisfaction with a Subteam Leader

	Component 1
I felt that my subteam leader was fair.	.90737
I was comfortable entrusting critical tasks to my subteam leader.	.93650
Rate your satisfaction with your subteam leader.	.93193

Table 10.6 Factor Analysis of Scale for Satisfaction with a Team Leader

	Component 1
I felt that my team leader was fair.	.94884
I was comfortable entrusting critical tasks to my team leader.	.95984
Rate your satisfaction with your team leader.	.96070

10.4.4 Satisfaction with a Group

Satisfaction with a group ("my subteam" or the "other subteam") was measured with three 7-point semantic differential scale items (6 items in all). For each of satisfaction with "my subteam" and satisfaction with the "other subteam" reliability measures were taken. Reliability was adequate with Cronbach's alphas of .9590 for satisfaction with "my subteam" and .9798 for satisfaction with the "other subteam." Factor analysis resulted in loadings on one factor each. All of the loadings were above .9, which is well above the .6 cut-off suggested by Bernard (2000). Communalities were also adequate with values of over .9 for each variable (not shown). The factor analysis loadings are shown below in Tables 10.7 and 10.8.

Table 10.7 Factor Analysis Loadings for Satisfaction with "My" Subteam

	Component 1
I was satisfied with members of my subteam	.9572
I was pleased with the way the members of my subteam and I worked together	.9663
I was very satisfied working with my subteam	.9706

Table 10.8 Factor Analysis Loadings for Satisfaction with the "Other" Subteam

	Component 1
I was satisfied with members of the other subteam	.9825
I was pleased with the way the members of the other subteam and I worked together	.9832
I was very satisfied working with the other subteam	.9854

10.4.5 Ineffective Bad Leadership

Ineffective bad leadership was measured with three 7-point semantic differential scale items for both team leader and subteam leader. In the event that a team had two subteam leaders for one of the subteams (co-subteam leaders), the scores were averaged as the way the data were collected it is not possible to ascertain for which co-leader a score was given. For each of "bad" team leader and "bad" subteam leader items, reliability measures were taken. Reliability was good with Cronbach's alpha of .9262 for "bad" subteam leader, and .9312 for "bad" team leader. Factor analysis resulted in loadings on one factor each with loadings all above .9 which is well above the .6 cut-off recommended by Bernard (2000). Communalities (not shown) were all adequate with values of over .8 for each variable. The factor analysis loadings are shown below in Tables 10.9 and 10.10.

Table 10.9 Factor Analysis of Scale for Ineffective "Bad" Subteam Leader

	Component 1
My subteam leader lacked the skill or will to sustain effective action.	.9290
My subteam leader was unyielding and did not adapt to new ideas.	.9600
My subteam leader lacked self-control and acted without thinking.	.9115

Table 10.10 Factor Analysis of Scale for Ineffective "Bad" Team Leader

	Component 1
My team leader lacked the skill or will to sustain effective action.	.9324
My team leader was unyielding and did not adapt to new ideas.	.9433
My team leader lacked self-control and acted without thinking.	.9370

10.4.6 Trust

Trust was measured by 10 items. Four were modified from Jarvenpaa, Knoll, and Leidner (1998) and six were modified from Cummings and Bromily (1996). The scale was repeated so that trust was measured for "my subteam" and for the "other subteam." Trust was measured in Personal Reflection 1 at the end of the first week (early trust) and in the post survey (longer term trust).

Factor analysis was performed for the four trust scales (early trust for "my subteam," early trust for the "other subteam," longer term trust for "my subteam," and longer term trust for the "other subteam"). For longer term trust communalities indicated that questions 5 and 10, with communalities of less than 4.5 should be removed. Hair et al. (2006) suggest that variables with communalities of less than 5.0 be removed but that benchmark of 5.0 is not firm. As exploratory research, this research uses 4.5 as the cut-off for removing variables. Therefore, factor analysis was then run again for longer term trust with questions 5 and 10 removed. The results are shown below in Tables 10.12 and 10.14. As can be seen from the tables, the results of the factor analysis are similar to the results found for longer term trust in Study 1. That is, one factor (Questions 3, 4, 6, 7, and 8) can be termed "Personal Trust" which is the trust that is based on the interactions the participants have had with each other. The other factor (Questions 1, 2, and 9) is termed "Process Trust" as it is trust that is based upon inferences made from the process of the team working together. As seen in Tables 10.11 and 10.14, communalities for the variables of the reduced scale are adequate.

Table 10.11 Factor Analysis of Longer Term Trust for "My Subteam" Q5, Q10 Removed

	Component 1	Component 2
1. I would have preferred if some members had less influence over important aspects of the project in my subteam	.1032	**.8324**
2. I wanted to more closely monitor the work of members in my subteam	.2831	**.7374**
3. I was comfortable when other members worked on a critical task or problem in my subteam	**.7524**	.2851
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in my subteam	**.7872**	.1990
5. I felt that members tried to get out of their commitments in my subteam	----	-------
6. I felt that members kept their word in my subteam	**.8086**	.1567
7. I felt that members were honest with me in my subteam	**.8117**	.2156
8. I felt that members negotiated joint expectations fairly in my subteam	**.8045**	.0828
9. I felt that members tried to get the upper hand in my subteam	.1416	**.6652**
10. I felt confident that members would not exploit me in my subteam	--------	--------

Table 10.12 Communalities for Longer Term Trust for "My Subteam" Reduced Scale

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.704	.624	.647	.659	-------	.678	.705	.654	.463	------

Table 10.13 Factor Analysis of Longer Term Trust for the "Other Subteam" Q5 Q10 Removed

	Component 1	Component 2
1. I would have preferred if some members had less influence over important aspects of the project in the other subteam	.1365	**.7700**
2. I wanted to more closely monitor the work of members in the other subteam	.3681	**5576**
3. I was comfortable when other members worked on a critical task or problem in the other subteam	**.8189**	1965

Table 10.13 Factor Analysis of Longer Term Trust for the "Other Subteam" Q5 Q10 Removed continued

	Component 1	Component 2
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in the other subteam	**.8514**	.1689
5. I felt that members tried to get out of their commitments in the other subteam	--------	----------
6. I felt that members kept their word in the other subteam	**.7973**	.2653
7. I felt that members were honest with me in the other subteam	**.8097**	.2281
8. I felt that members negotiated joint expectations fairly in the other subteam	**.7965**	.0460
9. I felt that members tried to get the upper hand in the other subteam	.0621	**.7080**
10. I felt confident that members would not exploit me in the other subteam	---------	----------

Table 10.14 Communalities for Longer Term Trust for the "other subteam" Reduced Scale

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.612	.446	.709	.753	------	.706	.708	.637	.505	------

For early trust, measured at the end of the first week, the factor analysis resulted in three factors for both trust for "my subteam" and trust for the "other subteam." Communalities are all adequate as seen in Tables 10.16 and 10.18. The results of the factor analysis are shown in Tables 10.15 and 10.17 below. This suggests that early trust is indeed different than long term trust. That is, the participants make judgments differently in early trust than they do in longer term trust and so the underlying concepts are different. Thus, there are three factors for early trust. The first factor, labeled Personal Trust is, as with longer term trust, a trust based upon the interactions over the week with the other members of the team. This trust is a traditional trust that is based upon observed behavior of the individual trustees. Personal Trust includes Questions 6,

7, 8, and 10. The second factor is Process Trust, also a traditional trust, which is based upon inferences made from the process of the team working together. Process Trust includes Questions 1, 2, 5, and 9. Finally, the third factor is labeled Expertise Trust and includes Questions 3 and 4. It is a swift trust (Mayer et al., 1995) based on a trustor's judgment about the other members' expertise. Recall that in the first week the participants do not work on a task-related activity. They only engage in team building exercises. Trusting expertise, then, is a generalized concern in that the trustor doesn't know if s/he can trust the expertise of the other members. So, trusting the others' expertise is not based on observed behaviors but other cues, such as perhaps what the other person says about his/her expertise. By the time the post survey is administered, trusting expertise is no longer a swift trust but can be evaluated based upon actual experience and so those items become part of the traditional Personal Trust.

One might speculate as to why Questions 5 and 10 have communalities that are inadequate in longer term trust but are adequate for early trust. It may be that laziness (Question 5) and exploitation (Question 10) become less of a concern in longer term trust. Additionally, although Question 5 loads on Personal Trust for trust for "my subteam" and Process Trust for trust for the "other subteam," it is consistent with Study 1 and, upon examination of the question, logical to group it with Process Trust. Note that the communality for Question 5 for the "other subteam" is barely adequate. Therefore, judgment calls for consistency and it is included in Process Trust. Similarly, for the "other subteam" Question 10 does not clearly load on Personal Trust. However, it loads clearly on Personal Trust for "my subteam" and therefore, for consistency, in this research is assumed to be an item measuring Personal Trust.

Table 10.15 Factor Analysis for Early Trust for "My Subteam"

	Component 1: Personal Trust	Component 2: Process Trust	Component 3: Expertise Trust
1. I would have preferred if some members had less influence over important aspects of the project in my subteam	.3696	**.6688**	.1548
2. I wanted to more closely monitor the work of members in my subteam	.2866	**.7789**	.1809
3. I was comfortable when other members worked on a critical task or problem in my subteam	.2788	.0167	**.8228**
4.Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in my subteam	.2343	.1990	**.8570**
5. I felt that members tried to get out of their commitments in my subteam	.2914	**.6268**	-.1914
6. I felt that members kept their word in my subteam	**.8184**	.1670	.1984
7. I felt that members were honest with me in my subteam	**.8179**	.1810	.2474
8. I felt that members negotiated joint expectations fairly in my subteam	**.8195**	.2088	.1109
9. I felt that members tried to get the upper hand in my subteam	-.1729	**.6881**	.4668
10. I felt confident that members would not exploit me in my subteam	**.5502**	.4229	.1379

Table 10.16 Communalities for Early Trust for "My Subteam"

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.608	.722	.755	.829	.514	.737	.763	.727	.721	.501

Table 10.17 Factor Analysis for Early Trust for the "Other Subteam"

	Component 1: Personal Trust	Component 2: Process Trust	Component 3: Expertise Trust
1. I would have preferred if some members had less influence over important aspects of the project in the other subteam	.4954	**.6221**	.1566
2. I wanted to more closely monitor the work of members in the other subteam	.1090	**.7272**	.2463
3. I was comfortable when other members worked on a critical task or problem in the other subteam	.1872	.0618	**.9094**
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in the other subteam	.2006	.2191	**.8856**

Table 10.17 Factor Analysis for Early Trust for the "Other Subteam" continued

	Component 1: Personal Trust	Component 2: Process Trust	Component 3: Expertise Trust
5. I felt that members tried to get out of their commitments in the other subteam	**.5517**	.3699	-.1101
6. I felt that members kept their word in the other subteam	**.8018**	.0048	.2403
7. I felt that members were honest with me in the other subteam	**.8430**	.0763	.2263
8. I felt that members negotiated joint expectations fairly in the other subteam	**.7896**	.1615	.1532
9. I felt that members tried to get the upper hand in the other subteam	.0234	**.7990**	-.0084
10. I felt confident that members would not exploit me in the other subteam	**.4738**	**.4288**	.2599

Table 10.18 Communalities for Early Trust for the "Other Subteam"

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.657	.601	.866	.873	.453	.701	.768	.673	.639	.476

Note that trust was not measured at the start of the project. If it had been, there might be a different pattern where all of the trust is swift trust. Rather, it is measured at the end of week 1 when the participants have worked together for a week intensely on non-task related activities. Thus, what results at that time is likely a mix of traditional trust (Personal Trust and Process Trust) and swift trust (Expertise Trust). While after the four weeks of the project what is measured is only traditional trust (Personal Trust and Process Trust). Again, that the communalities suggest pruning the scale for longer term trust and not for early trust is additional evidence that the two (early trust and longer term trust) are essentially different.

Reliability was assessed for each dimension of trust for each data set. Cronbach's alphas were inadequate in many cases. However, as noted in Ocker et al. (2009), Hair et al. (2006), and Cortina (1993), Cronbach's is sensitive to the number of items in the scale and the dimensions of trust have few items (e.g., Expertise Trust has only 2 items).

Composite reliability, however, is not sensitive to the number of items in the scale (Ocker et al., 2009), and so SmartPLS (Ringle et al., 2005) was used to find the composite reliability. SmartPLS also computes the average variance explained (AVE) which Chin (1998) indicates can be interpreted as a measure of reliability and should be over .5 for good reliability. The composite reliability, according to Hair et al. (2006) should be .7 or higher although scores of between .6 and .7 may be acceptable if there are other indicators of a model's good construct validity. The results of the reliability tests are shown below in Table 10.19.

Table 10.19 Reliability Measures for Trust in Study 2

Data Set	Type of Trust	Composite Reliability	AVE
Early Trust for "my" subteam	Expert Trust	.9052	.8274
	Personal Trust	.8928	.6768
	Process Trust	.8244	.5471
Early Trust for the "other" subteam	Expert Trust	.9413	.8890
	Personal Trust	.8682	.6286
	Process Trust	.6972	.4059
Longer term trust for "my" subteam	Personal Trust	.9082	.6645
	Process Trust	.8043	.5843
Longer term trust for the "other" subteam	Personal Trust	.9211	.7004
	Process Trust	.7012	.4693

As can be seen in the table above, all reliability measures are adequate, save two. For early Process Trust for the "other subteam," composite reliability at .6972 is less than .7 and the AVE at .4059 is less than .5. However, it is argued that because good reliability is shown for both indicators of reliability for the same items for Process Trust for "my subteam" and the composite reliability is almost .7, thus indicating construct reliability in other ways, the reliability is acceptable and the measures are retained. Also, longer term Process Trust for the "other subteam" has adequate composite reliability but the AVE is .4693 which is just under .5. AVE is more conservative than composite reliability (Chin, 1998). But because the AVE is barely under .5 and the composite

reliability is over the recommended threshold of .7, the items are retained for this Study 2 analysis.

Therefore, for analysis of trust in Study 2, for long-term trust measured in the post survey at the end of the four week project, there are two types of trust measured: Personal Trust and Process Trust. While for early trust in Study 2, measured at the end of week 1, three dimensions of trust are used in the analyses: Expertise Trust, Personal Trust, and Process Trust.

10.5 Research Question 1: Leadership Roles

Research question RQ1 asks, "What do leaders in PDTs do and does leadership configuration affect what leaders do?"

10.5.1 Hypothesis 1a: Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs.

For each role (innovator, broker, producer, director, coordinator, monitor, facilitator, mentor), the values of the scale items that measured that role were averaged to arrive at a score from 1 to 7, with 1 being "almost never" and 7 being "almost always." Averaging was used because the number of items per role varied from 2 to 3 items. It was possible, based upon previous experience in Study 1, that some subteams selected two subteam leaders (co-leaders) for one subteam, and so the survey provided an opportunity for the participants to answer leadership questions about both co-leaders. In such cases, for each role, the scores (on a scale of 1 to 7) for the two co-leaders were averaged to arrive at a subteam leader role score for the subteam. A total of 166 responses were collected regarding leader role enactments; 80 for subteam leaders and 86 for team leaders. Below,

in Table 10.20, the means of the role enactment scores for each role for subteam and team leaders is given. Standard deviations are in parentheses.

Table 10.20 Means and Standard Deviations for Leader Role Enactment Scores

N=166	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Leader N=80	5.250 (1.253)	5.300 (1.479)	5.232 (1.290)	5.404 (1.270)	5.475 (1.275)	5.054 (1.375)	4.950 (1.584)	5.413 (1.420)
Team Leader N=86	4.977 (1.547)	5.494 (1.498)	5.465 (1.566)	5.550 (1.506)	5.494 (1.558)	5.260 (1.528)	4.936 (1.634)	5.233 (1.628)

The means score for each role was greater than 4.9 out of 7, with a low of 4.936 for team leader as facilitator and a high of 5.494 for team leader as both broker and coordinator. The generally positive ratings suggest that the leaders did enact the leadership roles identified by Quinn (1988), thus lending support to Hypothesis 1a. Although in Study 1, which had similar results, the average values for team leaders were consistently a little lower than those for subteam leaders, this pattern was not seen for Study 2. It may be that in Study 1 there were far fewer responses regarding team leaders than subteam leaders and the more balanced picture suggested by these results for Study 2 is more indicative of the relative equal salience of team and subteam leader behaviors to participants.

10.5.2 Hypothesis 1b: Leadership configuration will influence role enactment.

Leader role enactment was not normally distributed for any role and all attempts at transformations (e.g. log) failed. Therefore nonparametric tests (Kruskal-Wallis) were preformed to ascertain if role enactments varied by leadership configuration. As shown below in Table 10.22, the results were insignificant for all leader roles suggesting that leadership configuration does not influence leader role enactment. Note that the Ns refer

to the number of responses, not the number of respondents. Because the Hierarchical condition has two types of leaders, members of Hierarchical teams responded to role enactment questions once for their subteam leader and once for their team leader. The results show that Hypothesis 1b is not supported for any role.

Table 10.21 Results of Kruskal-Wallis Tests for Effects of Leadership Condition on Leader Role Enactments

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Centralized Mean & SD N=47	4.68 (1.66)	5.36 (1.61)	5.33 (1.79)	5.55 (1.66)	5.48 (1.71)	5.28 (1.60)	4.86 (1.75)	5.15 (1.77)
Decentralized Mean & SD N=33	5.47 (1.26)	5.42 (1.53)	5.56 (1.29)	5.58 (1.93)	5.68 (1.09)	5.24 (1.26)	5.29 (1.54)	5.62 (1.38)
Hierarchical Mean & SD N=92	5.24 (1.29)	5.45 (1.42)	5.33 (1.31)	5.44 (1.32)	5.44 (1.38)	5.12 (1.46)	4.92 (1.56)	5.33 (1.47)
Chi-Square	5.1383	.0296	1.6020	1.5531	.8436	1.1808	1.4707	1.3113
Pr>Chi-Square	.0766	.9853	.4489	.4600	.6559	.5541	.4973	.5191

For each leader role, a comparison (nonparametric Kruskal-Wallis test) was made of subteam leader role enactment and team leader role enactment of that role. The results indicate that there is no significant difference for any leader role between subteam leader role enactment and team leader role enactment. Therefore, Hypothesis 1b is not supported for leader type.

Table 10.22 Kruskal-Wallis: Subteam Leader vs. Team Leader Role Enactments

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Leader Means & SD N=108	5.19 (1.27)	5.30 (1.41)	5.32 (1.29)	5.45 (1.28)	5.51 (1.30)	5.15 (1.36)	5.02 (1.50)	5.40 (1.42)
Team Leader Means & SD N=64	5.16 (1.32)	5.60 (1.29)	5.63 (1.34)	5.72 (1.23)	5.66 (1.32)	5.42 (1.34)	5.06 (1.49)	5.33 (1.50)
Chi-Square	.0012	1.9855	3.2419	2.1577	.8888	1.8698	.0083	.0130
p-value	.9720	.1588	.0718	.1419	.3458	.1715	.9274	.9093

Thus, for all tests, Hypothesis 1b is not supported. These results are contrary to what was found in Study 1 in which Hypothesis 1b was partially supported. It is possible that the clarification and emphasis of leader responsibilities in Study 2 helped leaders overcome effects of distance (e.g., difficulty in creating telepresence) that may have accounted for the differences by condition in leader role enactments in Study 1.

10.5.3 Hypothesis 1c: Emergent subteam leadership is more likely to occur in subteams for which there are no designated subteam leaders (Centralized) than in other leadership configurations (Decentralized, Hierarchical).

In the post leadership survey participants were asked if any members not designated as subteam leaders in the team contract emerged as subteam leaders. Members of six of the eight Centralized teams, five of the six Decentralized teams, and three of the seven Hierarchical teams reported that subteam leaders emerged in their teams. Therefore, six of eight teams in the condition without subteam leaders and eight of 13 teams in conditions that did have subteam leaders reported the emergence of subteam leaders. A test of Chi-Square was performed comparing the Centralized teams with teams in those conditions with selected subteam leaders (Decentralized and Hierarchical). The results

indicate there was not a significant difference in the frequency of emergent subteam leaders (X^2=.4038, p=.5251). However, a caveat must be noted. For small Ns (where expected values in any cell of the cross-tab table are less than 5), the results of a Chi-Square test may not be valid. However, an examination of the frequencies suggests that, in fact, there was not a significant difference. Therefore, Hypothesis H1c is not supported.

10.5.4 Hypothesis 1d: Emergent team leadership is more likely to occur in teams for which there is no designated team leader (Decentralized) than in other leadership configurations (Centralized, Hierarchical).

In the post leadership survey, participants were also asked if any members not designated as team leaders in the team contract emerged as team leaders. Members of six of the eight Centralized teams, four of the six Decentralized teams, and three of the seven Hierarchical teams reported that a team leader emerged for their team. Therefore, nine of the 13 teams that had designated team leaders (Centralized, Hierarchical) and four of the six teams that did not have designated team leaders (Decentralized) reported the emergence of a team leader. A test of Chi-Square was performed comparing the Decentralized teams with teams in those conditions with designated team leaders (Centralized, Hierarchical). The results indicated there was not a significant difference in the frequency of emergent team leaders (X^2=.0808, p=.7763). However, for small Ns, the results of Chi-Square tests may not be valid. However, an examination of the frequencies suggests that, in fact, there was not a significant difference. Therefore, Hypothesis H1d is not supported.

10.5.5 Hypothesis 1e: Role enactment of leader behaviors will be positively associated with perceived team and subteam performance and objective performance.

Perceived team and subteam performance were measured by scales of six items each measuring efficiency, quality, creativity, adherence to schedule, coordination, and communication performance dimensions. Each team's final deliverable was graded by designees of the researchers using a rubric designed by the researchers. Two experts also evaluated each team's final deliverable using the same grading rubric. For this analysis, objective performance was measured by the arithmetic average of the three evaluations.

A correlation (Spearman's rank) was done for perceptions of the extent of each role enacted by both subteam and team leaders, and perceived subteam performance, and for each role the perception of the extent of its enactment and perceived team performance. Missing values were not used in the analysis so there were a total of 161 observations for each correlation. All correlations were significant at the .05 level of significance. That is, leader role enactments are significantly associated with both team and subteam performance for all roles. The results below show that the correlation with team performance is higher than the correlation with subteam performance for all roles except for the director and mentor roles.

Table 10.23 Leader Roles vs. Perceived Performance (Spearman's r p)

N=161	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Performance	**.2917 .0002***	**.2383 .0023***	**.2932 .0002***	**.2753 .0004***	**.2558 .0011***	**.3352 <.0001***	**.2958 .0001***	**.2890 .0002***
Team Performance	**.3642 <.0001***	**.3204 <.0001***	**.3305 <.0001***	**.2462 .0016***	**.3456 <.0001***	**.3541 <.0001***	**.3072 <.0001***	**.2797 .0003***

It is of interest to explore if, when one looks at only subteam leaders or only team leaders, the associations of the roles with perceived performance hold. Therefore, correlations were performed for each role vs. perceived performance for only subteam leader role enactments and then also for only team leader role enactments. Results were illuminating. For all but one subteam leader role, the correlations with subteam performance were significant while the correlation with team performance was not. For the monitor role, both correlations were significant but the significance was higher for the correlation with subteam performance. Similarly, all of the team leader roles were significantly correlated with team performance while half of the team leader roles were not significantly correlated with subteam performance. For those team leader roles that were significantly correlated with both subteam and team performance (innovator, monitor, facilitator, and mentor), the correlation with team performance was more significant than the correlation with subteam performance. These results are not surprising as team leaders are likely more focused on team performance than subteam performance, while subteam leaders are likely more focused on subteam performance.

Table 10.24 Subteam Leader Roles vs. Perceived Performance (Spearman's r p)

N=78	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Performance	**.3063** **.0064***	**.3087** **.0060***	**.4551** **<.0001***	**.4139** **.0002***	**.3863** **.0005***	**.4557** **<.0001***	**.3102** **.0057***	**.2868** **.0109***
Team Performance	.1296 .2580	.0978 .3943	.2076 .0681	.1479 .1962	.1996 .0798	**.2772** **.0140***	.1392 .2243	.0796 .4885

Table 10.25 Team Leader Roles vs. Perceived Performance (Spearman's r p)

N=83	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Performance	**.2760** **.0116***	.2151 .0509	.2072 .0602	.1976 .0734	.1963 .0753	**.2684** **.0142***	**.2771** **.0112***	**.2896** **.0079***
Team Performance	**.5316** **<.0001***	**.5160** **<.0001***	**.4445** **<.0001***	**.3230** **.0029***	**.4552** **<.0001***	**.4293** **<.0001***	**.4320** **<.0001***	**.4222** **<.0001***

Thus, Hypothesis 1e is supported for perceived performance and the results suggest a pattern of association consistent with the objectives of each type or leader.

A correlation (Spearman's rank correlation) was done for each role behavior at the team level (i.e. average of individual scores for each role by team) and objective performance. Spearman rank correlation coefficients were used because the roles were not normally distributed. The results, shown below in Table 10.26 with the correlation coefficient in the first role and the significance level in the second row, indicates that for all roles, leader role behavior was not significantly correlated with objective performance.

Table 10.26 Leader Roles vs. Objective Performance at the Team Level (N=21)

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Objective	.06467	.28957	.07807	.16694	.14314	.18448	.08249	.16060
Performance	.7806	.2029	.7366	.4695	.5359	.4234	.7222	.4868

Hypothesis 1e proposes that leader role behaviors are positively associated with perceived performance and objective performance. The results support this hypothesis for perceived performance but not for objective performance. These results are consistent with the results of the analysis of Study 1.

10.5.6. Hypothesis 1f: Role enactment will be associated with perceived leader effectiveness.

Participants were asked on the post leadership survey to rate the performance (effectiveness) of their subteam and team leaders with a single item each. Correlations (Spearman's r) were done for each role enactment for all leaders versus the perceived leader performance. The results of the correlations suggest, as shown in the table below, that for all roles, role enactment is highly correlated with perceived leader effectiveness.

Table 10.27 Leader Roles vs. Perceived Leader Performance (Spearman's r p) N=161

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.7234	**.6940**	**.6930**	**.6935**	**.6380**	**.6711**	**.6560**	**.6489**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

Correlations were also done for subteam leader role enactments vs. perceived subteam leader effectiveness and team leader role enactments vs. perceived team leader effectiveness. As shown in Tables 10.28 and 10.29 below, all correlations were highly significant. Therefore, Hypothesis 1f is supported.

Table 10.28 Subteam Leader Roles vs. Perceived Subteam Leader Performance N=78

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.7072	**.6517**	**.5915**	**.6419**	**.5501**	**.5765**	**.6415**	**.6580**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

Table 10.29 Team Leader Roles vs. Perceived Team Leader Performance N=83

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.7583	**.7300**	**.7758**	**.7256**	**.7140**	**.7372**	**.6700**	**.6383**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

10.5.7 Hypothesis 1g: Leader role enactments will be associated with satisfaction with a leader such that subteam leader role enactments will have stronger (positive or negative) associations with satisfaction with a leader than will team leader role enactments.

A three-item scale on the post leadership survey asked the participants to rate their satisfaction with their subteam and team leaders. Correlations (Spearman's r) were done for each role enactment versus the aggregate satisfaction with leader score. The results of the correlations, shown in the table below, suggest that for all roles, role enactment is highly correlated with satisfaction with a leader.

Table 10.30 Correlations of Leader Roles vs. Satisfaction with a Leader N=166

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.66454	**.70108**	**.71360**	**.73690**	**.69542**	**.66886**	**.64820**	**.71435**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

This hypothesis proposes that associations of subteam leader role enactments with satisfaction with a subteam leader are higher than the associations of team leader role enactments with satisfaction with a team leader. Therefore, correlations were also done for subteam leader role enactments vs. satisfaction with a subteam leader and for team leader role enactments vs. satisfaction with a team leader. The results are shown below in Tables 10.31 and 10.32. Although all correlations are highly significant at the .0001 level of significance, with the exception of the innovator role, contrary to the proposed hypothesis, correlations of team leader role enactments and satisfaction with a team leader are greater than the correlations of subteam leader role enactments and satisfaction with a subteam leader. Therefore, Hypothesis 1g is partially supported.

Table 10.31 Subteam Leader Roles vs. Satisfaction with a Subteam Leader N=80

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.67919	**.63421**	**.61461**	**.62051**	**.52588**	**.57664**	**.61244**	**.64373**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

Table 10.32 Team Leader Roles vs. Satisfaction with a Team Leader N=86

Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
.66907	**.77547**	**.80100**	**.83895**	**.84377**	**.76016**	**.68550**	**.77195**
<.0001*	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

10.5.8 Hypothesis 1h: Leader role enactment will be positively associated with satisfaction with a group such that subteam leader role enactment will be associated with satisfaction with the collocated ("my") subteam and team leader role enactment will be positively associated with satisfaction with both the collocated and the distant ("other") subteam in the team.

A three-item scale on the post leadership survey was used to measure satisfaction with "my" subteam and the "other" subteam. A measure for satisfaction with the local subteam was obtained by aggregating the answers to the three questions regarding satisfaction with "my" subteam; a measure for satisfaction with the "other" subteam was obtained by adding together the scores for the three questions as they were asked about satisfaction with the "other" subteam. Correlations (Spearman's r) were done for each role enactment (all leader types) versus the satisfaction with "my" subteam and versus the satisfaction with the "other" subteam scores. The results of the correlations, shown below in Table 10.33, suggest that for all roles, the correlations are positive and highly significant, thus supporting the proposition that leader role enactments are positively associated with satisfaction with a group.

Table 10.33 Correlations of Leader Roles and Satisfaction with a Group

N=166	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Satisfaction with "my" subteam	**.3934 <.0001***	**.3345 <.0001***	**.4039 <.0001***	**.4035 <.0001***	**.3788 <.0001***	**.3642 <.0001***	**.2940 .0001***	**.3522 <.0001***
Satisfaction with the "other" subteam	**.4057 <.0001***	**.3512 <.0001***	**.3871 <.0001***	**.3344 <.0001***	**.3562 <.0001***	**.3400 <.0001***	**.3657 <.0001***	**.3930 <.0001***

Correlations were also done to ascertain the association of subteam leader role enactments and satisfaction with the local subteam and with the distant subteam. The results, shown below, are that, as hypothesized, all subteam roles are associated with

satisfaction with "my" subteam. Interestingly, only three subteam roles (producer, facilitator, and mentor) are also significantly associated with satisfaction with the "other" subteam. In those cases, the association with satisfaction with "my" subteam is stronger than the association of the role with satisfaction with the "other" subteam.

Table 10.34 Correlations of Subteam Leader Roles and Satisfaction with a Group

N=80	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Satisfaction with "my" subteam	**.3771** **.0006***	**.2396** **.0323***	**.4229** **<.0001***	**.4117** **.0001***	**.3839** **.0004***	**.3170** **.0042***	**.2415** **.0309***	**.3315** **.0027***
Satisfaction with the "other" subteam	.2186 .0514	.0962 .3957	**.2465** **.0275***	.2181 .0520	.1312 .2462	.2030 .0710	**.2210** **.0488***	**.2261** **.0437***

Correlations of team leader role enactment with satisfaction with "my" subteam, and with satisfaction with the "other" subteam, were also performed. The results, shown below in Table 10.35, suggest that all team leader role enactments, as hypothesized, are positively and significantly associated both with satisfaction with "my" subteam and with satisfaction with the "other" subteam. It is interesting to note that all of the roles are highly correlated with satisfaction with the "other" subteam at the <.0001 level of significance. The correlations with satisfaction with "my" subteam are also high, although not all are at the .0001 level of significance.

Table 10.35 Correlations of Team Leader Roles and Satisfaction with a Group

N=86	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Satisfaction with "my" subteam	**.4050** **.0001***	**.4343** **<.0001***	**.4210** **<.0001***	**.4220** **<.0001***	**.3946** **.0002***	**.4224** **<.0001***	**.3316** **.0018***	**.3615** **.0006***
Satisfaction with the "other" subteam	**.5473** **<.0001***	**.5772** **<.0001***	**.5134** **<.0001***	**.4362** **<.0001***	**.5283** **<.0001***	**.4786** **<.0001***	**.4851** **<.0001***	**.5159** **<.0001***

Thus, Hypothesis 1h is strongly supported.

10.5.9 Summary of Results of Testing Research Question 1 Hypotheses:

Below, in Table 10.36, is a summary of the results of testing hypotheses that relate to Research Question 1. Shown are the results for testing of Study 1 and Study 2 data.

Table 10.36 Summary of Results of Tests of Hypotheses Related to Research Question 1

HYPOTHESIS	STUDY 1	STUDY 2
1a: Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs.	Supported	Supported
1b: Leadership configuration will influence role enactment	Partially supported	Not supported
1c: Emergent subteam leadership is more likely to occur in subteams for which there are no designated subteam leaders (Centralized) than in other leadership configurations (Decentralized, Hierarchical)	N/A	Not supported
1d: Emergent team leadership is more likely to occur in teams for which there is no designated team leader (Decentralized) than in other leadership configurations (Centralized, Hierarchical)	N/A	Not supported
1e: Role enactment of leader behaviors will be positively associated with perceived team and subteam performance and objective performance	Supported for perceived performance; Not supported for objective performance	Supported for perceived performance; Not supported for objective performance
1f: Role enactment will be associated with perceived leader effectiveness	Supported	Supported
1g: Leader role enactments will be associated with satisfaction with a leader such that subteam leader role enactments will have stronger (positive or negative) associations with satisfaction with a leader than will team leader role enactments	N/A	Partially supported
1h: Leader role enactment will be positively associated with satisfaction with a group such that subteam leader role enactment will be associated with satisfaction with the collocated ("my") subteam and team leader role enactment will be positively associated with satisfaction with both the collocated and the distant ("other") subteam in the team	N/A	Supported

As shown in the table above, support was found in both Study 1 and Study 2 for the enactment of Quinn (1988) roles. Results in both studies also show that role enactment is associated with perceived leader effectiveness. What is interesting is that in Study 1, partial support was found for the hypothesis that leadership configuration influences role enactment but no support was found in Study 2 for that hypothesis. It is possible that the extra training about leader behaviors given in Study 2 equalized the

emphasis on role enactment across conditions. That is, it is possible that with the emphasis given to leader responsibilities in Study 2, leaders were able to overcome obstacles to their enactment of leader roles that leadership condition may have provided otherwise.

10.6 Research Question 2: Trust

Research question RQ2 asks, "Does leadership configuration have an impact on the development of swift trust and longer term trust in PDTs and what are the effects of trust?"

10.6.1 Hypothesis 2a: Leadership configuration will impact trust such that teams with distributed leadership will develop higher levels of initial (swift) trust and longer lasting trust than teams with centralized leadership.

Recall that the Factor Analysis of the trust measures revealed three factors for early trust (Personal Trust, Process Trust, and Expertise Trust) and two factors for longer term trust (Personal Trust and Process Trust).

For early trust, the results of the trust scale in the first Personal Reflection which was administered at the end of the first week were used in the analysis. Trust was measured for "my subteam" (i.e., trust of the participant for the members of his or her collocated subteam) and for the "other subteam" (i.e., trust of the participant for the members of the distant subteam in the team). In both cases, Personal Trust, Process Trust and Expert Trust were not normally distributed and efforts at transformations to achieve normality failed. However, the F test (ANOVA) is robust to requirements for normality

and therefore, both ANOVA and nonparametric Kruskal-Wallis tests were performed to see if trust varied by actual leadership configuration.

For early trust for "my subteam" the ANOVA failed to find significant differences by leadership configuration for Personal Trust (F=.48, p=.6194, N=146), Process Trust (F=.95, p=.3835, N=146), or Expertise Trust (F=.21, p=.8126, N=146). Similarly, for trust for the "other subteam" the results were insignificant for Personal Trust (F=.05, p=.9517, N=146), Process Trust (F=.42, p=.6552, N=146), and Expertise Trust (F=1.69, p=.1884, N=146).

The results of nonparametric tests (Kruskal-Wallis) were consistent with the ANOVA results for early trust. For trust for "my subteam" the results were insignificant for Personal Trust (X^2=.6585, p=.7194, N=146), Process Trust (X^2=2.1513, p=.3411, N=146) and Expertise Trust (X^2=.3212, p=.8516, N=146). Similarly, for trust for the "other subteam" the results were insignificant for Personal Trust (X^2=.1203, p=.9416, N=146), Process Trust (X^2=.9448, p=.6235, N=146), and Expertise Trust (X^2=2.9067, p=.2338, N=146). Therefore, Hypothesis 2a is not supported for early trust.

For longer term trust, the results of the trust scale in the post survey were used in the analysis. Trust was also measured for "my subteam" and for the "other subteam." Personal Trust and Process Trust were not normally distributed and efforts to normalize by transformations failed. However, again, since the F test is robust to requirements for normality both ANOVA and nonparametric Kruskal-Wallis tests were performed.

For trust for "my subteam" the ANOVA failed to find significant differences by leadership condition for either Personal Trust (F=.59, p=.5579, N=149) or for Process Trust (F=.62, p=.5418, N=149). For trust for the "other subteam" the ANOVA also

failed to find significant differences by leadership condition for either Personal Trust (F=1.31, p=.2722, N=149) or for Process Trust (F=1.26, p=.2867, N=149).

The results of the nonparametric Kruskal-Wallis tests were consistent with the ANOVA results. For trust for "my subteam" results were insignificant for both Personal Trust (X^2=.7691, p=.6808, N=149) and for Process Trust (X^2=1.2808, p=.5271, N=149). Similarly, the Kruskal-Wallis tests failed to find significant differences by leadership condition for trust for the "other subteam" for Personal Trust (X^2=1.6073, p=.4477, N=149) or for Process Trust (X^2=3.2223, p=.1997, N=149). Thus Hypothesis 2a is not supported for longer term trust.

Therefore, Hypothesis 2a is not supported.

10.6.2 Hypothesis 2b: Trust within a subteam will be positively associated with perceptions of subteam performance.

As described above, perceptions of subteam and team performance were measured by a scale of six semantic differential items each. An aggregate score was calculated for both perceptions of subteam performance and perceptions of team performance. Because of the lack of normality of the variables, Spearman's tests of correlations of perceptions of subteam performance and the dimensions of trust were performed for early trust and for longer term trust.

For early trust for "my subteam" the results were mixed. The results of correlations of subteam performance with early Personal Trust were significant (r=.30020, p=.0006, N=127) as were the results of correlations of subteam performance with early Process Trust (r=.27012, p=.0021, N=127). However, the correlation of subteam performance with early Expertise Trust did not reach significance at the .05 level

(r=.14968, p=.0930). It is of interest that performance, measured at the end of the project, is associated with traditional trust measured early in the project, but not with swift trust that develops from other cues. If, as early Expertise trust develops into and is subsumed by longer term Personal Trust, the trust for the trustee is as likely to increase as decrease, it would explain this finding. To explore that possibility, correlations (Spearman's r) were taken between early Expertise trust and longer term Personal trust. However, for trust for my subteam (r=.31380, p=.0003, N=127) and for trust for the other subteam (r=.44330, p<.0001, N=127) the results were highly significant. Therefore, the reasons for the finding that early Expertise trust (a swift trust) is not correlated with performance while longer term trust measured at the same time is correlated significantly with performance must be different. Nonetheless, it is interesting that longer term trust measured at the end of the first week can predict perceptions of performance measured at the end of the project while early Expertise trust cannot.

For longer term trust for "my subteam" the results of correlation of perceived subteam performance with longer term Personal Trust (r=.55302, p<.0001, N=149) and perceived subteam performance with longer term Process Trust (r=.38908, p<.0001, N=149) were both highly significant.

Thus, Hypothesis 2b is partially supported for early trust and supported for longer term trust.

10.6.3 Hypothesis 2c: Trust between subteams will be positively associated with perceptions of team performance.

For early trust, Spearman's tests of correlations of perceived team performance with Personal Trust, Process Trust, and Expertise Trust for the "other subteam" were

performed because the variables were not normally distributed. The results were mixed. Correlation of perceived team performance and early Personal Trust (r=.27897, p=.0015, N=127) was significant as was the result of the correlation of perceived team trust and early Expertise Trust (r=.25860, p=.0033, N=127). However, the correlation of perceived team performance and early Process Trust (r=.07184, p=.42222, N=127) was not significant at the .05 level of significance. This is contrary to the results found for correlations of early trust for "my" subteam and perceived subteam performance.

For longer term trust, the correlations of perceived team trust with longer term Personal Trust (r=.66786, p<.0001, N=149) and with longer term Process Trust (r=.31950, p<.0001, N=149) were both highly significant.

Therefore, Hypothesis 2c is partially supported for early trust and strongly supported for longer term trust.

10.6.4 Hypothesis 2d: Trust will be associated with objective team performance

In order to explore if trust is associated with objective team performance, the research hypothesis "Trust is associated with objective team performance" is tested with the expectation that there will be no support for the hypothesis.

Objective performance is measured at the team level. Recall there were 21 teams. Therefore correlations were performed for trust at the team level and objective performance. Team measures for the trust variables were determined by finding the means, for each team, of the trust scores of the dimensions of trust for the "other subteam." All variables were normally distributed so Pearson's r was calculated for longer term Personal Trust with objective performance; longer term Process Trust with objective performance; early Personal Trust with objective performance; early Process

Trust with objective performance; and early Expertise Trust with objective performance. The results are shown below in Table 10.37. The top number is r, the bottom number is p in each cell.

Table 10.37 Correlations of Trust with Objective Performance

	Long Term Personal Trust	Long Term Process Trust	Early Personal Trust	Early Process Trust	Early Expertise Trust
Objective Performance	.20677 .3685	**.56712** **.0073***	.13805 .5507	.23583 .3034	.22918 .3176

As can be seen in the table above, significant results were found only for the correlation of objective performance with team long term process trust for the "other subteam." With that exception, Hypothesis 2d is not supported. Therefore, Hypothesis 2d is partially supported.

It is of interest to explore whether there were significant differences for trust for "my subteam" and trust for the "other subteam" at the individual level of trust. For each leadership condition (Centralized, Decentralized, Hierarchical), paired t-tests were performed to compare trust for "my subteam" with trust for the "other subteam." The t-test is robust for assumptions of normality and so despite non-normality of individual trusts, it is used here.

For longer term trust, differences in Personal Trust and Process Trust for "my subteam" and the "other subteam" were tested. For the Centralized condition, there were no significant differences for either Personal Trust ($t=1.87$, $p=.0677$, $N=52$) or for Process Trust ($t=1.37$, $p=.1759$, $N=52$). For the Decentralized condition, however, there were significant differences for both Personal Trust ($t=2.84$, $p=.0069$, $N=44$) and for Process Trust ($t=2.75$, $p=.0087$, $N=44$). The Hierarchical condition had mixed results. There were significant differences for Personal Trust ($t=3.25$, $p=.0020$, $N=53$) but

insignificant results for Process Trust (t=.81, p=.4208, N=53). In each case where there were significant findings, the t was positive which indicates that trust for "my subteam" was higher than trust for the "other subteam." It is of interest that no differences were found in the Centralized condition where there are no subteam leaders and that both types of trust were higher for "my subteam" than for the "other subteam" in the Decentralized condition where there are only subteam leaders. However, it is difficult to understand why there are differences for Personal Trust but not for Process Trust in the Hierarchical condition in which there are both a team leader and subteam leaders.

Early trust, as measured in the first personal reflection at the end of the first week of the project, also presents inconsistent results. For the Centralized condition, there were insignificant results for Personal Trust (t=.12, p=.9020, N=52) and for Process Trust (t=.15, p=.8808, N=52). However, in the Centralized condition, Expertise Trust for "my subteam" was significantly higher than Expertise Trust for the "other subteam" (t=2.31, p=.0250, N=52). For the Decentralized condition, the results were insignificant for Process Trust (t=.97, p=.3372, N=42) but significant for both Personal Trust (t=2.20, p=.0333, N=42) and for Expertise Trust (t=3.81, p=.0005, N=42). In the Hierarchical condition, no significant differences were found for any of the types of trust: Personal Trust (t=-.31, p=.7541, N=52), Process Trust (t=-.54, p=.5890, N=52), or Expertise Trust (t=1.04, p=.3040, N=52).

10.6.5 Hypothesis 2e: Trust for members of a subteam will be associated with satisfaction with a subteam leader.

Satisfaction with a subteam leader was measured by the aggregate of scores for three items in the post survey. As described earlier, the third item results were normalized to

the range of the first two items. If there were two subteam leaders in a single subteam (co-leaders), the average of the two satisfaction scores was taken as the satisfaction with a subteam leader score. This is because the way the data were collected, if there were two subteam leaders in a single subteam, it was not possible to ascertain which items referred to which subteam leader. Because satisfaction with a subteam leader and trust were not normally distributed, correlations were performed using Spearman's rank correlation coefficient tests.

For early trust for "my subteam," satisfaction with a subteam leader is correlated significantly with Personal Trust ($r=.39173$, $p=.0007$, $N=71$), with Process Trust ($r=.34463$, $p=.0032$, $N=71$), and with Expertise Trust ($r=.23803$, $p=.0456$, $N=71$). Therefore, Hypothesis 2e is supported for early trust.

For longer term trust for "my subteam," satisfaction with a subteam leader is correlated significantly with both Personal Trust ($r=.48588$, $p<.0001$, $N=78$) and with Process Trust ($r=.36328$, $p=.0011$, $N=78$). Therefore, Hypothesis 2e is supported for longer term trust.

Therefore, Hypothesis 2e is supported.

10.6.6 Hypothesis 2f: Trust between subteams will be associated with satisfaction with a team leader.

Satisfaction with a team leader was also measured by the aggregate of three items on the post survey (the same three items used to measure satisfaction with a subteam leader, modified to refer to a team leader with the responses of the third item normalized to the range of the first two). Because neither satisfaction with a team leader nor trust was normally distributed, Spearman's rank correlation coefficients were derived.

For early trust for the "other subteam," satisfaction with a team leader was significantly and positively correlated with Personal Trust (r=.25544, p=.0292, N=73). However, it was not significantly correlated with either Process Trust (r=.08486, p=.4753, N=73) or with Expertise Trust (r=.21315, p=.0702, N=73).

For long term trust for the "other subteam," satisfaction with a team leader was significantly and positively associated with Personal Trust (r=.47589, p<.0001, N=83) and with Process Trust (r=.25162, p=.0218, N=83).

Therefore, Hypothesis 2f is partially supported for early trust and supported for long term trust.

10.6.7 Hypothesis 2g: Trust for members of a subteam will be positively associated with satisfaction with the collocated ("my") subteam.

Satisfaction for "my subteam" was measured by the aggregate of three items on the post survey. Neither satisfaction for "my subteam" nor the trust measures were normally distributed and so Spearman's rank correlation coefficient tests were performed to test the correlation of trust for "my subteam" with satisfaction with "my subteam."

For early trust, measured at the end of the first week in the first personal reflection, the results of the correlations were mixed. Early Personal Trust for "my subteam" was significantly and positively associated with satisfaction with "my subteam" (r=.40332, p<.0001, N=113). However, the correlations of satisfaction with "my subteam" and Process Trust (r=.17308, p=.0668, N=113) and with Expertise Trust (r=.18108, p=.0549, N=113) were insignificant. Thus Hypothesis 2g is partially supported for early trust.

For longer term trust, measured in the post survey, Hypothesis 2g was strongly supported for both Personal Trust for "my subteam" (r=.56671, p<.0001, N=126) and for Process Trust for "my subteam" (r=.40028, p<.0001, N=126).

Therefore, Hypothesis 2g is partially supported for early trust and strongly supported for longer term trust.

10.6.8 Hypothesis 2h: Trust between subteams will be positively associated with satisfaction with the remote ("other") subteam.

Satisfaction with the remote ("other") subteam was measured by the aggregate of three items in the post survey (the same three items as for satisfaction for the local ("my subteam") adapted for the remote subteam). Neither satisfaction with the "other" subteam nor the trust measures was normally distributed therefore correlations were performed using Spearman's rank correlation coefficient tests.

For early trust, measured at the end of the first week, correlations were made between early Personal Trust and satisfaction with the "other subteam" (r=.50011, p<.0001,N=113); between early Process Trust and satisfaction with the "other subteam" (r=.18026, p=.0561, N=113); and between early Expertise Trust and satisfaction with the "other subteam" (r=.29274, p=.0017, N=113). Hypothesis 2h was supported for the correlations with Personal Trust and with Expertise Trust but not supported for the correlations with Process Trust.

For longer term trust, measured in the post survey, Hypothesis 2h was supported. The correlations of longer term Personal Trust and satisfaction with the "other subteam" (r=.72962, p<.0001, N=126) and between longer term Process Trust and satisfaction with

the "other subteam" (r=.29992, p=.0006, N=126) were both significant at the .05 level and positive.

Therefore, Hypothesis 2h is partially supported for early trust and supported for longer term trust.

10.6.9 Summary of Results of Testing Research Question 2 Hypotheses:

Below, in Table 10.38, is a summary of the results of testing hypotheses that relate to Research Question 2. Shown are the results for testing of Study 1 and Study 2 data.

Table 10.38 Summary of Results of Tests of Hypotheses Related to Research Question 2

HYPOTHESIS	STUDY 1	STUDY 2
2a: Leadership configuration will impact trust such that teams with distributed leadership will develop higher levels of initial trust and longer lasting trust than teams with centralized leadership.	Not supported	Not Supported
2b: Trust within a subteam will be positively associated with perceptions of subteam performance.	Supported	Partially supported for early trust; Supported for longer term trust.
2c: Trust between subteams will be positively associated with perceptions of team performance.	Supported	Partially supported for early trust; Supported for longer term trust
2d: Trust will be associated with objective performance.	Not Supported	Partially supported
2e: Trust for members of a subteam will be associated with satisfaction with a subteam leader.	N/A	Supported
2f: Trust between subteams will be associated with satisfaction with a team leader.	N/A	Partially supported for early trust; Supported for longer term trust.
2g: Trust for members of a subteam will be positively associated with satisfaction with the collocated ("my") subteam.	N/A	Partially supported for early trust; Supported for longer term trust

Table 10.38 Summary of Results of Tests of Hypotheses Related to Research Question 2 continued

HYPOTHESIS	STUDY 1	STUDY 2
2h: Trust between subteams will be positively associated with satisfaction with the remote ('other") subteam.	N/A	Partially supported for early trust; Supported for longer term trust

As the table above shows, for long term trust the results of Study 2 analyses are consistent with the results of Study 1 analyses. However, early trust results (only available in Study 2) are only partially supported. Inconsistent results for early trust may be the result of it not being measured at the same time as the dependent variables. That is, the correlations with early trust were done with measures of the dependent variables (satisfaction with the team performance, etc.) taken at the end of the project. If early trust has the potential to develop into either traditional trust or distrust, then the inconsistent results of those correlations can be explained. For future studies, measures of the other constructs (e.g., satisfaction with a team) should be taken at the same time as the measure of early trust as well as at the end of the project so that relationships, if they exist, can be uncovered.

10.7 Research Question 3: Leader Effectiveness

Research question 3 asks, "Does leadership configuration have an impact on perceived leadership effectiveness in PDTs and what are the effects of leadership effectiveness?

10.7.1 Hypothesis 3a: Leadership configuration influences perceptions of leader effectiveness such that perceptions of leader effectiveness will be higher for subteam leaders than for team leaders.

Perceived leader performance (effectiveness) was measured for subteam leaders and for team leaders by a single question each in the post survey. As noted in the methodology section of this dissertation, if a subteam had co-subteam leaders, then the scores for those leaders were averaged to obtain a single subteam leader score. This is because the way the data were collected it is impossible to ascertain which rating was referring to which co-subteam leader. Subteam trust is interpreted in this analysis as the trust for one's local subteam ("my" subteam) while team trust is the trust between subteams (for the "other" subteam).

Perceived leadership performance was not normally distributed and attempts at transformations to achieve normality failed. Therefore, a nonparametric test (Kruskal-Wallis) was performed to test this hypothesis. The results were not significant (X^2=.7120, p=.3988, N (team leaders) = 102, N (subteam leaders) = 95). Therefore, Hypothesis 3a is not supported.

10.7.2 Hypothesis 3b: Perceived leader effectiveness will be positively associated with team and subteam performance.

Perceived leader performance and perceived team performance were significantly, positively correlated (Spearman's r = .38108, p<.0001, N=197) thus supporting Hypothesis 3b. Perceived leader performance and perceived subteam performance were also significantly, positively correlated (Spearman's r = .39192, r<.0001, N=197) also supporting this hypothesis.

A team measure of perceived leader performance was obtained by taking the average, for a team, of the perceived leader performance scores. The measure was not normally distributed and so a Spearman's ranked correlation coefficient test was performed to find the correlation between leader performance and objective performance. The result (r=.20306, p=.3773, N=21) was not significant and so Hypothesis 3b is not supported for objective performance.

Therefore, Hypothesis 3b is supported for perceived performance of team and subteam but not for objective performance.

10.7.3 Hypothesis 3c: Effective team leadership will be more positively associated with team trust than with subteam trust.

For longer term trust, perceived effective team leadership was significantly and positively associated with Personal Trust for the local ("my") subteam (r=.23111, p=.0194, N=102) but not with Process Trust for the local subteam (r=.09993, p=.3177, N=102). On the other hand, perceived effective team leadership was significantly and positively associated with both Personal Trust between subteams (for the "other" subteam)

(r=.35219, p=.0003, N=102) and with Process Trust between subteams (r=.21447, .p=.0304, N=102). Therefore, Hypothesis 3c is supported for longer term trust.

For early trust, perceived team leader effectiveness was positively and significantly associated with early Personal Trust for the local subteam (r=.22086, p=.0387, N=88) but not with early Process Trust for the local subteam (r=.03806, p=.7248, N=88) or with early Expertise Trust for the local subteam (r=.06317, p=.5587 N=88). Similarly, perceived team leader effectiveness was positively and significantly associated with early Personal Trust between subteams (r=.26997, p=.0110, N=88) but not with early Process Trust (r=.08367, p=.4383, N=88) or with early Expertise Trust between subteams (r=.13100, p=.2238, N=88). Since the correlation of team leader effectiveness and early Personal Trust for "my" subteam was only marginally more significantly associated with early Personal Trust for the "other subteam (r=.26997, p=.0110) than the correlation of team leader effectiveness and early Personal Trust for the "other" subteam (r=.22086, p=.0387), Hypothesis 3c is not supported for early trust.

That is, Hypothesis 3c is supported for longer term trust and partially supported for early trust. It should be noted that perceived team leadership and longer term trust are measured at the end of the project while early trust is measured after only one week. These results suggest that early trust cannot, with the exception of Personal Trust, predict how effective participants will find their leaders by the end of the project. It would have been interesting to have measured perceived leader effectiveness earlier on in the project as well. However, that was not done but should be considered for future studies.

10.7.4 Hypothesis 3d: Effective subteam leadership will be more positively associated with subteam trust than with team trust.

For longer term trust, perceived subteam leader effectiveness was positively and significantly associated with both longer term Personal Trust for "my" subteam (r=.36519, p=.0003, N=95) and with longer term Process Trust for the local subteam (r=.3680, p=.0008, N=95). However, it was not significantly associated with either longer term Personal Trust between subteams (the "other" subteam) (r=.15870, p=.1245, N=95) or for longer term Process Trust between subteams (r=.11165, p=.2814, N=95). Therefore, Hypothesis 3d is supported for longer term trust.

For early trust, perceived subteam leader effectiveness was positively associated with early Personal Trust for the local subteam (r=.23385, p=.0356, N=81) but not with either early Process Trust for the local subteam (r=.18130, p=.1053, N=81) or with early Expertise Trust for the local subteam (r=.16725, p=.1356, N=81). Perceived subteam leader effectiveness was not significantly associated with early Personal Trust between subteams (r=.15770, p=.1597, N=81), early Process Trust between subteams (r=.10540, p=.3490. N=81) or with early Expertise Trust between subteams (r=.01744, p=.8772, N=81). Therefore Hypothesis 3d is supported only for early Personal Trust.

Thus, Hypothesis 3d is also supported for longer term trust but only partially supported for early trust. Again, it may be informative to, in the future, measure perceived effective subteam leadership at the same time that early trust is measured.

10.7.5 Hypothesis 3e: Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership.

Table 10.39 below shows the results of correlations for longer term trust with perceived leader effectiveness:

Table 10.39 Perceived Leader Performance vs. Longer Term Trust (Spearman's r p)

	Personal Trust for "my" subteam	Process Trust for "my" subteam	Personal Trust for the "other" subteam	Process Trust for the "other" subteam
Perceived Subteam Leader Effectiveness	**.36519** **.0003***	**.33680** **.00080***	.15870 .1245	.11165 .2814
Perceived Team Leader Effectiveness	**.23111** **.0194***	.09993 .3177	**.35219** **.0003***	**.21447** **.0304***

As can be seen in the table above, the correlations between perceived subteam leader effectiveness and trust for "my" subteam are stronger than the correlations between team leader effectiveness and trust for "my" subteam thus supporting Hypothesis 3e. However, the converse is true for trust between subteams. That is, the correlations with perceived team leader effectiveness are stronger in those cases. Thus, Hypothesis 3e is not supported for longer term trust.

For early trust, only the correlations between perceived leader effectiveness and early Personal Trust were significantly correlated. In the case of early trust for "my" subteam, effective team leadership was more strongly correlated with Personal Trust (r=.22086, p=.0387, N=88) than was effective subteam leadership (r=.23385, p=.0356, N=81) thus not supporting the hypothesis. For early trust between subteams, perceptions of team leader effectiveness was significantly correlated with early Personal Trust (r=.26997, p=.0110. N=88) while perceptions of subteam leader effectiveness was not significantly correlated (r=.15770, p=.1597, N=81) also not supporting this hypothesis. It

is curious that for early trust team leader effectiveness is more strongly associated with early Personal Trust than is effective subteam leadership. One possibility that occurred to the researcher is that in the first week when the subteams work intensely together on their contract, the trust that develops between the subteams is more predictive of the trust that is maintained throughout the project than is the trust that develops within a subteam. However, an examination of the correlations between early Personal Trust and longer term Personal trust failed to find support for this conjecture. Although the correlations between early Personal Trust and longer term Personal Trust both within and between subteams are both highly significant, the correlation between early Personal Trust and longer term Personal Trust between subteams ($r=.41813$, $p<.0001$, $N=127$) has a smaller "r" than the correlation between early Personal Trust and longer term Personal Trust within subteams ($r=.48012$, $p<.0001$, $N=127$). Thus, the results are unexplained at this time.

Therefore, Hypothesis 3e is not supported.

10.7.6 Hypothesis 3f: Effective leadership will be positively associated with satisfaction with the leader.

Satisfaction with a leader was measured by three items on the post survey. As discussed earlier, an oversight resulted in the third item being a 10-point scale item while the other two were 7-point scale items. Therefore, the third item's results were transformed by multiplying by 7/10 to bring the results in the range of the other two items. Then an aggregate was taken of the three measures to obtain the satisfaction with the leader measure.

None of the variables were normally distributed and so a Spearman's ranked correlation coefficient test was performed. The results suggest that effective leadership is strongly correlated with satisfaction with the leader (r=.72383, p<.0001, N=161) thus strongly supporting Hypothesis 3f.

10.7.7 Hypothesis 3g: Effective subteam leadership will be positively associated with satisfaction with the collocated ("my") subteam.

Satisfaction with a subteam was measured by three items on the post survey. Neither satisfaction with a subteam nor perceived subteam leader effectiveness were normally distributed (nor transformations failed to achieve normality) and so a Spearman's ranked correlation coefficient test was performed. The result was that perceived subleader effectiveness was significantly associated with satisfaction for the collocated subteam (r=.39767, p=.0003, N=79) thus supporting Hypothesis 3g.

10.7.8 Hypothesis 3h: Effective team leadership will be positively associated with satisfaction with both the collocated ("my") subteam and the remote ("other") subteam.

Satisfaction with the collocated and remote subteams was measured by three items each on the post survey. None of the variables were normally distributed and attempts at transformations to achieve normality failed. Spearman's ranked correlation coefficient tests suggest that perceived team leader effectiveness is positively and significantly associated with both satisfaction with the local collocated subteam (r=.38540, p=.0001, N=92) and with the remote "other" subteam (r=.56255, p<.0001, N=92) thus supporting Hypothesis 3h.

10.7.9 Summary of Results of Testing Research Question 3 Hypotheses:

Below, in Table 10.40, is a summary of the results of testing hypotheses that relate to Research Question 3. Shown are the results of testing Study 1 and Study 2 data.

Table 10.40 Summary of Results of Tests of Hypotheses Related To Research Question 3

HYPOTHESIS	STUDY 1	STUDY 2
3a: Leadership configuration influences perceptions of leader effectiveness such that perceptions of leader effectiveness will be higher for subteam leaders than for team leaders.	Not Supported	Not supported
3b: Perceived leader effectiveness will be positively associated with team and subteam performance.	Supported for perceived group performance; Not supported for objective performance	Supported for perceived team performance; Not supported for objective performance
3c: Effective team leadership will be more positively associated with team trust than with subteam trust.	Supported	Supported for longer term trust; Not supported for early trust
3d: Effective subteam leadership will be more positively associated with subteam trust than with team trust.	Supported	Supported for longer term trust; Partially supported for early trust
3e: Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership.	Supported	Not Supported
3f: Effective leadership will be positively associated with satisfaction with the leader.	N/A	Supported
3g: Effective subteam leadership will be positively associated with satisfaction with the collocated ("my") subteam.	N/A	Supported
3h: Effective team leadership will be positively associated with satisfaction with both the collocated ("my") subteam and the remote ("other") subteam.	N/A	Supported

Table 10.40 above summarizes the results of hypotheses testing in both Study 1 and Study 2 of hypotheses related to Research Question 3. Of interest is that, as with other results of tests involving trust, results are supportive of hypotheses for longer term trust, but did not support or only partially supported hypotheses involving early trust. Also noteworthy is that in both studies, leadership configuration was not shown to influence perceptions of leader effectiveness. This is a surprising result. However, the

short duration of the project together with the training of leaders on their responsibilities may have contributed to the resulting lack of significant differences in leader effectiveness between conditions. Also surprising was the difference in results of Study 1 and Study 2 testing of Hypothesis 3e. In Study 1 support was found for the hypothesis that "Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership." Support was not found for that hypothesis in Study 2. It is possible that the fact that the N for the Decentralized condition (with subteam leaders) in Study 1 was so high contributed to the test results.

10.8 Research Question 4: Distance

Research question RQ4 asks, "Does distance (cultural, geographic, temporal) impact trust, leader role enactments, and/or perceived leader effectiveness?

As described above, temporal distance is measured by the time zone difference between the two time zones of a team's subteams. Because of issues of collinearity, cultural distance was not considered in the analyses. Geographic distance is not examined per se because the team structures are such that geographic distance is explained by the time zone distances.

10.8.1 Hypothesis 4a: The stronger the distance faultlines between subteams in PDTs, the lower the team trust.

Spearman's ranked correlation coefficient tests were performed between the measure of temporal distance and each type of trust between subteams. The results are shown below in Table 10.41.

Table 10.41 Correlations of Temporal Distance with Trust

	Longer Term Personal Trust N=149	Longer Term Process Trust N=149	Early Personal Trust N=146	Early Process Trust N=146	Early Expertise Trust N=146
Time Distance	-.1227 .1359	-.1338 .1037	**-.2231** **.0068***	**-.2941** **.0003***	**-.1931** **.0196***

Noteworthy in the results is that while temporal distance is not significantly associated with longer term trust, it is significantly and negatively associated with early trust. This result may be because as the project progresses, teams adapt and learn to overcome the impediments of distance.

Thus, Hypothesis 4a is not supported for longer term trust but is supported for early trust.

10.8.2 Hypothesis 4b: The stronger the distance faultlines among subteams in PDTs, the lower the perceived leader effectiveness.

Because it is the team leader who manages across distances, of interest are the relationships, if any, between perceived team leader effectiveness and distance. Therefore, because perceived team leader effectiveness was not normal, a Spearman's ranked correlation coefficient test was performed between temporal distance and perceived team leader effectiveness. The result was insignificant (r=.033, p=.7373) and therefore, Hypothesis 4b is not supported.

10.8.3 Hypothesis 4c: The larger the distance faultlines between subteams, the more likely there will be emergent leaders who share leader roles with the designated leader(s).

In the post survey, respondents were asked if subteam leader(s) emerged in their subteams, or if team leader(s) emerged in their teams. Logistic regression was performed to see if the temporal distance measure predicted the emergence of either a subteam leader or team leader. The results are shown below in Tables 10.42 and 10.43.

Table 10.42 Logistic Regression: Distance Effect on Emergence of Subteam Leader

N=204	Parameter Estimate	Wald Chi-Square	Pr>Chi-Square
Time Distance	-.0394	.4811	.4879

Table 10.43 Logistic Regression: Distance Effect on Emergence of Team Leader

N=204	Parameter Estimate	Wald Chi-Square	Pr>Chi-Square
Time Distance	.0227	.1494	.6992

As can be seen in the tables above, neither of the parameter estimates are significant suggesting that temporal distance does not influence the emergence of either subteam or team leaders. It should be noted that 14 of the 21 teams reported the emergence of a subteam leader and ten teams reported the emergence of a team leader. That there does not appear to be an association of temporal distance with the emergence of leaders indicates that other team and subteam dynamics were at play that influenced the emergence of leaders. Recall that Hypotheses 1c and 1d, which proposed that leadership configuration would impact the emergence of leaders, were also not supported. Future studies should investigate this phenomenon. Therefore, Hypothesis 4c is not supported.

10.8.4 Hypothesis 4d: Distance faultlines between subteams will affect the level of saliency of leadership role enactments to team members either positively or negatively.

First the relationships between temporal distance and leader enactment of roles without regard to whether the leader was a subteam or team leader (i.e., for all leaders) was explored. The results of Spearman's ranked correlation coefficient tests of temporal distance with leader role enactments for all leaders is shown below in Table 10.44.

Table 10.44 Correlation of Distance and All Leader Role Enactments

N=166	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Time	.1379	.0533	.1068	.0689	.0671	.1516	.1285	.0546
Distance	.0763	.4954	.1709	.3775	.3907	.0512	.0990	.4849

All of the correlations of distance dimensions with leader role enactments were insignificant.. What is of interest, of course, is whether distance affects team leaders, subteam leaders or both.

Therefore, Spearman's ranked correlation coefficient tests were then performed between temporal distance and each team leader role enactment measure. The results are shown below in Table 10.45.

Table 10.45 Correlations of Distance and Team Leader Role Enactments

N=86	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Time	.1760	.0429	.0697	.0084	.0248	.1390	.1914	.0599
Distance	.1051	.6952	.5234	.9386	.8210	.2017	.0776	.5838

The results of the correlations suggest that, temporal distance did not have an effect on the saliency of role enactment by team leaders. Therefore, Hypothesis 4d is not supported for team leader role enactments..

Spearman's r was also calculated for temporal distance versus subteam leader role enactments. The results are shown below in Table 10.46.

Table 10.46 Correlations of Distance and Subteam Leader Role Enactments

N=80	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Time	.0824	.0599	.1623	.1348	.1116	.1663	.0629	.0529
Distance	.4676	.5979	.1504	.2331	.3242	.1404	.5791	.6414

The results of the correlations are that none of the relationships were significant. Thus, for subteam leader role enactments, Hypothesis 4d is not supported.

Thus, Hypothesis 4d is not supported.

10.8.5 Summary of Results of Testing Research Question 4 Hypotheses

Below, in Table 10.47, is a summary of the results of testing hypotheses that relate to Research Question 4.

Table 10.47 Summary of Results of Tests of Hypotheses Related to Research Question 4

HYPOTHESIS	STUDY 1	STUDY 2
4a: The stronger the distance faultlines between subteams in PDTs, the lower the team trust.	N/A	Not supported for longer term trust; Supported for early trust
4b: The stronger the distance faultlines among subteams in PDTs, the lower the perceived leader effectiveness.	N/A	Not supported
4c: The larger the distance faultlines between subteams, the more likely there will be emergent leaders who share leader roles with the designated leader(s).	N/A	Not supported
4d: Distance faultlines between subteams will affect the level of saliency of leadership role enactments to team members either positively or negatively.	N/A	Not supported

Table 10.47 above summarizes the results of hypothesis testing in Study 2 of hypotheses related to Research Question 4. Tests were not done for Study 1 data because distance was held constant in Study 1 (all teams had a subteam from the U.S. and one from the Netherlands). For Study 2, while hypothesized relationships between temporal distance and perceived leader effectiveness and distance and emergent leadership were not supported, the results of correlations between distance and trust are of interest. Distance is not significantly correlated with longer term trust but is significantly and

negatively correlated with early trust. This result suggests that for nascent teams, temporal distance impedes the development of trust but that as the teams gain experience over time, they are able to overcome the impediments of cultural and temporal distance.

10.9 Research Question 5: Ineffective "Bad" Leadership

Research question RQ5 asks, "What are the effects of ineffective bad leadership in PDTs?"

Ineffective bad leadership is measured by three new items in the post survey based on the characteristics of ineffective leadership as defined by Kellerman (2004). The measure for ineffective bad leadership is taken to be the aggregate of the three item scores. Because the literature focuses on beneficial leadership, not generally on "bad" leadership, the literature does not provide guidance for the development of hypotheses about ineffective bad leadership. Therefore, this study proposes sub-research questions to be explored through quantitative analysis.

10.9.1 RQ5a: Is ineffective bad leadership salient in PDTs?

Each of the three items for ineffective bad leadership was a 7-point semantic differential scale. The statements were statements of ineffective bad leadership behavior and the scales went from 1 (strongly disagree) to 7 (strongly agree). Therefore, the aggregate score range was from 3 to 21 with the higher the score the more the respondents agreed that their leader demonstrated ineffective bad leadership. The mean of all the scores was 5.2855 (N=166) which indicates that in general the respondents did not think that their leaders demonstrated ineffective bad leadership. It is possible that contributing to the

lack of ineffective behavior saliency were the instructions given to leaders of their responsibilities and the oversight of the instructors in the classroom.

It is of interest to see if there was a difference in the perceptions of ineffective bad leadership by leadership configuration (Centralized, Decentralized, and Hierarchical). The means for the aggregate scores for the three conditions were all low (Centralized: mean 5.7142, N = 42; Decentralized: mean 5.2188, N = 32; Hierarchical: mean 5.29348, N =92). The measure of bad leadership was not normally distributed and a non-parametric test (Kruskal-Wallis) found there was not a statistical difference between leadership conditions (X^2=2.316, p=.3040).

Therefore, there is no evidence that for this study ineffective bad leadership was a problem.

10.9.2 RQ5b: Is there a relationship between ineffective bad leadership and emergent leadership?

Emergent leadership was measured by a dichotomous question (i.e., did any leader emerge as a subteam/team leader?). Therefore, a logistic regression was performed to ascertain if bad leadership could predict emergence of a leader. The results suggested that ineffective bad leadership was a significant predictor of emergence of a leader (B_1=.1606, X^2=10.5685, p=.0012, N=166).

It is of interest whether this holds true for just subteam leaders, team leaders, or both. Therefore, logistic regressions were performed to see if ineffective bad subteam leadership predicts emergent subteam leaders (B_1=.1250, X^2= 3.2788, p=.0702, N=80) and whether ineffective team leadership predicts emergent team leaders (B_1=.2028, X^2=7.604, p=.0058). Therefore, there is evidence that ineffective bad team leadership

predicts the emergence of a team leader, but no evidence that ineffective bad subteam leadership predicts the emergence of a subteam leader. However, recall that there is no evidence that ineffective bad leadership was a pervasive problem in this study. It would be interesting to see if, in a future study, these results hold.

10.9.3 RQ5c: Is there an association between ineffective bad leadership and leader role enactments?

To investigate this question, first for each role, a correlation (Spearman's r) was done between the measure for the salience of that role behavior and the measure for ineffective bad leadership. As Table 10.48 below shows, for each role, there is a negative and significant correlation between the two measures. In each cell of the table, the top number is Spearman's r and the bottom number is p. Recall that leader roles are positive behaviors intended to create positive group and member outcomes. Therefore, it is not surprising that the relationship between these positive leader behaviors (roles) and ineffective bad leadership is negative.

Table 10.48 Correlations of Leader Roles and Ineffective Bad Leadership

N=166	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Ineffective Bad Leadership	**-.48640** **<.0001***	**-.47025** **<.0001***	**-.54886** **<.0001***	**-.54375** **<.0001***	**-.48205** **<.0001***	**-.47479** **<.0001***	**-.45088** **<.0001***	**-.52251** **<.0001***

Further insight was sought by examining the correlations between the measures for team leader role behaviors and ineffective bad team leadership and also between subteam leader role enactment and ineffective bad subteam leadership. As Table 10.49 shows below, in all cases the correlation (Spearman's r) was significant and, once again, negative. However, it is interesting to note that for all roles the correlation between team leader role enactment and ineffective bad team leadership is stronger than the correlation

between subteam leader role enactment and ineffective bad subteam leadership. At this time no speculation is made as to why there is that difference.

Table10.49 Correlations Between Sub and Team Leader Roles and Ineffective Bad Leadership

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Bad Subteam Leader N=80	**-.39343 .0003***	**-.32031 .0038***	**-.42114 .0001***	**-.44638 <.0001***	**-.30008 .0068***	**-.37539 .0006***	**-.33475 .0024***	**-.39455 .0003***
Bad Team Leader N=86	**-.58425 <.0001***	**-.61924 <.0001***	**-.65828 <.0001***	**-.63713 <.0001***	**-.64175 <.0001***	**-.57249 <.0001***	**-.55807 <.0001***	**-.63006 <.0001***

10.9.4 RQ5d: Is there a relationship between ineffective bad leadership and perceptions of leader effectiveness?

The results of a Spearman's ranked correlation coefficient test indicate that there is a strongly negative relationship between ineffective bad leadership and perceptions of leader effectiveness ($r=-.50067$, $p<.0001$, $N=161$). It is not surprising that if a respondent thinks his or her leader is ineffective, then she or he will not rate the leader as having a good performance. But, one might question if this negative and significant relationship holds for team leaders, subteam leaders, or both. The results of Spearman's rank correlation coefficient tests indicate that the relationship holds for both subteam leaders ($r=-.38339$, $p=.0005$, $N=78$) and for team leaders ($r=-.60206$, $p<.0001$, $N=83$). Once again, the relationship is stronger for team leadership than for subteam leadership.

10.9.5 RQ5e: Is there a relationship between ineffective bad leadership and trust?

For longer term trust and bad leadership, tests of Spearman's ranked correlation coefficient were conducted because of the lack of normality of the variables. Table 10.50

below shows the results for correlations of longer term trust with the measure of ineffective bad leadership. All correlations were both significant and negative. To assess whether this relationship holds for subteam leaders, team leaders, or both, correlations were also done of longer term trust with team leaders and with subteam leaders as also shown in Table 10.52 below. All correlations were significant and negative. It is not surprising that concomitant with an ineffective leader would be a lack of trust as the results suggest.

Table 10.50 Correlations of Longer Term Trust with Ineffective Bad Leadership

	Longer Term Personal Trust for "my" subteam	Longer Term Process Trust for "my" subteam	Longer Term Personal Trust for the "other" subteam	Longer Term Process Trust for the "other" subteam
Ineffective Bad Leader N= 161	**-.37612 <.0001***	**-.39106 <.0001***	**-.40430 <.0001***	**-.38509 <.0001***
Ineffective Bad Subteam Leader N=78	**-.44780 <.0001***	**-.46491 <.0001***	**-.41925 .0001***	**-.35032 .0017**
Ineffective Bad Team Leader N=83	**-.30511 .0050***	**-.31628 .0036***	**-.38929 .0003***	**-.41166 .0001***

Recall that early trust was measured in the first personal reflection at the end of the first week of the project while ineffective bad leadership was measured in the post survey at the end of the four week project. However, it still is interesting to see the correlations (Spearman's r), shown below in Table 10.51, between early trust and ineffective bad leadership. As can be seen, all the correlations are negative and significant except for the correlation between early Expertise Trust and ineffective subteam bad leadership. That correlation is also negative, but not significant. One can speculate about the reasons for this pattern of negative and significant correlations. It

may be that leaders who are ineffective are ineffective from the start and the correlations reflect the lack of trust engendered by bad leadership.

Table 10.51 Correlations of Early Trust and Ineffective Bad Leadership

	Early Personal Trust for "my" subteam	Early Process Trust for "my" subteam	Early Expertise Trust for "my" subteam	Early Personal Trust for the "other" subteam	Early Process Trust for the "other" subteam	Early Expertise Trust for the "other" subteam
Ineffective Bad Leader N=144	**-.35606 <.0001***	**-.36105 <.0001***	**-.31451 .0001***	**-.30154 .0002***	**-.26744 .0012***	**-.22842 .0059***
Ineffective Bad Subteam Leader N=71	**-.38985 .0008***	**-.42045 .0003***	**-.28664 .0154***	**-.31392 .0077***	**-.29170 .0136***	-.15711 .1907
Ineffective Bad Team Leader N=73	**-.33224 .0041***	**-.29670 .0108***	**-.35077 .0023***	**-.29621 .0109***	**-.24036 .0405***	**-.31159 .0073***

10.10 Research Question 6: Patterns of Enactment of Leader Roles

Research question RQ6 asks, "Are there different patterns of enactment of leadership roles in different leadership structures?"

The results of the quantitative analysis done for Hypothesis 1b, described above, failed to find a significant difference in the enactment of the leadership roles by leadership condition. Therefore, it is not possible to find different patterns in the enactment of the leadership roles by condition. This is contrary to the findings in Study 1. In Study 1, Hypothesis 1b was partially supported and further analysis (for RQ6) did find patterns of leader role enactment by condition.

As with Study 1, it is interesting to examine the countries from which the team leaders came. In Study 1, all teams were comprised of US and Netherlands subteams and the majority of the team leaders were from the US subteam. In Study 2 all teams had one

subteam from the US. The other subteam was from China, Spain, or the UK with the exception of one team that had both subteams from the same US university. Of the 21 teams in Study 2, 15 teams were in either the Centralized or Hierarchical condition and so had a team leader. One of those teams was comprised of two subteams from the same US university (but from different classes) and so is not of interest for this analysis. Of the 14 teams of interest, six were US-China teams, six were US-UK teams, and two were US-Spain teams. Of those 14 teams, only one (a US-Spain team) had a team leader from a non-English speaking country, lending support to the proposition raised in the analysis of Study 1 that team leaders may arise from English speaking countries because the language of the project was English and thus the leader would be more comfortable with the language.

Of the six US-China teams, all team leaders were from the US. While language may have been an important factor (and, in fact, the personal reflections revealed that the Chinese students may not have been completely fluent in English), it is also possible that the difference in cultures played a role in the selection of team leaders from the US. According to Hofstede's cultural dimension indexes (Hofstede, 2001), China is high on Collectivism (index of 20) while the US is high on Individualism (index of 91). Therefore, it may be that the US students were more prone to volunteer for leadership positions than the members from the China subteams.

The question remains, however, why in the 6 US-UK teams, 5 of the team leaders were from the UK and only 1 from the US. Both the US and UK are English speaking countries and both are high on individualism (UK index of 89; US index of 91). In this

research, no explanation is posited and it remains to be seen if this pattern holds in future studies.

For the US-Spain teams, one had a Spanish team leader and one had a team leader from the US. While the US is high on individualism, Spain is only moderate on individualism (index of 51) and the language of Spain is not English. However, with so few teams of this structure, it is also likely that if there is a pattern it will emerge if in future studies there are more teams with US-Spanish structure.

10.11 Research Question 7: Communications Media Used

Research 7 asks, "Is there an effect on communications media use by leadership configuration and/or distance and are there relationships between communications media used and trust and/or the communications media used and enactment of leader roles?"

Communications media use was measured in the post survey for 14 media on a scale of 1 (never) to 7 (to a great extent) for both communication within a subteam and communication between subteams. For purposes of description, and to be consistent with the analysis of Study 1, ratings of 2-3 are considered to be "low" frequency, 4-5 "moderate" frequency, and 6-7 "high" frequency. Ratings of between 1 and 2 are "nearly never" while ratings of 1 indicate that the medium was never used.

An examination of the data showed that some answers were clearly erroneous. With the exception of one team (Team 37), all teams had subteams that were on different continents. Team 37 had two subteams that were from the same university, although from different classes. Therefore, with the exception of communication in Team 37, communication between subteams by face-to-face meetings was, with almost certainty,

not possible. Similarly, communication between subteams by course management systems, which were used within classes, not between classes, was with high certainty not possible for any team. Therefore, respondents who answered questions about communications media by indicating at least some use of face-to-face between subteams when the respondent was not from Team 37, and/or some use of course management systems between subteams were assumed to have erred in their answers, perhaps because they misunderstood the difference between "between subteams" and "within subteams" The responses from those 31 respondents were not used in the data analysis concerned with communications media used.

The communications media for which respondents indicate the frequency of use were the PDT System, instant messaging, email, text messaging, Facebook, Internet phone (e.g., Skype), face-to-face meetings, FAX, video conferencing, teleconferencing, course management system (e.g., Angel, Webboard), and bulletin boards or forums. As the list could not be all inclusive, the participants also rated the frequency of use of "other" and were given the opportunity to write in a text box what "other" referred to.

The frequency of use of the communications media over all conditions is shown below in Table 10.52.

Table 10.52 Means and Standard Deviations for Use of Communications Media

N = 118	**Within Subteam**	**Between Subteams**
PDT System	4.54 (2.02)	5.43 (1.75)
Instant Messaging	4.74 (2.07)	4.70 (2.11)
Email	6.03 (1.45)	6.00 (1.40)
Text Messaging	2.65 (1.97)	1.44 (1.33)
Facebook	1.84 (1.49)	1.61 (1.27)

Table 10.52 Means and Standard Deviations for Use of Communications Media continued

N = 118	**Within Subteam**	**Between Subteams**
Phone	2.75 (2.01)	1.27 (1.06)
Internet Phone (e.g., Skype)	1.31 (1.03)	1.29 (1.11)
F2F Meetings	5.44 (2.04)	1.14 (0.82)
FAX	1.00 (0)	1.00 (0)
Video Conferencing	1.03 (0.22)	1.10 (0.65)
Teleconferencing	1.08 (0.59)	1.00 (0)
Course Management System	1.75 (1.68)	1.00 (0)
Bulletin Board or Forum	1.28 (0.95)	1.22 0.91)
Other	1.29 (1.08)	1.18 (0.89)

Overall, for within-subteam media use, FAX was never used. Facebook, Internet phone, video conferencing, teleconferencing, course management system, bulletin board, and "other" were nearly never used. Text messaging and phone were used with low frequency. The PDT System, instant messaging, and face-to-face meetings were used with moderate frequency. Email was used with high frequency. Of note is that the frequency for face-to-face meetings was 5.44 which could be considered to be "nearly high."

For communications between subteams, FAX, teleconferencing, and course management systems were never used. Nearly never used were text messaging, Facebook, phone, Internet phone, face-to-face meetings (which would have been used by Team 37), video conferencing, bulletin boards, and "other." No media were reported to have been used with low frequency. The PDT System and instant messaging were

reported to have been used with moderate frequency. Email was used with high frequency.

Respondents were given the option to indicate what communications media they were referring to when selecting "other." Google Docs (four cites for within-subteam communication; two cites for between-subteam communication) was by far the most frequently cited other communications media used for both within and between subteams. Two teams also used the website they created for their team web page. One respondent reported that for both kinds of communication his/her subteam used a site called whenisgood.net.

Thus, overall, teams appeared to choose email as the media most used. For within-subteam communications, face-to-face meetings were used since subteams were collocated. The PDT System was used with moderate frequency both within and between subteams but was used more for between-subteam communications. This may have been because of the unavailability, for all but one team, of face-to-face meetings for between subteam communications. Instant messaging was also used with moderate frequency for both kinds of communication.

10.11.1 Hypothesis 7a: There is a relationship between leadership configuration and communications media used.

None of the communications media options data were normally distributed and attempts at transformations to achieve normality failed. Therefore, nonparametric tests (Kruskal-Wallis) were performed for each option to see if the use varied by leadership configuration. Table10.53 below shows the results for frequency of communication

media use within a subteam and Table 10.54 below shows the results for frequency of communication media use between subteams.

Table 10.53 Kruskal-Wallis Results for Media Use WITHIN a Subteam

Media	Centralized Mean (SD) N=39	Decentralized Mean (SD) N=35	Hierarchical Mean (SD) N=44	Chi-Square	Pr>Chi-Square
PDT System	4.821 (2.15)	4.400 (1.90)	4.409 (2.02)	1.3149	.5182
Instant Msg.	4.436 (2.25)	5.400 (1.75)	4.477 (2.06)	4.7271	.0941
Email	6.000 (1.64)	5.743 (1.54)	6.273 (1.17)	3.1451	.2075
Text Msg.	3.051 (2.04)	2.629 (1.90)	2.318 (1.95)	3.4347	.1795
Facebook	2.282 (1.59)	1.400 (1.22)	1.795 (1.52)	11.9323	**.0026***
Phone	3.154 (2.11)	2.857 (1.99)	2.295 (1.87)	3.8158	.1484
Internet Phone	1.667 (1.53)	1.114 (0.53)	1.159 (0.64)	4.8079	.0904
Face-to-face	5.256 (2.24)	5.743 (1.88)	5.364 (1.99)	1.5047	.4712
FAX	1.000 (0)	1.000 (0)	1.000 (0)	0	1.0000
Video Conferencing	1.000 (0)	1.114 (0.40)	1.000 (0)	7.2369	**.0268***
Teleconference	1.103 (0.64)	1.143 (0.85)	1.000 (0)	1.2120	.5455
Course Management System	1.923 (1.88)	1.857 (1.90)	1.500 (1.27)	0.5250	.7691
Bulletin Boards/ Forums	1.385 (1.09)	1.371 (1.11)	1.136 (0.63)	1.9475	.3777
Other	1.462 (1.25)	1.114 (0.68)	1.273 (1.17)	2.5428	.2804

Table 10.54 Kruskal-Wallis Results for Media Use BETWEEN Subteams

Media	Centralized Mean (SD) N=39	Decentralized Mean (SD) N=35	Hierarchical Mean (SD) N=44	Chi-Square	Pr>Chi-Square
PDT System	5.769 (1.68)	5.400 (1.70)	5.159 (1.83)	3.0075	.2223
Instant Msg.	4.282 (2.15)	5.49 (1.79)	4.455 (2.18)	7.0600	**.0293***
Email	5.641 (1.78)	5.914 (1.34)	6.386 (0.89)	3.7001	.1572
Text Msg.	1.462 (1.39)	1.457 (1.38)	1.409 (1.26)	0.1255	.9392
Facebook	1.923 (1.42)	1.114 (0.47)	1.727 (1.45)	12.6484	**.0018***
Phone	1.205 (1.00)	1.343 (1.30)	1.273 (0.90)	0.9134	.6334
Internet Phone	1.103 (0.50)	1.143 (0.85)	1.568 (1.56)	5.1422	.0765
Face-to-face	1.000 (0)	1.000 (0)	1.364 (1.31)	6.9023	**.0317***
FAX	1.000 (0)	1.000 (0)	1.000 (0)	0	1.0000
Video Conferencing	1.000 (0)	1.029 (0.17)	1.250 (1.04)	3.0135	.2216
Teleconference	1.000 (0)	1.000 (0)	1.000 (0)	0	1.0000
Course Management System	1.000 (0)	1.000 (0)	1.000 (0)	0	1.0000

Table 10.54 Kruskal-Wallis Results for Media Use BETWEEN Subteams continued

Media	Centralized Mean (SD) N=39	Decentralized Mean (SD) N=35	Hierarchical Mean (SD) N=44	Chi-Square	Pr>Chi-Square
Bulletin Boards/ Forums	1.308 (1.10)	1.286 (0.99)	1.091 (0.60)	1.6672	.4345
Other	1.154 (0.71)	1.114 (0.68)	1.250 (1.16)	0.2462	.8842

For communications media use within a subteam, significant results were found only for Facebook and video conferencing. All other results were not significant at the .05 level of significance. This is contrary to the results of Study 1 which found significant results only for face-to-face meetings. For this study (Study 2), video conferencing was only used (and used rarely at that) by team(s) in the Decentralized condition thus accounting for the significant results. For Facebook, teams in the Centralized condition used it with low frequency while in the other conditions it was used nearly never. However, it is important to note that all three of the significant results are for media that were not used with any great frequency, and thus the results have little substantive or practical significance.

For communications media use between subteams, significant results were found only for instant messaging, Facebook, and face-to-face meetings. This is also different than the results in Study 1 which found significant results for the PDT System, Facebook, and teleconferencing. It should be noted that in Study 1, face-to-face meetings were not possible between subteams. In Study 2 they were possible for the one team (Hierarchical condition) that had zero distance between its subteams. However, of the media which had significant results, only instant messaging was used with any significant frequency.

For the few media for which frequency of use was different depending upon the leadership condition, it would be informative to ascertain for which conditions frequency was greater. Although the media use data were not normally distributed, ANOVA is robust with regard to normality. Therefore, for the media for which the nonparametric tests were significant at the .05 level, ANOVAs were run with Tukey's tests to determine in which configurations the media were used more frequently. It should be noted, however, that model adequacy was not achieved in any case as the residuals were not normally distributed nor had constant variance. However, because of the robustness of the F-test, the results are reported here.

For frequency of use of Facebook within subteams ($F=3.39$, $p=.0370$, $N=118$), the Tukey test indicated that the Centralized condition (2.282) was significantly greater than the Decentralized condition (1.400). The frequency in the Hierarchical condition (1.795) was not found to be significantly different than in either of the other two conditions. However, as noted above, Facebook was used only nearly never or with low frequency so this finding does not have great impact on understanding the patterns of communication media use.

For video conferencing within subteams ($F=3.34$, $p=.0391$, $N=118$), the Tukey's failed to find differences significant at the .05 level. However, again video conferencing was used with such low frequency within subteams that it does not impact the understanding of the media use patterns.

For instant messaging between subteams ($F=3.65$, $p=.0291$, $N=118$), the Tukey's found that the Decentralized condition (5.49) use was significantly greater than the

Centralized use (4.282). Hierarchical use (4.455) was not found to be significantly different than in the other two conditions.

For use of Facebook between subteams (F=4.28, p=.0161, N=118), the Tukey test indicates that use was greater in the Centralized condition (1.923) than in the Decentralized condition (1.114). Use in the Hierarchical condition (1.727) was not found to be significantly different than use in the other two conditions.

For face-to-face meetings between subteams (F=2.83, p=.0632, N=118), the ANOVA failed to find any significant differences. This is different than the finding of the Kruskal-Wallis test but it should be noted that model adequacy was not reached for ANOVA. It should also be noted that, with the exception of the one zero distant Hierarchical team, face-to-face meetings were not possible between subteams.

Therefore, in most cases frequency of communication media use does not vary by leadership condition and Hypothesis 7a is only partially supported. However, the results do suggest that a variety of communications media will be used if available to partially distributed teams.

10.11.2 Hypothesis 7b: There is a relationship between distance and communications media used.

Spearman's ranked correlation coefficient was calculated for temporal distance with each of the media options presented to the respondents in the survey. This was done for both communications within a subteam and communications between subteams. Tables 10.55 and 10.56 below show the results of these correlations. In each cell in the tables, the top number is Spearman's r and the bottom number is p. Note that correlations were not

performed in cases where one of the variables was a constant because r is undefined when one of the variables takes on just one value.

Table 10.55 Correlations of Distance Measure with Media Used Within a Subteam

N = 118	PDT System	Instant Msg.	Email	Text Msg.	Facebook	Phone	Internet Phone
Temporal Distance	**-.1882 .0413***	**.2398 .0089***	**-.2552 .0053***	.1334 .1497	**-.3204 .0004***	**.2144 .0197***	.1601 .0833
	F2F	**FAX**	**Video conference**	**Tele-conference**	**Course Mgmt. System**	**Bulletin board**	**Other**
Temporal Distance	.0168 .8567	--------	.1213 .1907	.0532 .5675	-.0703 .4496	-.1039 .2630	.0173 .8522

Table 10.56 Correlations of Distance Measure with Media Used Between Subteams

N = 118	PDT System	Instant Msg.	Email	Text Msg.	Facebook	Phone	Internet Phone
Temporal Distance	-.1106 .2331	**.1854 .0445***	**-.2678 .0034***	-.0184 .8432	**-.3189 .0004***	**-.2112 .0217***	-.1575 .0885
	F2F	**FAX**	**Video conference**	**Tele-conference**	**Course Mgmt. System**	**Bulletin board**	**Other**
Temporal Distance	**-.3309 .0003***	---------	-.1093 .2388	---------	---------	-.0425 .6474	-.0396 .6706

Of particular interest are the results of correlations of temporal distance with communications media between subteams. As noted above, only the PDT System, instant messaging, and email were used with at least moderate frequency. It is interesting that temporal distance did not have a significant association with frequency of use of the PDT System for between subteam communications. It may be that any distance required use of the System since face-to-face meetings were not possible and so the magnitude of the distance did not have an effect. On the other hand, temporal distance was positively associated with instant messaging and negatively associated with email. Note that instant messaging is a synchronous technology while email is an asynchronous one. It is possible that the greater the distance, the more the need to have synchronous

communications so that issues that arise because of distance can be resolved immediately. This would require flexibility in overcoming the temporal distance. For example, one subteam may need to work late in the night or early in the morning to accommodate the other subteam's schedule.

It is curious to note that not only are there significant relationships for within-subteam communications and distance, but that the patterns are similar to the patterns suggested by the results of correlations of distance with between-subteam correlations. That is, as discussed above, for within-subteam communications only the PDT System, instant messaging, face-to-face meetings, and email were used with at least moderate frequency. The association between face-to-face meetings and distance was not significant. That is not surprising as all subteams met face-to-face depending upon such factors as their class schedule. But the associations between instant messaging and email with temporal distance are the same for within-subteam communications as between-subteam communications. It may be that the patterns that developed between subteams were naturally carried over to within-subteam communications. For example, if a team used instant messaging a great deal for between-subteam communications, they may have become accustomed to using it and the high frequency of use may have carried over to their within-subteam communications. What is unexplained is why the association between temporal distance and the frequency of use of the PDT System for within-subteam communications is significant and negative. This research does not postulate as to why that is, but it is a pattern that would be interesting to explore in future studies.

10.11.3 Hypothesis 7c: There is a relationship between communications media used and enactment of leader roles.

Correlations (Spearman's r) were performed between the eight leadership roles and the fourteen media for which respondents in the post survey rated the frequency of use. This was done for both communications within a subteam and communications between subteams. Tables 10.57 and 10.58 below show the results of these correlations. In each cell in the tables, the top number is Spearman's r and the bottom number is p. Note that correlations were not performed when one of the variables was a constant as the correlation coefficient, r, is undefined when either variable takes on just one value (e.g., a communication medium never used will have value of 1 for all observations).

Table 10.57 Correlations of Leader Roles and Media Used Within Subteams

N = 137	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
PDT System	.1097 .2020	.0523 .5438	.1204 .1611	.1025 .2331	.0972 .2586	.1074 .2117	.0195 .8210	.0977 .2560
Instant Message	.0800 .3528	-.0209 .8081	.0891 .3006	-.0015 .9865	-.0012 .9892	.0749 .3841	.0824 .3385	.0208 .8090
Email	-.0246 .7752	-.0461 .5924	-.0198 .8180	.0028 .9742	-.0667 .4385	-.0853 .3215	-.0741 .3897	.0039 .9635
Text Message	-.0049 .9548	-.0597 .4886	.0835 .3323	.0339 .6943	-.0004 .9961	.0840 .3293	-.0577 .5029	-.0687 .4252
Facebook	-.0133 .8777	.0866 .3143	.0486 .5729	.0674 .4340	.0452 .6001	.0813 .3447	.0201 .8158	.0989 .2500
Phone	-.0223 .7957	-.0148 .8642	.0256 .7666	.0022 .9793	-.0285 .7413	.0584 .4975	-.0388 .6525	-.0679 .4306
Internet Phone	.0477 .5798	.0887 .3026	.0501 .5613	.0406 .6378	.0749 .3844	.0770 .3713	.0951 .2692	.1581 .0650
FTF	.0461 .5925	.0711 .4091	.0564 .5126	.0261 .7619	.0636 .4603	.0383 .6570	.0438 .6114	.0278 .7473
FAX	---	---	---	---	---	---	---	---
Video Conference	.0777 .3671	.0203 .8135	.0377 .6619	.0482 .5759	-.0164 .8494	.0101 .9070	.0933 .2784	.0203 .8137
Tele-Conference	.0746 .3866	.0563 .5134	.0462 .5918	.0928 .2811	.0569 .5090	.0806 .3489	.1185 .1678	.1287 .1340
Course Management	**.2161** **.0112***	.1573 .0664	.1244 .1477	.1315 .1255	.0934 .2775	.1531 .0742	**.2315** **.0065***	**.2104** **.0136***
Bulletin Board	.0309 .7203	.1441 .0931	**.1731** **.0432***	.1617 .0591	**.1969** **.0211***	.1240 .1490	.0408 .6361	.0333 .6991
Other	-.0564 .5124	.0001 .9999	.0674 .4341	.0075 .9312	.0427 .6199	.0765 .3742	.0112 .8966	-.0443 .6071

Table 10.58 Correlations of Leader Roles and Media Used Between Subteams

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
PDT System	.1621 .0584	.1002 .2442	**.2259** **.0080***	**.1736** **.0425***	.1673 .0507	**.2498** **.0032***	.0679 .4308	.1204 .1612
Instant Message	.1357 .1140	-.0046 .9570	.1063 .2163	-.0199 .8172	.0006 .9944	.1045 .2242	.1289 .1332	.0482 .5757
Email	.1246 .1467	.0120 .8890	.0102 .9055	-.0428 .6199	-.0349 .6855	-.1066 .2150	-.0466 .5885	.0437 .6119
Text Message	.0110 .8988	-.0489 .5702	.0275 .7499	-.0461 .5924	.0020 .9817	-.0320 .7106	-.0748 .3848	-.0595 .4896
Facebook	-.0236 .7844	.0780 .3652	.0489 .5702	.0429 .6185	.0661 .4426	.0317 .7129	-.0618 .4727	.0297 .7307
Phone	-.0549 .5237	-.1553 .0700	-.0734 .3940	-.0643 .4555	-.0908 .2915	-.1190 .1661	**-.1819** **.0334***	-.1544 .0717
Internet Phone	.0621 .4712	.0774 .3687	.0053 .9511	-.0238 .7827	.0727 .3988	.0288 .7380	-.0288 .7385	-.0316 .7137
FTF	-.0271 .7531	.0540 .5309	.0709 .4106	.0712 .4087	.0895 .2985	.0918 .2863	.0871 .3114	.0952 .2683
FAX	--------	--------	--------	--------	--------	--------	--------	--------
Video Conference	.0556 .5185	.0151 .8614	.0477 .5803	-.0096 .9110	-.0263 .7606	.0079 .9266	-.0134 .8767	.0096 .9118
Tele-Conference	--------	--------	--------	--------	--------	--------	--------	--------
Course Management	--------	--------	--------	--------	--------	--------	--------	--------
Bulletin Board	.0223 .7959	.1208 .1596	.1500 .0803	.1492 .0819	.1450 .0909	.0926 .2817	.0226 .7935	.0148 .8636
Other	.0741 .3895	.1075 .2112	.1466 .0873	.1317 .1249	.1333 .1205	.1486 .0831	.0814 .3443	.0404 .6392

For both correlations of roles and media used within subteams and between subteams most correlations were not significant. In fact, there were fewer correlations than were found in Study 1. Of note in Study 1 was that there were more significant correlations of leader roles and communication media used within subteams than correlations of leader roles and communication media used between subteams. This also holds for Study 2, however, the difference is minimal (only one).

In Study 2, for communications within a subteam, there were significant correlations for innovator, facilitator, and mentor with course management systems; and producer and coordinator with bulletin board. It is noteworthy that both course

management systems and bulletin boards were nearly never used and so it is difficult to explain these correlations.

For Study 2, for communications between subteams, there were significant correlations for producer, director, and monitor with the PDT System; and for facilitator with phone. Phone was nearly never used and it is not possible to explain that result. However, the PDT System was moderately used. It is interesting that in Study 1 there were no correlations between the PDT System and any role although it was also moderately used in Study 1. It may be that the content of the PDT System was different in Study 2. For example, more exchanges on the PDT System may have taken place in Study 2 than in Study 1 while in Study 1 it may have been primarily used to post work in progress. In any event, the result is interesting in that task related roles are associated significantly with the use of the PDT System in Study 2.

Therefore, Hypothesis 7c is partially supported.

10.11.4 Hypothesis 7d: There is a relationship between communications media used and trust.

To investigate whether or not there is a relationship between media used for communication and trust, correlations were performed. Because of a lack of normality of the variables, Spearman's ranked correlation coefficients were obtained. For media used for communication within a subteam correlations were done with longer term Personal Trust, longer term Process Trust, early Personal Trust, early Process trust, and early Expertise trust for members of the collocated subteam ("my subteam"). For media used between subteams, correlations were done between the fourteen technology options and longer term Personal Trust, longer term Process Trust, early Personal Trust, early Process

Trust, and early Expertise Trust between subteams ("other subteam"). The results are shown below in Tables 10.59 to 10.62.

Table 10.59 Longer Term Trust for "My Subteam" vs. Media Use Within a Subteam

	Personal Trust			**Process Trust**	
N= 118	**r**	**p**		**r**	**p**
PDT System	**.2043**	**.0265***		.0687	.4601
Instant Message	.0151	.8707		-.0706	.4474
Email	**.2443**	**.0077***		.1637	.0764
Text Message	-.0640	.4911		-.0850	.3602
Facebook	.1594	.0846		.0705	.4484
Phone	-.0362	.6974		-.1329	.1515
Internet Phone	-.1459	.1149		-.1450	.1172
Face-to-face Meeting	**.2500**	**.0063***		**.1991**	**.0307***
FAX	--------	--------		--------	--------
Video Conferencing	-.0170	.8547		.0346	.7098
Teleconferencing	-.0177	.8495		.0410	.6593
Course Management System	.1061	.2527		.0250	.7882
Bulletin Board/ Forum	.0203	.8277		-.0449	.6291
Other	.0780	.4013		.0499	.5917

Table 10.60 Early Trust for "My Subteam" vs. Media Use Within a Subteam

	Personal Trust			**Process Trust**			**Expertise Trust**	
N = 103	**r**	**p**		**r**	**p**		**r**	**p**
PDT System	.0398	.6898		.0459	.6451		-.0339	.7339
Instant Message	-.0095	.9239		-.0062	.9502		-.0281	.7782
Email	.0073	.9413		.0360	.7180		.1450	.1440
Text Message	-.1628	.1005		-.0525	.5983		-.0471	.6367
Facebook	-.0300	.7637		.0283	.7768		.0419	.6793
Phone	-.1683	.0893		-.1919	.0522		-.1033	.2990
Internet Phone	-.1396	.1596		-.1208	.2241		.0314	.7526
Face-to-face meeting	.1665	.0927		.1343	.1763		**.2497**	**.0110***
FAX	--------	--------		-------	--------		--------	--------
Video Conference	-.1163	.2419		-.0221	.8249		.0066	.9471
Teleconference	-.1280	.1976		**-.2079**	**.0351***		.0066	.9471
Course Management System	.0256	.7976		-.0179	.8575		.1231	.2154
Bulletin Board / Forum	**-.2354**	**.0167***		-.1392	.1609		-.0364	.7150
Other	.0318	.7500		-.0329	.7413		.0440	.6590

Table 10.61 Longer Term Trust for the "Other Subteam" vs. Media Use Between Subteams

	Personal Trust			Process Trust	
N= 118	r	p		r	p
PDT System	.1140	.2190		.0543	.5591
Instant Message	.1761	.0565		.0493	.5959
Email	**.2519**	**.0059***		.0390	.6754
Text Message	.0720	.4388		.0036	.9695
Facebook	.1002	.2804		.0599	.5192
Phone	.0899	.3329		.0590	.5259
Internet Phone	.1254	.1760		.0647	.4865
Face-to-face Meeting	**.2100**	**.0225***		-.0134	.8853
FAX	--------	--------		--------	--------
Video Conferencing	.1792	.0522		**.2187**	**.0173***
Teleconferencing	--------	--------		--------	--------
Course Management System	--------	--------		--------	--------
Bulletin Board/ Forum	.0461	.6203		-.1182	.2023
Other	.0340	.7147		-.0650	.4841

Table 10.62 Early Trust for the "Other Subteam" vs. Media Use Between Subteams

	Personal Trust			Process Trust			Expertise Trust	
N = 103	r	p		r	p		r	p
PDT System	.0591	.5534		.0200	.8413		-.0782	.4325
Instant Message	.1427	.1503		.0731	.4628		.1138	.2522
Email	.0281	.7784		-.0566	.5704		**.2022**	**.0405***
Text Message	.0460	.6444		-.0217	.8279		-.0984	.3229
Facebook	.1015	.3075		.0535	.5917		.0612	.5393
Phone	.0747	.4530		.1182	.2344		.0653	.5123
Internet Phone	.0697	.4839		-.0325	.7442		-.0189	.8494
Face-to-face meeting	.1150	.2474		.0277	.7811		.1111	.2637
FAX	--------	--------		--------	--------		--------	--------
Video Conference	.1554	.1170		.1553	.1172		.1574	.1124
Teleconference	--------	--------		--------	--------		--------	--------
Course Management System	-------	--------		--------	--------		--------	--------
Bulletin Board / Forum	**-.2499**	**.0109***		-.1471	.1381		-.1700	.0860
Other	-.0354	.7227		-.0015	.9882		-.0271	.7860

Very few of the correlations were significant. This is consistent with the results of Study 1. For longer term Personal Trust for "my subteam," correlations were positive and significant with the PDT System, email, and face-to-face meeting. It is interesting to note that those three media were used with at least moderate frequency for within-subteam communications. However, instant messaging was also used with moderate frequency and did not correlate significantly with longer term Personal Trust for "my

subteam." For longer term Process Trust for the collocated subteam, only face-to-face meeting was significantly correlated. It is reasonable to conclude that trust can build as interactions through these media are increased. For early trust for the collocated subteam, only bulletin board was significantly correlated. It is of interest to note that the correlation was negative. Also negative and significant was the correlation between early Process Trust for the local subteam and teleconference. However, it must be noted that both bulletin board and teleconference were used nearly never and so conclusions cannot be drawn. However, of more interest is that early Expertise Trust for the local subteam was significantly and positively correlated with face-to-face meeting.

For longer term Personal Trust for the distant subteam, only email was significantly correlated. For longer term Process Trust for the distant subteam, only video conferencing was positively correlated. Note that while email was used with high frequency, video conferencing was nearly never used. Thus, what is of interest is that the more email was used, the more Personal Trust developed. For early Personal Trust for the distant subteam, only bulletin board was significantly correlated, and it was a negative correlation. However, it should be noted, again, that bulletin board was used nearly never. No media were significantly correlated with early Process Trust and only email was significantly correlated with early Expertise Trust for the other subteam.

Thus, there were few significant correlations between trust and media used, and most of them were for trust for "my subteam." Longer term, traditional trust, can build through a variety of types of interactions. It may be that what is important is that the interactions take place, not necessarily any particular media through which the communications take place. However, it is noteworthy that face-to-face meetings were

significantly correlated with both longer term Personal Trust and longer term Process Trust. This is consistent with media richness theory (Daft and Lengel, 1986) and with findings in the literature (DeRosa et al., 2004) that richer media (e.g., face-to-face) allows for more cues that can promote the development of traditional trust and that trust in virtual teams is more difficult to achieve than trust in collocated teams. Also, recall that the collocated subteam members had prior experience working with each other as they were enrolled in the same section of a course. Additionally, in the one team for which face-to-face meetings were possible between subteams, both subteams were from the same university and therefore the members may well have known each other prior to the study. Thus, it is likely that the members had a history of face-to-face experiences which built a knowledge base and therefore, the results are consistent with Channel Expansion Theory (Carlson and Zmud, 1999) which posits that as people gain experience with each other their perceptions of the richness of a communication media increases. Therefore, Hypothesis 7d is partially supported.

10.11.5 Summary of Results of Tests of Hypotheses Related to Research Question 7:

Below, in Table 10.63 is a summary of the results of testing hypotheses that relate to Research Question 7. Shown are the results for testing of Study 1 and Study 2 data.

Table 10.63 Summary of Results of Tests of Hypotheses Related To RQ 7

HYPOTHESIS	STUDY 1	STUDY 2
H7a: There is a relationship between leadership configuration and communications media used.	Partially Supported	Partially Supported
H7b: There is a relationship between distance and communications media used.	N/A	Partially Supported
H7c: There is a relationship between communications media used and enactment of leader roles.	Partially Supported	Partially Supported
H7d: There is a relationship between communications media used and trust.	Partially Supported	Partially Supported

The results of the testing of hypotheses related to Research Question 7 suggest strongly that partially distributed teams should be given a selection of communication media to use from which they can select the subset that best suits their needs. Although the results were not consistent between the two studies, both studies indicated (H7a) that leadership configuration can influence which media are used most frequently. For example, in Study 2, Tukey's test found that the Decentralized condition use of instant messaging was significantly greater than the use in the Centralized condition. It is likely that other subteam and team characteristics also influence the choice of communication media, but clearly a "one size fits all" approach of providing communication tools will fail to be the most efficacious approach. This research's studies were of short durations (4 weeks each). Research has shown that as teams develop over time, technology needs often change (Carte and Chidambaram, 2004). Taking into account the result suggesting that PDTs need a variety of communication capabilities and that these needs may change over time gives impetus to the proposition that providing them with "tailorable technology" (Turoff, Foster, Hiltz and Ng, 1989, Germonprez, Hovorka and Collopy, 2007) which are designed to be tailored by the users to their needs may be important to promoting efficient and efficacious communication.

Another noteworthy finding was that the more email was used, the more Personal Trust developed. This is consistent with the findings in the literature that communication is critical to the development of trust (Coppola et al., 2004). In terms of technology used, for between-subteam communications, the results suggest that distance (temporal) affects the use of technology such that the synchronous instant messaging is used more frequently when distance is larger and email, an asynchronous medium, is used with less

frequency. It may be that the greater the distance, the more the need for the ability to clarify and expound upon issues as they arise which would call for greater use of synchronous communication.

10.12 Research Question 8: Emergent Leaders

Research question 8 asks, "Do teams with emergent leaders have greater or less satisfaction than those who retain their designated structure?"

In order to examine this research question, respondents' satisfaction between subteams was compared with whether an emergent leader was reported by the respondent. Because of the lack of normality of the satisfaction measure, a nonparametric test (Kruskal-Wallis) was used. The results ($X^2 = 4.3158$, $p = .0378$) suggest that if a respondent reported emergent leadership, he or she had greater satisfaction for the "other" subteam (between-subteam satisfaction). This is not surprising as when there is an emergent leader, it is reasonable to assume that the leader filled a void necessary for effective team or subteam functioning. What would be of interest is to ascertain the level of satisfaction before the emergence of the leader. However, the way the data were collected it is not possible to determine that for this study. It would be worthwhile to do so in future studies.

10.13 Conclusion

Quantitative analysis of Study 2 data adds to the understanding developed through analysis of Study 1 data by testing the same relationships as in Study 1 and also testing relationships involving additional variables (early trust, satisfaction with team and

subteam, satisfaction with leader, and ineffective bad leadership). While the two studies were similar in nature, with equivalent tasks, there were differences, detailed in the Overview of this chapter, which could partially account for differences in test results. Most significantly, distance was varied in Study 2 so that the effects of distance on trust, perceived leader effectiveness, emergent leadership, and communication media used could be tested.

Significant amongst the findings of both studies is that the leadership roles identified by (Quinn, 1988), studied previously in collocated and virtual teams, do appear to be enacted in partially distributed teams as well. While leadership condition (Decentralized, Hierarchical, Centralized) did have significant effects in the Study 1 analysis, it did not in the Study 2 analysis for many of the same variables, possibly due to the additional training leaders and members received in Study 2. But Distance, varied only in Study 2, did have an effect on both early trust and on communication media chosen.

Since early trust was measured in Study 2, albeit not in Study 1, the results of the analysis of Study 2 regarding trust are important to a better understanding of trust and the effects of and on trust in partially distributed teams. This research was able to identify types of trust occurring early and longer term and found that the trust does, in fact, differ depending upon the stage of life-cycle of the team. For early trust, measured after one week of non-task related activities, two types of traditional trust (Personal Trust and Process Trust) and one type of swift trust (Expertise Trust) were identified. Longer-term trust was characterized by being either Personal Trust or Process Trust, as the early Expertise Trust became subsumed by Personal Trust as time went on and the respondents

had more experience with the trustees. Results of tests of the effects of and on trust indicate that the relationships between trust and external variables (e.g., perceived performance), differ for early trust and longer-term trust. This indicates that as trust develops in a partially distributed team, the effects of the trust may change.

The Study 2 analysis adds to the understanding of PDTs and how distance (cultural and temporal) and the different types of leadership (subteam, team leaders) affect the functioning of the PDT and the satisfaction of its members.

CHAPTER 11

COMBINED STUDY 1 AND STUDY 2 DATA ANALYSIS

11.1 Introduction

During the fall semester of 2007 (Study 1) and then spring semester of 2008 (Study 2), two full scale studies were undertaken. The independent variables were leadership configuration and distance (cultural, geographic, and temporal). For Study 1 distance was held constant although leadership configuration was varied. Both distance and leadership configuration were varied in Study 2. Details of separate quantitative analyses of these Studies are found in Chapters 8 and 10 of this dissertation.

This chapter describes analysis done on the combined data sets of the two studies. First the subjects, conditions, and tasks are briefly described. Then, quantitative analysis of the combined data set is discussed. Of primary interest to this research are the effects of leadership condition and distance on the enactment of leader roles. It is proposed in the model presented in this research that through leader role enactments, leadership condition and distance affect perceived leader effectiveness, performance and satisfaction. Although the hypothesis that leadership condition will affect role enactments was only partially supported in Study 1 and not supported in Study 2, it is possible that with the larger N (more power) of the combined semesters and greater variety of team structures, it would be supported for the combined semesters. Similarly, the hypothesis addressing the effects of distance on leader role enactments was not tested in Study 1 (where distance was held constant) and was only partially supported in the Study 2 analysis. Therefore, first bivariate analyses of those relationships are described. Next, the results of partial least squares (PLS) analysis of the model with only supported

or partially supported hypotheses are described. This initial PLS model with supported or partially supported relationships is tested first with respect to team leaders and then with respect to subteam leaders. However, in each of these initial models there are over 200 relationships making the model difficult to understand. Therefore, those two models are further pruned to reduced models with only the relationships that are significant in the initial PLS models. This pruning of the model continues until a valid, reliable model with only significant paths (parsimonious model) is achieved.

PLS is used because it does not make any assumptions about the distributions of the variables (Chin, 1998). Reported for all PLS models in this research are the Beta Weights (path coefficients) and t-values. The t-values are obtained from using Bootstrapping (a resampling method), in this research with 500 samples, and provide indicators of the precision of the PLS estimates (Beta Weights) (Chin, 1998). For the reduced models, reliability measures (AVE, Composite Reliability, and Cronbach's Alpha) are also computed and reported. Note that average variance explained (AVE) can be interpreted as a measure of reliability and, according to Chin (1998), should be over .5 for good reliability. While Cronbach's alpha is sensitive to the number of items in a scale, composite reliability is not (Ocker et al., 2009). According to Hair et al. (2006), composite reliability should be at least .7 although scores of between .6 and .7 may be acceptable if there are other indicators of a model's good construct validity. The application used in this research is SmartPLS (Ringle et al., 2005).

11.1.1 Subjects

Three hundred sixty four undergraduate students from three universities in two countries (USA and the Netherlands) were placed into 40 teams of 7 to 11 members each in Study 1. In Study 2, two hundred and eight undergraduate students from five universities in four countries (USA, Spain, UK, and China) were placed into 21 teams of eight to 12 members each. In Study 1, one subgroup from a team felt that their remote subgroup was unresponsive and so they joined another team leaving that team as a collocated traditional team. Therefore, the remainder of the team was not included in the analysis, leaving 39 teams with 359 members in the analysis from Study 1. In Study 2 four students failed to complete the task and were removed from the data set so that the total number of subjects was 204. Therefore, the number of subjects in the combined data set was 563.

Each team consisted of two subteams. Each team, with the exception of one team in Study 2, consisted of one subteam from the US and one from a different university and country. For that one zero-distant team exception, both subteams were from the same US university, albeit from different classes. Each subteam was from the same collocated or hybrid class so members of the subteam were collocated with each other while distant (with that one exception) from their teammates belonging to their team's other subteam.

11.1.2 Conditions

Teams were assigned to one of three conditions: Centralized, Hierarchical, or Decentralized. In the Centralized condition the team was to self-select an overall team leader but no subteam leaders. In the Hierarchical condition, the team was to have one overall team leader and each subteam was to have a subteam leader. In the Decentralized condition, there was to be no overall team leader but each subteam was to self-select a

subteam leader. Teams selected their leaders as part of the first week's activities in which they created a team contract. For Study 1 the manipulation failed and most teams selected leaders that put them in the Decentralized condition no matter what condition they were assigned. The manipulation was successful in Study 2, most likely because procedures were changed to emphasize the condition assignment. Details of the manipulation and changes to procedures are found in Chapter 10 of this dissertation. The analysis assumes the actual leadership condition when it differs from the assigned one.

Distance was to be operationalized as cultural, time zone, and geographic distance and is measured at the team level as the distance between the two subteams in a team. However, the measurements of the four dimensions (Hofstede, 2001) of culture: power distance, uncertainty avoidance, individualism and collectivism, and masculinity and femininity suffered from issues of multicollinearity. Therefore, as described in Chapter 5, cultural distance was dropped from the analyses. Distance was measured only as temporal distance in the analyses. Time zone difference is the absolute value of the difference in time zone of the countries in which the participant goes to school measured as GMT+. Table 11.1 below shows temporal indexes and distance scores for the countries and structures of teams that participated in Study 1 and Study 2 as well as the number of teams in each structure.

Table 11.1 Cultural and Temporal Indexes and Distances for the Combined Data Set

Country	**Time Zone (GMT +)**
USA	-4
UK	1
Spain	2
China	8
Netherlands	2
Team Configuration & Number of Teams	**Time Zone Distance**
USA – UK (8)	5
USA – Spain (3)	6
USA – China (9)	12
USA – USA (1)	0
USA—NL (39)	6

Because all non-zero distance teams were comprised of subteams that had east-west distance and were separated by at least one time zone, geographic distance and the issues it raises are captured by the time zone differences. Therefore, for this research, only time zone distances are measured.

11.1.3 Task

For both studies, the task was to determine the functional requirements and related decisions for an emergency management information system in response to a Request for Proposal prepared by the researchers. Although the details and focus of the two study EMIS's were different, the two study tasks were equivalent. All teams worked on the same task and the final report was due at the end of the four-week study. Intermediate deliverables were designed to help the participants work well in a PDT and guide them in the process of preparing the final report. Final reports were graded by designees of the researchers (for Study 2 one of the graders was also a researcher) and then independently

graded by two experts, all of whom used the same grading rubric to ensure grading consistency.

11.1.4 Communication Media

Each team was provided with private space on the PDT System, a customized wiki that does not function as a wiki because open editing is not provided. Participants were able to post to discussion forums, create discussion forums, upload files, and create pages. Although encouraged, communication was not restricted to the PDT System (called the "wiki" in Study 1) although all deliverables were posted to the team space as well as emailed to the researchers.

11.1.5 Procedures

All participants worked on the task and the intermediate deliverables. In Study 1 all participants completed a peer evaluation at the end of the project; in Study 2 it was completed at the discretion of the instructors. Participation in the experimental instruments (surveys and personal reflections) was voluntary for US students (as per the requirements of the Institutional Review Boards), and required for all others, and participants received extra credit for completing them. There was a background survey at the beginning of the project, personal reflections at the end of each week, and two post surveys. Personal reflections were surveys that included open ended questions for which the participants were to reflect on their experiences the week before. There were two post surveys because of the large number of post survey questions. One was devoted to questions about leadership and the other contained the remainder of the question items.

For the purposes of discussion in this chapter, both post surveys will be referred to as "the post survey."

The first week the participants engaged in activities that prepared them for working in a PDT by completing Module 1. They completed a system tutorial, introduced themselves on the PDT System, and worked through scenarios that guided them to understand issues of working in a PDT and to the completion of a team contract.

Active work on the response to the RFP (final deliverable) began in week 2. The participants completed Module 2 which had the goal of moving the participants from an "us vs. them" mindset to one of "we." Module 2 had two activities. There was a team building activity in which the participants interviewed members of their counterpart subteam and built a team page of member biographies with information about the members of the team. The second activity was a brainstorming activity to generate a list of functionality for the proposed EMIS.

The beginning of week 3 marked the midpoint of the project. During this week participants completed Module 3. For team building the participants completed a team assessment activity designed to help the participants assess their team interaction and performance and reach agreement on an action plan for improvement. Participants in both studies also continued to work on the final proposal: Study 1 participants were not given a specific activity nor did they have a deliverable; Study 2 participants were guided to produce a detailed outline of the functional requirements for the EMIS using the brainstorming list as a foundation.

During the fourth and final week, the participants did not have a team building exercise. The teams completed their final deliverables using a proposal template provided to them on the PDT System.

11.2 Quantitative Measures of Intervening and Dependent Variables

11.2.1 Enactment of Leader Roles

The post survey had 18 items per leader (subteam or team leader) relating to the eight leadership roles identified by Quinn (1988). The eight roles are innovator, broker, producer, coordinator, monitor, facilitator, and mentor (Denison et al., 1995). The participants were asked about the extent to which their leaders enacted each role behavior. Scale items were derived from Denison et al. (1995), with two 7-point semantic differential scale items per role and two additional new items (one for the director role and one for the monitor role).

11.2.2 Perceived Leader Effectiveness

Perceived leader effectiveness was measured by one 10-point semantic differential scale item each for team and subteam leader in the post survey.

11.2.3 Trust

The scale items for trust within a subteam (with the same 10 items repeated for trust between subteams) were included in both the post survey and first personal reflection. The ten 7-point semantic differential scale items had four questions (8 in total) adapted from Jarvenpaa et al. (1998) and six questions (12 total) adapted from Cummings and Bromily (1996). Factor analysis and reliability measures suggested that there are three

types of early trust: Expertise Trust, Personal Trust, and Process Trust, and two types of longer term trust: Personal Trust and Process Trust. Expertise Trust is a swift trust based on the trustor's judgment about the other member's expertise; Personal Trust is a trust that is based on the interactions the participants have had with each other. Process Trust is a trust based on inferences made from the process of the team working together. For early trust, all 10 items were used; for longer term trust a subset of 8 items was used because communalities suggested eliminating two items.

11.2.4 Communications Media

To capture what communications media teams used, the post survey had a series of questions asking about the frequency of use of 13 different communications media (plus "other") on a scale of 1 (never) to 7 (to a great extent) for both communications within a subteam and communications between subteams. The communications media rated were the PDT System (wiki), instant messaging, e-mail, text messaging, Facebook, Internet Phone (e.g., Skype), face-to-face meetings, fax, video conferencing, teleconferencing calls, course management system, and external forums or bulleting boards.

11.2.5 Performance

Perceived performance of a team or subteam was measured in the post survey by six 7-point semantic differential scale items each. The scale items were adapted from (Mortensen and Hinds, 2001). Each question asked about one of the six dimensions of performance: quality, creativity, adherence to schedule, coordination of member efforts, and communication. Although objective performance was measured, because testing of Study 1 and Study 2 did not suggest there were significant effects on it, except for the

association with longer term Process Trust, and because objective performance is measured at the team level, it is not included in the combined study analysis.

11.2.6 Satisfaction with a Leader

Satisfaction with a leader (subteam or team) was measured on the post survey with three semantic differential scale items that asked the participants to rate their overall satisfaction with the leader. Through an oversight, the first two questions were 7-point items and the third question was a 10-point item. For analysis, therefore, the third question answers are normalized to fit in the range of a 7-point scale.

11.2.7 Satisfaction with a Group

Satisfaction with a group (collocated "my" subteam or remote "other" subteam) was measured on the post survey with three 7-point semantic differential scale items adapted from (Fuller et al., 2006-7).

11.3 Reliability and Validity of Scales

Reliability measures were taken for multi-item scales. For those constructs used in the PLS analysis, reliability measures (AVE, composite reliability, and Cronbach's alpha) are reported along with the results of calculating PLS for the reduced models. In the sections below which discuss the results of PLS for the reduced models, reliability of the scales used in the reduced models will be addressed.

However, leader roles are also analyzed first using bivariate analysis, as discussed in the next section. Constructs may be classified as reflective or formative. Reflective constructs are those for which the measures each are reflective of the entire construct;

formative constructs are those for which the measures each reflect a part of the meaning of the construct, and in total the measures define the construct. While conceptually the leader roles are a formative construct, there were multiple items per role (two or three). Those items are reflective of their particular role. Therefore, Cronbach's alphas (standardized), as shown in the table below, were also calculated for the items by role (for subteam and team leaders and for all leaders without regard to type of leader) and all were adequate at above .8. Note that in the post survey some participants answered erroneously and those responses are not included in the analysis. For example, if a Decentralized member answered regarding a team leader (which the Decentralized condition does not have), the response is not included in the analysis.

Table 11.2 Cronbach's Alphas for Leader Role Enactments: Combined Semesters

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Subteam Leader N=298	.9210	.8796	.9419	.9252	.9103	.8698	.8402	.8873
Team Leader N=150	.9239	.8985	.9557	.9529	.9294	.8999	.8096	.9038
All Leaders N=448	.9224	.8864	.9470	.9360	.9182	.8808	.8297	.8944

Factor analysis was performed for those reflective scales that had multiple items measuring them. Prior research has suggested that factor analysis, a means of measuring validity, is not appropriate for formative constructs (MacKenzie et al., 2005, Petter et al., 2007). The statistical package SAS® was used to perform the factor analysis (principal components with Varimax rotation). For those reflective constructs that were not measured in Study 1 but were measured in Study 2, factor analysis was not repeated for the combined semester data set. Since those constructs (e.g., Satisfaction with a Leader) had only data from Study 2, the results of the factor analysis described in Chapter 10 on

Study 2 analysis still holds for the combined data set. Recall that in the analysis of Study 2, Satisfaction with a Subteam Leader, Satisfaction with a Team Leader, Satisfaction with the collocated (my) subgroup, and Satisfaction with the distant (other) subgroup all loaded on one factor and had adequate reliability as measured by Cronbach's alpha.

The only reflective constructs with data from both Study 1 and Study 2 that are used in the analysis of the combined semesters requiring factor analysis for the combined data set were Perceived Group Performance (subteam and team) and trust. Factor analysis on the combined data set resulted in Perceived Subteam Performance and Perceived Team Performance each loading on one factor (as shown below in Tables 11.3 and 11.4) with adequate communalities (not shown) of above .5 for each variable.

Table 11.3 Factor Analysis of Perceived Subteam Performance: Combined Data Set

VARIABLE	FACTOR 1
Efficiency	.85215
Quality	.88451
Creativity	.79884
Adherence to Schedule	.83337
Coordination of Member Efforts	.86699
Communication Between members	.83731

Table 11.4 Factor Analysis of Perceived Team Performance: Combined Data Set

VARIABLE	FACTOR 1
Efficiency	.86192
Quality	.85960
Creativity	.80844
Adherence to Schedule	.84560
Coordination Between Subteams	.87923
Communication Between Subteams	.83563

Reliability of the trust dimensions that are included in the reduced models will be addressed in the sections below that focus on the analysis of the reduced models (one with respect to team leaders; one with respect to subteam leaders). Recall that early trust was only measured in Study 2. Therefore, there is no data from Study 1 measuring it and so the results of factor analysis done in the Study 2 analysis hold for the combined data set as well. Study 2 analysis revealed that there are three types of early trust: Early Expertise Trust, Early Personal Trust, and Early Process Trust. All ten trust items are used in measuring early trust.

Initial factor analysis of longer term trust for the combined semester data set resulted in two factors each for longer term trust for "my" subteam and longer term trust for the "other" subteam. However, for longer term trust for "my" subteam question #5 had communality of less than .45 as did question #10 for longer term trust for the "other" subteam. Hair et al. (2006) recommend that variables with communalities of less than 5.0 should be removed but that benchmark of 5.0 is not firm. As exploratory research, this research uses 4.5 and the cut-off for removing variables. Therefore, and consistent with the results of factor analysis in Study 1 and Study 2, questions #5 and #10 were removed from the longer term trust scale analysis and factor analysis was performed again. The results are shown below in Tables 11.5 and 11.7. As can be seen from the tables, the results of the factor analysis are consistent with the results found for longer term trust in Studies 1 and 2. That is, one factor (Questions 3, 5, 6, 7, and 8) can be termed "Personal Trust" which is the trust that is based on the interactions of the participants with each other. The other factor (Questions 1, 2, and 9) is termed "Process Trust" as it is trust that is based upon inferences made from the process of the team

working together. As seen in Tables 11.6 and 11.8, communalities for the variables of the reduced set of items are adequate. Note that for the analyses, negatively worded question responses were reversed.

Table 11.5 Factor Analysis of Longer Term Trust for "My Subteam" Q5, Q10 Removed: Combined Data Set

	Factor 1	Factor 2
1. I would have preferred if some members had less influence over important aspects of the project in my subteam.	.20273	**.76967**
2. I wanted to more closely monitor the work of members in my subteam.	.29201	**.75330**
3. I was comfortable when other members worked on a critical task or problem in my subteam.	**.75949**	.18747
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in my subteam.	**.80241**	.21335
5. I felt that members tried to get out of their commitments in my subteam.	---------	---------
6. I felt that members kept their word in my subteam.	**.77053**	.19820
7. I felt that members were honest with me in my subteam.	**.78612**	.23436
8. I felt that members negotiated joint expectations fairly in my subteam.	**.79475**	.13024
9. I felt that members tried to get the upper hand in my subteam.	.09567	**.74841**
10. I felt confident that members would not exploit me in my subteam.	---------	----------

Table 11.6 Communalites for Longer Term Trust for "My Subteam" Reduced Scale: Combined Data Set

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q`0
.633	.653	.612	.689	--------	.633	.673	.649	.569	-------

Table 11.7 Factor Analysis of Longer Term Trust for the "Other Subteam" Q5 Q10 Removed: Combined Data Set

	Factor 1	Factor 2
1. I would have preferred if some members had less influence over important aspects of the project in the other subteam.	.19434	**.76177**
2. I wanted to more closely monitor the work of members in the other subteam.	.27443	**.67886**
3. I was comfortable when other members worked on a critical task or problem in the other subteam.	**.77891**	.20674
4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in the other subteam.	**.81079**	.21233
5. I felt that members tried to get out of their commitments in the other subteam.	----------	----------
6. I felt that members kept their word in the other subteam.	**.75626**	.25285

Table 11.7 Factor Analysis of Longer Term Trust for the "Other Subteam" Q5 Q10 Removed: Combined Data Set continued

	Factor 1	Factor 2
7. I felt that members were honest with me in the other subteam.	**.81038**	.17721
8. I felt that members negotiated joint expectations fairly in the other subteam.	**.81724**	.08362
9. I felt that members tried to get the upper hand in the other subteam.	.06333	**.70834**
10. I felt confident that members would not exploit me in the other subteam.	----------	----------

Table 11.8 Communalities for Longer Term Trust for the "Other Subteam" Reduced Scale: Combined Data Set

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
.618	.536	.649	.702	-------	.636	.688	.675	.506	-------

11.4 Bivariate Analysis: The Effects of Distance and Leadership Configuration on Leader Role Enactments

Of primary interest in this research is whether temporal distance and/or leadership configuration affect leader role enactment. These questions are embodied in Hypothesis 1b (Leadership configuration will influence role enactment) and Hypothesis 4d (Distance faultlines between subteams will affect the level of saliency of leadership role enactments to team members either positively or negatively). Hypothesis 1b was only partially supported in Study 1 and not supported in Study 2. Hypothesis 4d was not supported for team leaders and not supported for subteam leaders. However, it may be that with a larger N (more power), and the greater diversity of teams in the combined data set, (stronger) support can be found for the hypotheses. Therefore, before embarking on PLS modeling of supported hypotheses, bivariate analysis was done for Hypotheses 1b and 4d.

11.4.1 Hypothesis 1b: Leadership configuration will influence role enactment:

Because none of the leader role enactment measures were normally distributed, nonparametric tests (Kruskal-Wallis) were performed. Below, in Table 11.9 are the results of the tests for all leader roles without regard to whether the leader was a team leader or a subteam leader.

Table 11.9 Results of Nonparametric Tests: Does Leadership Configuration Affect Role Enactment?

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Centralized Mean N=59	4.07	5.03	5.05	5.22	5.18	5.00	4.55	4.92
Decentralized Mean N=198	5.37	5.57	5.65	5.56	5.71	5.30	5.23	5.54
Hierarchical Mean N=191	5.37	5.60	5.47	5.49	5.54	5.25	5.11	5.41
Chi-Square	18.99	4.9702	3.8576	0.5433	3.4800	0.5751	7.0570	4.3528
Pr>Chi-Square	**<.0001***	.0833	.1453	.7621	.1755	.7501	**.0293***	.1134

Thus, only the innovator and facilitator role enactments vary by leadership condition when considering all leaders regardless of leader type (subteam or team leader). In both cases the role enactment is more salient to members in the Hierarchical and Decentralized conditions than in the Centralized condition. This may be the influence of a difference in saliency for team leader role enactments. In fact, as will be discussed next, that is the case. The team leaders either do not enact the innovator and facilitator roles as much in the Centralized condition or it is not apparent to the members if they do enact them. The innovator encourages change and the facilitator encourages the expression of ideas and reaching compromise (Denison et al., 1995). It may be that those activities require an affective proximity to members that is difficult for team leaders to reach.

It is of interest to examine subteam leaders and team leaders separately when considering the question of whether or not leadership configuration affects leader role enactment. Table 11.10 below shows the results of Kruskal-Wallis tests of responses regarding team leaders.

Table 11.10 Results of Nonparametric Tests: Does Leadership Condition Affect Team Leader Role Enactment?

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Centralized Mean N=59	4.41	5.03	5.05	5.22	5.18	5.00	4.55	4.92
Hierarchical Mean N=91	5.49	5.77	5.69	5.61	5.57	5.40	5.29	5.47
Chi-Square	17.2576	6.5337	2.6894	0.3750	0.4104	1.2877	5.9746	2.0539
Pr > Chi-Square	**<.0001***	**.0106***	.1010	.5403	.5218	.2565	**.0145***	.1518

Only for the innovator, broker and facilitator roles is there a difference in saliency of enactment of team leader roles by condition. In each case the Hierarchical team leader is perceived more to have enacted the roles. Interestingly, if one looks at the placement of the innovator, broker, and facilitator roles in the Competing Values Framework Model (Quinn, 1988), one sees that all three roles are in the flexibility hemisphere of the circumplex. The only other role in that hemisphere is the mentor role. It is possible that when team leaders have subteam leaders to cope with the day to day logistics and task management, they are freer enact the roles situated in the flexibility hemisphere.

Table 11.11 below shows the results of similar testing with regard to subteam leader role enactments. The results are insignificant for all role enactments. That is, there is no support for the hypothesis that leadership configuration affects subteam leader role enactments.

Table 11.11 Results of Nonparametric Tests: Does Leadership Configuration Affect Subteam Leader Role Enactment?

	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Decentralized Mean N=198	5.37	5.57	5.65	5.56	5.71	5.30	5.23	5.54
Hierarchical Mean N=100	5.25	5.44	5.27	5.38	5.50	5.11	4.96	5.36
Chi-Square	0.0132	0.0667	0.0298	0.0033	.1005	0.2371	1.0048	0.1001
Pr > Chi-Square	.9084	.7962	.8628	.9543	.7512	.6263	.3161	.7517

11.4.2 Hypothesis 4d: Distance faultlines between subteams will affect the level of saliency of leadership role enactments to team members either positively or negatively..

It is of interest to examine first whether distance affects leader role enactment without regard to whether the leader is a subteam or team leader. Below, in Table 11.12, are the results of correlations of distance with all leaders' role enactments without regard to whether the leader is a team or subteam leader.

Table 11.12 Correlations of Distance with (All) Leader Role Enactments

N=448	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Time	.0957	.0286	.0849	.0249	.0495	**.0999**	**.0952**	.0326
Distance	.0430	.5454	.0726	.5992	.2961	**.0346***	**.0441***	.4913

The correlations of Time Distance with the monitor and facilitator roles are both positive and significant. Interestingly, when correlations were done in the Study 2 analysis of distance versus all leaders' roles, temporal distance did not have significant effect on leader role enactments in Study 2. The addition of the data from US-NL teams of Study 1 changed the results. It may be that the relationship between distance and leader role enactment may be more complex than a simple correlation would suggest.

The results of correlations (Spearman's r) of each role enacted by team leaders with each dimension of distance (cultural and temporal) are shown below in Table 11.13.

Table 11.13 Correlations of Distance with Team Leader Role Enactments

N=150	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Time	.1526	.0343	.0511	-.0099	.0042	.1026	**.1755**	.0545
Distance	.0623	.6772	.5346	.9047	.9592	.2117	**.0317***	.5074

As was the case with the analysis of Study 2 alone, by and large temporal distance did not have an effect on the saliency of role enactment by team leaders. Time Distance was positively and significantly associated with the facilitator role. It may be that time distances compel team leaders to spend more time enacting the facilitator role behaviors thus causing them to be more salient to the team members. For example, if there is conflict because of the distance, an effective leader will encourage communication and compromise which are facilitator role behaviors. It is interesting to note that when Study 2 was analyzed alone the correlations were all insignificant. Again, somehow the dynamics of the USA-NL teams may have been different enough to make the results for the combined study different. Future research with teams of a variety of configurations may tease out the factors that cause distance to have effects, negative or positive, on leader role enactment.

One might expect that distance would not have an effect, positive or negative, on subteam leader role enactments because those leaders are focused primarily on their own, collocated subteams. But, recall that in order to produce the joint team deliverable, the subteam leaders in the Decentralized condition must interact across distance with their remote subteam counterpart and in the Hierarchical condition the subteam leader will interact at least with the team leader who may or may not be collocated with him or her.

Thus, one might expect that for task related behaviors, distance may have an effect on subteam leaders. However, as seen in Table 11.14 below, temporal distance was not significantly correlated with any of the subteam leader roles.

Table 11.14 Correlations of Distance with Subteam Leader Role Enactments

N=298	Innovator	Broker	Producer	Director	Coordinator	Monitor	Facilitator	Mentor
Time	.0397	.0161	.1099	.0468	.0757	.0993	.0286	.0063
Distance	.4943	.7816	.0582	.4213	.1925	.0872	.6235	.9138

11.5 Assessing the Model Using Partial Least Squares (PLS)

It is of interest to test the model using multivariate techniques and arrive at a parsimonious model that has only significant paths. Because there are so many constructs it would be difficult to interpret a model built from all the constructs. Therefore, PLS models were created with respect to team leaders and also with respect to subteam leaders. The program SmartPLS (Ringle et al., 2005)was used. PLS was chosen because it is not sensitive to the distribution of the variables (Chin, 1998). In each case (with regard to team leaders and with regard to subteam leaders), a first model was developed with paths of partially or fully supported hypotheses tested in Studies 1 and/ or Study 2. This initial model was tested for validity and reliability and pruned as needed to create a valid and reliable model. This was done iteratively until reliability and validity were achieved. Then the PLS results were examined for path significance. Insignificant paths were dropped and PLS was run on the resultant pruned model. Each model was examined for reliability and validity. This process was repeated until a valid and reliable model for which all paths were significant was developed. This model, a parsimonious model, was the end result of the process thus described. In the sections describing the models with respect to team leaders and subteam leaders, shown are figures of the PLS

model with beta weights for the final parsimonious model, a table of reliability testing results for the parsimonious model, and a table of the results of running PLS and bootstrapping on the final parsimonious model. Tables of the results of running PLS and bootstrapping on intermediate valid and reliable models are shown in Appendices G and H. Because of space restrictions, abbreviations are used to label the constructs in the figures of the final parsimonious models. Below in Table 11.15 is a chart of the definitions of the abbreviations used.

Table 11.15 Definitions of Abbreviations Used in PLS Model

Abbreviation	**Definition**
EPTM	Early Personal Trust for "my"" subteam
EPTO	Early Personal Trust for the "other subteam
ETB	Early trust for the "other" subteam (between subteams)
ETW	Early trust for "my" subteam (within subteam)
LDRSHP	Leadership configuration
LTPTM	Longer term Personal Trust for "my" subteam
LTPTO	Longer term Personal trust for the "other" subteam
LTTB	Longer term trust for the "other" subteam (between subteams)
LTTW	Longer term trust for "my" subteam (within subteam)
MedB	Media used between subteams
MedW	Media used within a subteam
PSP	Perceived subteam performance
PTP	Perceived team performance
SatMSub	Satisfaction with "my" subteam
SatOSub	Satisfaction with the "other" subteam
SatSL	Satisfaction with a subteam leader
SatTL	Satisfaction with a team leader
SLE	Perceived subteam leader effectiveness
TLE	Perceived team leader effectiveness
SLR	Subteam leader roles
TLR	Team leader roles
TIME	Temporal distance

Below the process of evaluating a model for validity and reliability is described. Then, the following two sections (11.6 and 11.7) discuss the results of examining models with respect to team leaders and models with respect to subteam leaders.

11.5.1 Evaluation of the Measurement Model

Each model tested was examined for validity and reliability. PLS performs confirmatory factor analysis (CFA) when run and the results were examined for reliability, convergent validity, and discriminant validity. For reliability the average variance explained (AVE), composite reliability, and Cronbach's alpha were examined. Reliable constructs have AVE which is greater than .5 (Chin, 1998), Composite Reliability that is greater than .7 (Agarwal and Karahanna, 2000), and Cronbach's alpha greater than .7 (Jiang and Benbasat, 2007). However, Cronbach's alpha is sensitive to the number of items measuring a construct. In cases where there are a small number of constructs, composite reliability is a better indicator of internal consistency (Ocker et al., 2009).

For convergent validity the AVE should be greater than .5 and the outer loadings (item loadings) reported by PLS should be greater than .707 (Henderson III, 2007). Discriminant validity is evidenced by (1) that the indicators load more strongly on their own constructs than any other constructs in the model, (2) that the square root of AVE is greater than .7 and, for each construct, is larger than its correlation with any other construct, and (3) the correlations of constructs should be less than .9 indicating the distinctness of each construct (Henderson III, 2007, Agarwal and Karahanna, 2000).

11.5.2 Evaluating the Structural Model

The PLS algorithm results in beta weights for each path of the model. The beta weights are the standard beta weights of a regression analysis (Kanawattanachai and Yoo, 2007). By using the Bootstrapping method, one can obtain a t-value for each path which will indicate which ones are significant (Chin, 1998). In the case of the combined semesters

data set for this dissertation, significance at the .05 level is achieved if the t-value is greater than 1.648 (Rosenthal and Rosnow, 1984).

11.5.3 Redefinition of Constructs

Because there are so many constructs used in the hypotheses and models, a model using them all would be unintelligible. Therefore, it was decided to combine some related constructs into "super constructs" so as to reduce the number of constructs in the PLS models. While this technique reduces the number of constructs in the PLS model, it also can result in losing some details.

The eight leader roles were subsumed by a new construct, team leader roles (TLR) (subteam leader roles (SLR)). The indicators (one per role) for the new constructs TLR and SLR are the mean of the items that measure each role. The average of the media used most frequently (the PDT System, email, instant message, and f2f for use with a subteam; PDT System, email, and instant message) are used as indicators for Media Use Within (MedW) and Media Use Between (MedB)

Four new constructs were defined for trust: Early trust for "my" subteam (ETW), early trust for the "other" subteam (ETB), longer term trust for "my" subteam (LTTW), and longer term trust for the "other" subteam (LTTB). For each new construct, the mean of the items that define the types of trust are used as indicators. So, for example, ETB has as indicators the average of early Personal Trust for the "other" subteam, average of early Process Trust for the "other" subteam, and the average of early Expertise Trust for the "other" subteam. The new constructs for leader roles and trust are formative constructs. All others are reflective.

11.6 Assessing the Model With Respect to Team Leaders Using PLS

The first model tested was one that had as paths the significant or partially significant hypotheses paths from the bivariate analysis of Study 1 and/or Study 2. This model, TmLDR_ModelV1, was first examined for reliability and validity. Although reliability was achieved, convergent validity and discriminant validity were not achieved. For convergent validity, one requirement is that the outer loadings be greater than .7. This was not realized for early Expertise Trust for "my" subteam, early Process Trust for both "my" and the "other" subteam, or longer term Process Trust for both "my" subteam and for the "other" subteam. Discriminant validity tests had the issue of early Expertise Trust for "my" subteam loading higher on ETB than on its own construct of ETW. Therefore, Expertise Trust and Process Trust were dropped from the model and the resultant model, TmLDR_ModelV2 was tested.

For model TmLDR_ModelV2, because only Personal Trust was being measured, the constructs for trust were replaced by reflective constructs EPTM, EPTO, LTPTM, and LTPTO, each of which had as indicator the mean of the items measuring personal trust for that type of trust. Model TmLDR_ModelV2 was valid and reliabile. Therefore the beta weights and t-scores obtained from running PLS and bootstrapping were examined. However, not all paths were significant. See Appendix G for the results of running PLS and bootstrapping on model TmLDR_ModelV2. Therefore, all insignificant paths were removed from model TmLDR_ModelV2 to create model TmLDR_ModelV3 which was then tested.

Reliability and validity were achieved for model TmLDR_ModelV3 and all paths were significant. Below in Table 11.16 is a table showing the results of testing for

reliability of all multi-item reflective constructs. Note that the measures of reliability are not appropriate for formative constructs such as TLR (Team Leader Roles) (Chin, 1998). However, for the multi-item reflective constructs, all AVE scores are greater than .7, all composite reliabilities are greater than .9, and all Cronbach's alpha measures are greater than .9. Thus reliability is achieved.

Table 11.16 Reliability of the Final (V4) PLS Model With Respect to Team Leaders

	AVE	Composite Reliability	Cronbach's Alpha
PSP	.7154	.9377	.9203
PTP	.7199	.939	.9222
SatMSub	.9242	.9734	.959
SatOSub	.9611	.9867	.9798
SatTL	.9094	.9678	.9502

All results of tests for validity, as described above in section 11.5.1, were adequate. Therefore, model TmLDR_ModelV3 is the parmismonious model sought. Below is a diagram of the model, with R^2 and beta weights, as well as a table with the results listed by hypotheses.

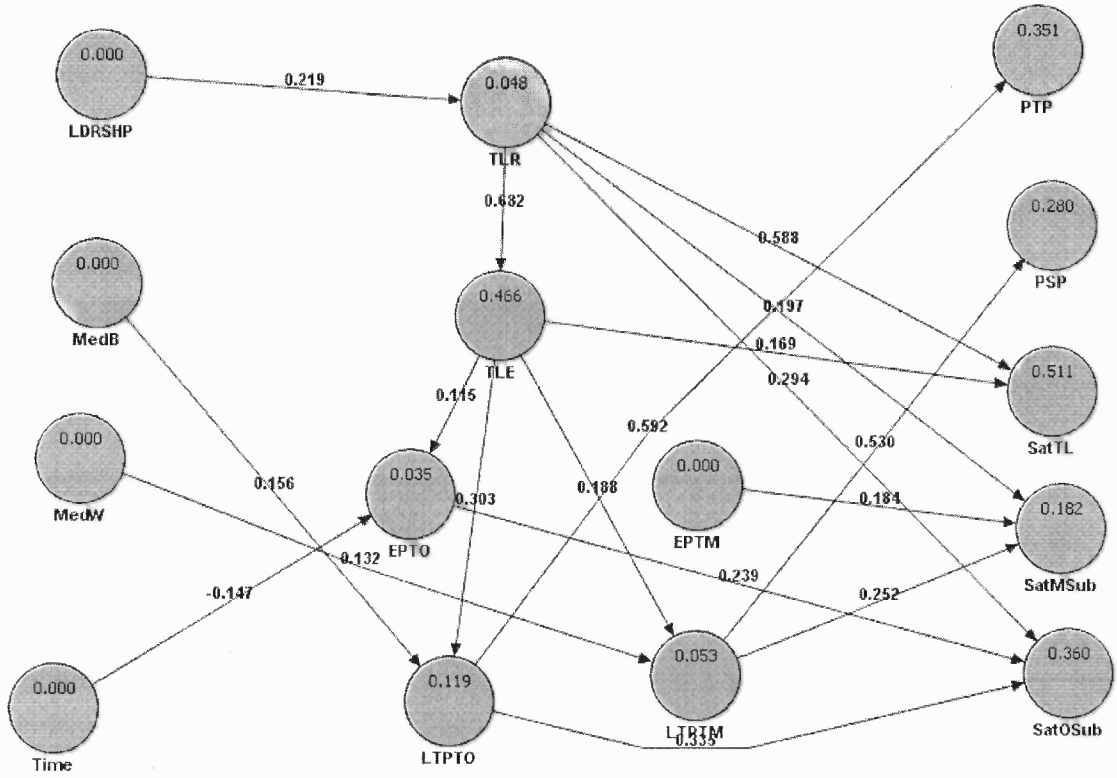

Figure 11.1 Parsimonious model with respect to team leaders.

Table 11.17 Results of Testing Parsimonious Model With Respect to Team Leaders

Hypothesis	Path From	Path To	Model V3	
			Beta Weights	t-value t>1.648 => p<.05
1b	LDRSHP	TLR	.2194	**3.5141**
1f	TLR	TLE	.6825	**12.2278**
1g	TLR	SatTL	.5885	**7.1452**
1h	TLR	SatMSub	.1967	**2.4315**
	TLR	SatOSub	.2939	**4.4401**
2b	LTPTM	PSP	.5296	**13.7105**
2c	LTPTO	PTP	.5924	**17.3004**
2g	EPTM	SatMSub	.1839	**2.9069**
	LTPTM	SatMSub	.2521	**5.0722**
2h	ETPO	SatOSub	.2393	**4.3935**
	LTPTO	SatOSub	.3351	**6.4809**
3c	TLE	LTPTM	.188	**3.7543**
	TLE	EPTO	.1149	**2.1659**
	TLE	LTPTO	.303	**5.6639**
3f	TLE	SatTL	.1693	**2.2098**
4a	TIME	EPTO	-.1466	**2.2483**
7d	MedW	LTPTM	.1322	**2.6435**
	MedB	LTPTO	.156	**3.1751**

The strongest relationships were from team leader roles to team effectiveness (B=.6825), from longer term Personal Trust for the local subteam to perceived subteam performance (B=.5296), and from longer Personal Trust for the remote subteam to perceived team performance (B=.5924). Also strong were the paths from team leader roles to satisfaction with a team leader (B=.5885), longer term personal trust for the local subteam to satisfaction with the local subteam (B=.2521), and longer term Personal Trust for the remote subteam to satisfaction for the remote subteam B=(.3351). The other paths in the final parsimonious model were also significant, however, not as strongly as the paths described above.

That trust influences perceptions of subteam and team performance is consistent with the literature (Wakefield et al., 2008) and suggests that building trust is critical for members to feel positively about their team and subteam performance. Leadership is shown to affect team leader role enactments and temporal distance is shown to affect early trust but not longer term trust. It may be that over time the participants gained experience and devised procedures to overcome the deleterious effects of temporal distance.

Thus, the results indicate that team leader role enactments are important for perceptions of team leader effectiveness and satisfaction with both a group and the team leader. This is an important finding as it can guide team leaders to behave in ways that can promote positive affect in their team members. Similarly, Personal Trust is important for perceptions of group performance and for satisfaction. Developing personal trust is therefore important for team leaders to do. It is interesting that media used both between and within subteams is only significantly associated with longer term trust, not early

trust. It may be that time to adjust to the media used is required before it can have a positive effect on trust.

11.7 Assessing the Model With Respect to Subteam Leaders Using PLS

The first subteam leader focused model tested was one that had as paths the significant or partially significant hypotheses from the bivariate analyses of Study 1 and/or Study 2. This model, SLDR_ModelV1, was examined first for reliability and validity by running the PLS program. Reliability was adequate with all AVE's greater than .7, all composite reliability scores over .9, and all Cronbach's alpha over .9. However, the outer loadings were under .7 for early Expertise Trust for the local subteam and all Process Trust thus failing to achieve convergent validity. Additionally, early Expertise Trust for the local subteam and longer term Process Trust for the remote team loader more strongly on constructs to which they do not belong, thus failing to achieve discriminant validity.

Therefore, in an attempt to achieve a valid model, Expertise Trust and Process Trust were dropped and only Personal Trust was used. The new superconstructs for Personal Trust were the reflective constructs of LTPTM, LTPTO, EPTM, and EPTO. This new model, SLDR_Model V2, was then tested with PLS.

Reliability, convergent validity, and discriminant validity were achieved for SLDR_Model V2 and so the model's paths were examined for significance by analyzing the t-scores obtained by running the bootstrap program. Appendix H shows the results of this analysis. Not all paths wre significant. The insignificant paths were removed and the resulting model, SLDR_ModelV3 was tested.

Results of tests for reliability and validity were all adequate and all paths were significant. Therefore, SLDR_ModelV3 is the parsimonious model sought. Below in Table 11.18 are the results of testing for reliability of all multi-item reflective constructs. All AVE scores were over .7, and all composite reliability measures and Cronbach's alphas were over .9. Thus, reliability has been achieved.

Table 11.18 Reliability of the Final (V5) PLS Model With Respect to Subteam Leaders

	AVE	Composite Reliability	Cronbach's Alpha
PSP	.7155	.9378	.9203
PTP	.72	.9391	.9222
SatMSub	.9242	.9734	.959
SatOSub	.9611	.9867	.9798
SatSL	.874	.9541	.9279

The results of tests of discriminant and convergent validity, as described in section 11.5.1, were all adequate and so model SLDR_ModelV3 is bothr reliable and valid. Below is a diagram of the model, with R^2 and beta weights, as well as a table with the results of running PLS and bootstrapping listed by hypotheses.

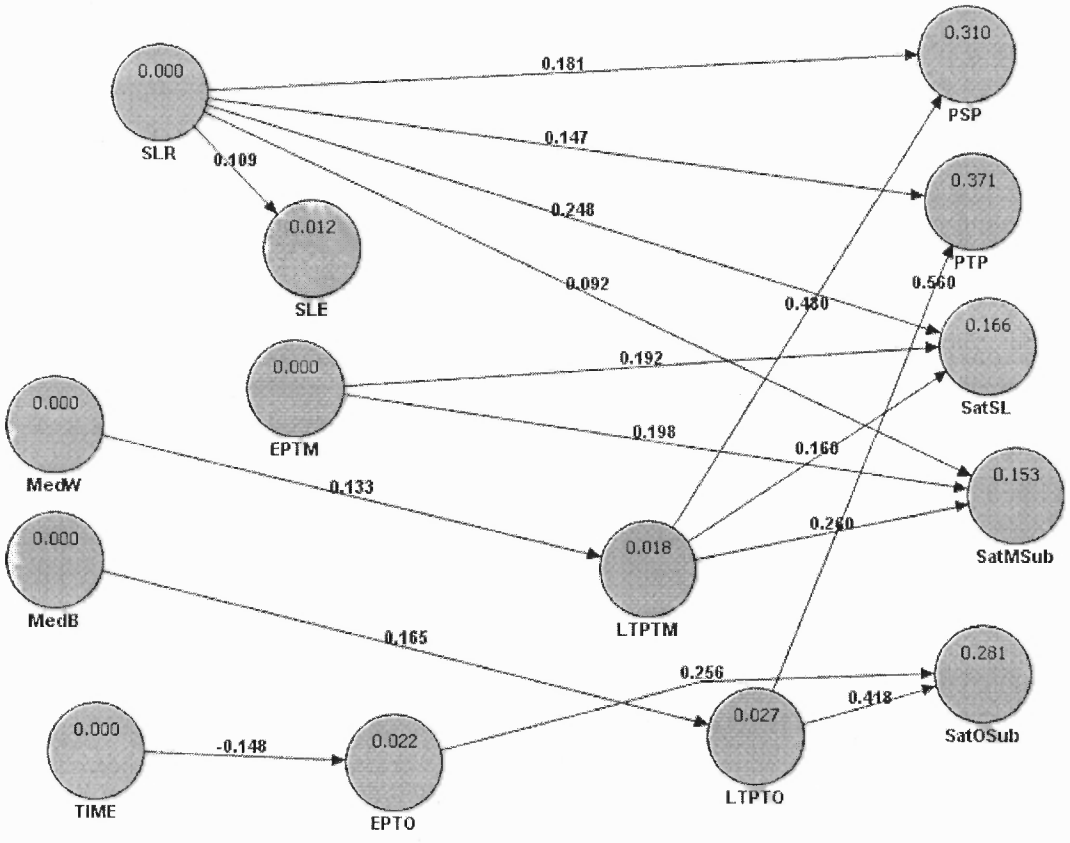

Figure 11.2 Parsimonious model with respect to subteam leaders.

Table 11.19 Results of Testing Parsimonious Model With Respect to Subteam Leaders

Hypothesis	Path From	Path To	Model V3	
			Beta Weights	t-value t>1.648 => p<.05
1e	SLR	PSP	.1815	**3.9237**
	SLR	PTP	.1474	**3.3213**
1f	SLR	SLE	.1086	**1.9448**
1g	SLR	SatSL	.2484	**2.9899**
1h	SLR	SatMSub	.0924	**1.6993**
2b	LTPTM	PSP	.4799	**10.3307**
2c	LTPTO	PTP	.5605	**15.4033**
2e	EPTM	SatSL	.1917	**2.9623**
	LTPTM	SatSL	.1603	**2.7304**
2g	EPTM	SatMSub	.1977	**3.0552**
	LTPTM	SatMSub	.2597	**4.5833**
2h	EPTO	SatOSub	.256	**4.5174**
	LTPTO	SatOSub	.4175	**8.242**
4a	TIME	EPTO	-.1481	**2.193**
7d	MedW	LTPTM	.1332	**2.5245**
	MedB	LTPTO	.1647	**3.0925**

As with the model with respect to team leaders, temporal distance is shown to negatively affect early Personal Trust for the remote subteam members. Again, that longer term trust does not appear to be affected by temporal distance suggests that the participants learned to adjust to the time difference. It is plausible that the training modules with the contract assisted them in coping with the impediments temporal distance can cause.

Leadership configuration (LDRSHP) was included in the parsimonious model with respect to team leaders but not in the model with respect to subteam leaders. That is, the paths from leadership configuration that were significant in the bivariate relationship were not significant in the parsimonious model with respect to subteam leaders. This is an interesting result that should be examined in future studies.

Consistent with the results of the parsimonious model with respect to team leaders, the path in the model with respect to subteam leaders from longer term trust for the "other" subteam to perceived team performance was highly significant (B=.5605) and the path from longer term trust for the local subteam to perceived subteam performance (B=.4799), thus giving further evidence of the importance of developing trust. Also highly significant in the parsimonious model with respect to subteam leaders is the path from longer term Personal Trust for the remote subteam to satisfaction with the other subteam (B=.4175). The other paths are also significant, but not as markedly so.

The results of the PLS and bootstrap tests suggest that the enactment of subteam leader roles is important for perceived team and subteam performance and important for satisfaction with a subteam leader. Thus, it is important that leaders make their

leadership behaviors salient to their members. As subteam leaders are collocated with their charges, they are able to do so without the impediments that distance might bring.

It is also noteworthy that the results suggest strongly that trust is important for perceptions of group performance and for satisfaction with both the subteam leader and with the subgroups. Thus, it is imperative that trust be fostered through such actions as keeping communications flowing.

11.8 Conclusion

The examination of PLS models with respect to subteam leaders and with respect to team leaders found somewhat different results for each. This has implications for management and leadership. That is, one cannot assume that what works for subteam leaders will also work for team leaders and vice versa.

Finally, it should be noted that subteams met face-to-face in their classes. A number of them were observed by the researchers who found that, in general, the students were enthusiastic and highly motivated to work on the PDT project. That may have been in part because the final deliverable counted for a significant part of their class grades. But, the students were observed to be even more motivated than one would expect to result from that incentive. For example, a number of the team web pages were extraordinary and went far beyond what was expected. Thus, the PDT studies were enlightening to the researchers and enjoyed by the participants.

CHAPTER 12

SUMMARY AND DISCUSSION

12.1 Introduction

Partially distributed teams are a common form of team and yet research focusing specifically on them is scant. Often when they are studied, they are studied along with fully virtual teams. Yet, because they have collocated members in subteams, there may be differences between PDTs and fully virtual teams. This research is intended to add to the nascent yet growing body of work devoted to understanding PDTs. Included in the extant research on PDTs are studies of training (Ocker et al., 2009), leader delegation (Zhang, 2008), and temporal perception (Egan, 2008). This dissertation research focuses on leadership and the effects of distance and leadership configuration on outcomes of performance and satisfaction through the intermediary processes of technology use, leader roles, leader effectiveness and trust.

A model was proposed along with eight research questions, five of which had hypotheses that test the model. The three research questions, described below, that were not included in the model were exploratory. There was a pilot study and two full scale studies over two semesters. Study 1 varied leadership configuration but not distance, and Study 2 varied both leadership configuration and distance. Each study was of four-week duration with student subjects preparing a proposal for an emergency management information system. Bivariate analysis was conducted on the data separately for each of Study 1 and Study 2. Then multivariate analysis, using Partial Least Squares (PLS), was performed on the combined Study 1 and Study 2 data set

In Study 1 although leadership configuration was varied, many of the teams chose leaders that put them in the Decentralized condition no matter what their assigned condition was. This, discussed in Chapter 8, resulted in an imbalance of leadership configurations. Distance was not varied in Study 1 but was varied in Study 2. The intention was to measure distance as cultural, using Hofstede's cultural dimensions (Hofstede, 2001), and temporal. However, preliminary analysis showed that the dimensions of cultural distance had high collinearity and so cultural distance was dropped from the analysis and only temporal distance is measured. Temporal distance is measured as the absolute value of the time zone difference for the two subteams in a team.

PLS was performed on models with respect to subteam leaders and with respect to team leaders on the combined semester data set. Because of the large number of variables and paths, redefinitions of some constructs were made. See Chapter 11 for a description and definitions of these "superconstructs." The initial PLS models had paths that reflected hypotheses that were supported or partially supported in Study 1 and/or Study 2. Pruning of the models was done until a valid and reliable model was derived that had all paths significant. These parsimonious models were derived with respect to team leaders and with respect to subteam leaders.

Analysis of the trust measures suggested that trust is not a unidimensional construct and that early trust (measured at the end of week 1) is different than longer term trust (measured at the end of 4 weeks). For early trust the dimensions are Expertise Trust, Personal Trust, and Process Trust. For longer term trust, the dimensions are

Personal Trust and Process Trust. The items measuring early Expertise Trust load on Personal Trust for longer term trust indicating that trust changes over time.

To summarize the findings, in this chapter each research question is restated and the results of the tests of it are discussed. Also discussed are qualitative results of analyzing the Personal Reflections in Study 1 as they relate to the quantitative findings. In the tables presenting the results, "N/A" indicates that the hypothesis was not tested for that analysis. Then the model is shown with supported or partially supported paths highlighted. Finally, concluding remarks are made and implications discussed.

12.2 Summary of Findings

12.2.1 Summary of Results for Research Question 1

Research Question 1 asks, "What do leaders in PDTs do and how does leadership configuration affect what leaders do?

Below in Table 12.1 is a summary of the results of hypotheses testing for hypotheses related to Research Question 1.

Table 12.1 Summary of RQ1 Results

HYPOTHESIS	STUDY 1	STUDY 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
1a: Leadership roles as identified by Quinn (1988) are enacted by leaders in PDTs.	Supported	Supported	N/A	N/A
1b: Leadership configuration will influence role enactment	Partially supported	Not supported	Supported	N/A
1c: Emergent subteam leadership is more likely to occur in subteams for which there are no designated subteam leaders (Centralized) than in other leadership configurations (Decentralized, Hierarchical)	N/A	Not supported	N/A	N/A

Table 12.1 Summary of RQ1 Results continued

HYPOTHESIS	STUDY 1	STUDY 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
1d: Emergent team leadership is more likely to occur in teams for which there is no designated team leader (Decentralized) than in other leadership configurations (Centralized, Hierarchical)	N/A	Not supported	N/A	N/A
1e: Role enactment of leader behaviors will be positively associated with perceived team and subteam performance and objective performance	Supported for perceived performance; Not supported for objective performance	Supported for perceived performance; Not supported for objective performance	N/A	Supported
1f: Role enactment will be associated with perceived leader effectiveness	Supported	Supported	Supported	Supported
1g: Leader role enactments will be associated with satisfaction with a leader such that subteam leader role enactments will have stronger (positive or negative) associations with satisfaction with a leader than will team leader role enactments	N/A	Partially supported	Supported	Supported
1h: Leader role enactment will be positively associated with satisfaction with a group such that subteam leader role enactment will be associated with satisfaction with the collocated ("my") subteam and team leader role enactment will be positively associated with satisfaction with both the collocated and the distant ("other") subteam in the team	N/A	Supported	Supported	Supported

Both the quantitative and qualitative analyses found that the leader roles enacted by Quinn (1988) are also enacted by leaders in PDTs. The leader roles are positively and significantly associated with perceived leader effectiveness and satisfaction.. This, then, can guide leaders in PDTs as to behaviors (i.e., roles) they can enact that will have positive effects on their members' perceptions of the leader. Since, as described below, perceptions of leader effectiveness are associated with trust and perceptions of

performance, being aware of the leadership roles can help the leaders influence members' perceptions of outcomes. However, it is noteworthy that role enactments are positively associated with perceived performance but not with objective performance. The objective performance measures in both Study 1 and Study 2 (grades on the final deliverable) were mostly A's and B's which may have impacted the results. Table 12.2 below shows the distribution of grades for the final proposal. As can be seen, in Study 1 65% of the grades were A or B while in Study 2, 95% of the grades were A or B. Also, as discussed in Chapter 5, objective performance measures a product while perceived performance measures perceptions of process. This may also contribute to the difference in the results.

Table 12.2 Grade Distribution

Range	Grade	Study 1	Study 2
90-100	A	13	10
80-89	B	11	10
70-79	C	6	0
60-69	D	5	1
<60	F	2	0

12.2.2 Summary of Results for Research Question 2

Research Question 2 asks, "Does leadership configuration have an impact on the development of swift trust and longer term trust in PDTs and what are the effects of trust?

Below in Table 12.3 is a summary of the results of hypotheses testing for hypotheses related to Research Question 2.

Table 12.3 Summary of RQ2 Results

HYPOTHESIS	STUDY 1	STUDY 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
2a: Leadership configuration will impact trust such that teams with distributed leadership will develop higher levels of initial trust and longer lasting trust than teams with centralized leadership.	Not supported	Not Supported	N/A	N/A
2b: Trust within a subteam will be positively associated with perceptions of subteam performance.	Supported	Partially supported for early trust; Supported for longer term trust.	Supported for longer term Personal Trust	Supported for longer term Personal trust
2c: Trust between subteams will be positively associated with perceptions of team performance.	Supported	Partially supported for early trust; Supported for longer term trust	Supported for longer term Personal Trust	Supported for longer term Personal trust
2d: Trust will be associated with objective performance.	Not Supported	Partially supported	N/A	N/A
2e: Trust for members of a subteam will be associated with satisfaction with a subteam leader.	N/A	Supported	N/A	Supported
2f: Trust between subteams will be associated with satisfaction with a team leader.	N/A	Partially supported for early trust; Supported for longer term trust.	N/A	N/A
2g: Trust for members of a subteam will be positively associated with satisfaction with the collocated ("my") subteam.	N/A	Partially supported for early trust; Supported for longer term trust	Supported for Personal Trust	Supported for Personal Trust
2h: Trust between subteams will be positively associated with satisfaction with the remote ('other") subteam.	N/A	Partially supported for early trust; Supported for longer term trust	Supported for Personal Trust	Supported for Personal Trust

Leadership configuration was not shown to influence either early trust or longer term trust in either study. However, longer term trust was positively and significantly associated with perceptions of performance. The relationship of perceptions of performance and early trust was partially supported. This suggests that developing interpersonal relationships, especially in the early life of a team, is crucial to developing positive affect towards the team and subteam. However, we cannot know for certain the direction of the relationship. That is, we do not know in fact that trust is a cause of perceived group performance and satisfaction. It is possible that perceptions that the group is performing well increases trust. More longitudinal data would be required to tease out the direction of the associations.

It is interesting to note that for most of the hypotheses related to RQ2, support was found for the relationship of longer term trust with the variable in question, while only partial support was found for early trust. This adds to the evidence that early and longer term trust are different and suggests that trust, in the teams examined, grew over time.

12.2.3 Summary of Results for Research Question 3

Research Question 3 asks, "Does leadership configuration have an impact on perceived leadership effectiveness in PDTs and what are the effects of leadership effectiveness?

Below in Table 12.4 is a summary of the results of quantitative tests of the hypotheses related to Research Question 3.

Table12.4 Summary of RQ3 Results

HYPOTHESIS	STUDY 1	STUDY 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
3a: Leadership configuration influences perceptions of leader effectiveness such that perceptions of leader effectiveness will be higher for subteam leaders than for team leaders.	Not Supported	Not supported	N/A	N/A
3b: Perceived leader effectiveness will be positively associated with team and subteam performance.	Supported for perceived team and subteam performance; Not supported for objective performance	Supported for perceived team performance; Not supported for objective performance	N/A	N/A
3c: Effective team leadership will be more positively associated with team trust than with subteam trust.	Supported	Supported for longer term trust; Not supported for early trust	Supported for Personal Trust	N/A
3d: Effective subteam leadership will be more positively associated with subteam trust than with team trust.	Supported	Supported for longer term trust; Partially supported for early trust	N/A	N/A
3e: Effective subteam leadership will be more positively associated with both subteam and team trust than will effective team leadership.	Supported	Not Supported	N/A	N/A
3f: Effective leadership will be positively associated with satisfaction with the leader.	N/A	Supported	Supported	N/A
3g: Effective subteam leadership will be positively associated with satisfaction with the collocated ("my") subteam.	N/A	Supported	N/A	N/A
3h: Effective team leadership will be positively associated with satisfaction with both the collocated ("my") subteam and the remote ("other") subteam.	N/A	Supported	N/A	N/A

The results of the analyses of hypotheses related to RQ3suggests that perceptions of leader effectiveness are important to perceptions of performance and trust. Positive feelings for the leader and team/subteam can influence how members feel about their group's outcomes. It is important that distant leaders, then, create a telepresence so that their actions are salient to the team members. Whether the leader enacts the positive roles effectively, can influence how the members perceive themselves, their work, and their teammates. However, no support was found for leadership configuration influencing the perceptions of leader effectiveness.

12.2.4 Summary of Results for Research Question 4

Research Question 4 asks, "Does distance (cultural, temporal, and geographic) impact trust, leader role enactments, and/or perceived leader effectiveness?"

Unfortunately, as noted above, multicollinearity problems with the dimensions of cultural distance resulted in dropping cultural distance and only measuring temporal distance between subteams of a team. Because all of the teams were of east-west distance (as opposed to north-south) geographic distance need not be measured as the time zone difference captures it. Also, note that in Study 1 distance was held constant with all teams having a U.S. subteam and a subteam from the Netherlands.

Below in Table 12.5 are the results of testing the hypotheses related to Research Question 4:

Table 12.5 Summary of RQ4 Results

HYPOTHESIS	STUDY 1	STUDY 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
4a: The stronger the distance faultlines between subteams in PDTs, the lower the team trust.	N/A	Not supported for longer term trust; Supported for early trust	Supported for early Personal Trust for the "other" subteam	Supported for early Personal Trust for the "other" subteam
4b: The stronger the distance faultlines among subteams in PDTs, the lower the perceived leader effectiveness.	N/A	Not supported	N/A	N/A
4c: The stronger the distance faultlines between subteams, the more likely there will be emergent leaders who share leader roles with the designated leader(s).	N/A	Not supported	N/A	N/A
4d: Distance faultlines between subteams will affect the level of saliency of leadership role enactments to team members either positively or negatively.	N/A	Not supported	N/A	N/A

Results were mixed. The results find support for distance being negatively associated with early trust. That the more temporal distance the lower the trust which is not surprising as coordination problems and communication problems that can result from temporal distance can impede trust development. But as there was not a significant relationship between temporal distance and longer term trust, it is possible that the participants learned to overcome the issues of temporal distance.

12.2.5 Summary of Results for Research Question 5

Research Question 5 asks, "What are the effects of ineffective bad leadership in PDTs?"

The leader roles identified by Quinn (1988) are positive ones. That is, enacting them is with the intention of results that are positive for group and group members. It is

the positive focus of leader behaviors that is prevelant in the literature. Kellerman (2004), however, addresses the leader behaviors that are detrimental to team and members – that is, "bad" leadership. This dissertation research investigates what effects ineffective bad leadership in PDTs might have. For Study 1 Personal Reflections were coded for "bad" leadership. For Study 2, a scale was developed based on Kellerman's (2004) definition of ineffective bad leadership. This exploratory research is not included in the model. The literature provides no clues as to hypotheses that might be developed and so this dissertation investigated more specific research questions to attempt to answer Research Question 5. The results of the quantitative analysis of Study 2 are shown below in Table 12.6.

Table 12.6 Summary of RQ5 Results

Research Question	**Study 1**	**Study 2**	**Parsimonious Model WRT Team Leaders**	**Parsimonious Model WRT Subteam Leaders**
RQ5a: Is ineffective bad leadership salient in PDTs?	N/A	No evidence that ineffective bad leadership was a pervasive problem (mean 5.3 on a scale of 3 to 21)	N/A	N/A
RQ5b: Is there a relationship between ineffective bad leadership and emergent leadership?	N/A	Evidence that ineffective bad team leadership predicts the emergence of a team leader; No evidence for subteam leader	N/A	N/A
RQ5c: Is there an association between ineffective bad leadership and leader role enactments?	N/A	Negative and significant associations between ineffective bad leadership and leader role enactments	N/A	N/A
RQ5d: Is there a relationship between ineffective bad leadership and perceptions of leader effectiveness?	N/A	Strongly negative relationship between ineffective bad leadership and perceptions of leader effectiveness.	N/A	N/A

Table 12.6 Summary of RQ5 Results continued

Research Question	Study 1	Study 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
RQ5e: Is there a relationship between ineffective bad leadership and trust?	N/A	There is a negative and significant relationship for all types of trust except for early Expertise Trust for the "other" team and ineffective bad subteam leader which was negative but not significant.	N/A	N/A

Both the Study 1 qualitative analysis of the Personal Reflections and the quantitative analysis of Study 2 indicate that there were few instances of ineffective bad leadership in the PDTs studied. That is, ineffective bad leadership was not seen to be a pervasive problem. This may be because the subjects were students who were overseen by a classroom instructor. The quantitative Study 2 analysis results are as expected. Ineffective bad leadership is negatively associated with leader role enactments (positive behaviors), perceptions of leader effectiveness, and trust. Interestingly, while ineffective leadership is significantly related to emergence of a team leader, the association with sub team leader emergence is insignificant. However, inasmuchas there were so few instances of bad leadership, one should not draw conclusions from these results. It should be studied further in future research.

12.2.6 Summary of Results for Research Question 6

Research Question 6 asks, "Are there different patterns of enactment of leadership roles in different leadership structures?"

Examination of Hypothesis 1b (leadership configuration will influence role enactment) failed to find differences in role enactment in the analysis of Study 2 data but did find differences in the analysis of Study 1 data. For example, in the Study 1 analysis, team leader role enactments were generally more strongly associated with subteam performance than team performance in the Centralized condition but for the Hierarchical condition (the only other condition having team leaders), the association was stronger with team performance. It may be that when there is only a team leader (Centralized condition), the leader focuses on the subteams, but in the Hierarchical condition, there are also subteam leaders who can focus on the subteam while the team leader focuses on the team as a whole. However, it is difficult to compare across leadership configuration in Study 1 because the majority of the teams were in the Decentralized condition. Future studies may yield more clarity to the analysis of this research question.

12.2.7 Summary of Results for Research Question 7

Research Question 7 asks, "Is there an effect on communications media use by leadership configuration and/or distance and are there relationships between communications media used and trust and/or the communications media used and enactment of leader roles?"

There were, in the post survey for both Study 1 and Study 2, questions in which the participants rated their use of 14 communications media (including "other") both for use within the subteam and between subteams. For the qualitative analysis of Study 1 the Personal Reflections were coded for media used. In both the quantitative analysis and the

qualitative analysis of Study 1, email, instant messenger and the PDT System were the media most used by the subteams for both within and between subteam communications. For within subteam communications, face-to-face meetings were also frequently used. Therefore, in the PLS analysis, only those media were considered.

The results of quantitative analysis of the hypotheses related to Research Question 7 are shown below in Table 12.7.

Table 12.7 Summary of RQ7 Results

HYPOTHESIS	STUDY 1	STUDY 2	Parsimonious Model WRT Team Leaders	Parsimonious Model WRT Subteam Leaders
H7a: There is a relationship between leadership configuration and communications media used.	Partially Supported	Partially Supported	N/A	N/A
H7b: There is a relationship between distance and communications media used.	N/A	Partially Supported	N/A	N/A
H7c: There is a relationship between communications media used and enactment of leader roles.	Partially Supported	Partially Supported	N/A	N/A
H7d: There is a relationship between communications media used and trust.	Partially Supported	Partially Supported	Supported for longer term Personal Trust	Supported for longer term Personal trust

In the PLS models preceding the development of the parsimonious model, only the paths from media used to trust were supported. However, there is partial support for the separate bivariate analysis for the relationships between media used and enactment of leader roles. The bivariate analyses also suggest that leadership configuration and distance have an effect on the media used. It is difficult to tease out a final conclusion from these contrary results. However, it should be noted that because of the redefinition of some constructs in the PLS analysis (see Chapter 11), there may have been information lost that could have revealed other relationships with media used.

The top choices for communications technologies for both within subteam and between subteam communications were email, instant message (IM) and the PDT System. It is interesting that the respondents chose a combination of synchronous and asynchronous technologies to use. It is likely that when they needed immediate feedback they used synchronous media (e.g., instant message) and when they needed thoughtful response or to exchange documents they used asynchronous media (e.g., email). An example of this was given in the comment of a U.S. leader in Study 1 in a personal reflection when s/he recounted, "A few of my team members were slow to respond to the emails from the other subteam so the team from the Netherlands all IMed me about it....I told my team members they should get on (AIM) as much as possible..."

In fact, the personal reflections of Study 1 suggested that instant message was used for meetings and group collaboration. One member wrote, "..and already met with them for 2 hours through MSN." Thus, despite the obstacle of time zone difference, IM was used for meetings. "We have a meeting on MSN twice a week and we have experienced no problems." Instant message was used for between subteam communications most frequently in the Decentralized configuration. It is plausible that it served as a replacement for face-to-face interaction. When there is no team leader, as in the Decentralized configuration, there needs to be more between subteam communications. In the Hierarchical and Centralized configurations there is a team leader who can serve as a "bridge" between subteams and make sure that things get done.

Email was by far the most frequently used media choice for both between and within subteam communications. Although not the richest media (Daft and Lengel, 1986), it was perhaps the most natural (DeRosa et al., 2004) because of familiarity and

experience. That is, even though more advanced technologies were available (e.g., Skype is free), the subjects stuck to the ones they were most familiar with. The PDT System was new but they had training on it and were required to use it to post documents. This reliance on familiar media choices is an indication that comfort and familiarity is important for acceptance and usability.

The analyses suggest that given a suite of media choices, the teams will choose some of them (asynchronous and synchronous) to use and that not all teams will choose the same media. This choice may be influenced by distance and leadership configuration. It may also be affected by comfort and familiarity with the media. Effective media mixes, then will have familiar media choices (or training on the unfamiliar) and have a mix of both synchronous and asynchronous choices. Experience can improve the naturalness of a medium for a user (DeRosa et al., 2004) and so training is important for members unfamiliar with a medium. Finally, it is crucial that all members in all subteams have access to and equal comfort with the communication media choices for their team.

12.2.8 Summary of Results for Research Question 8

Research Question 8 asks, "Do teams with emergent leaders have greater or less satisfaction than those who retain their designated structure?"

Because satisfaction was not measured quantitatively in Study 1, this research question was only explored through the quantitative analysis of Study 2. However, both the qualitative analysis of Study 1 and the quantitative analysis of Study 2 suggest that there were few instances of emergent leadership. Nonetheless, for Study 2 data a nonparametric test (Kruskal-Wallis) was performed to examine this research question.

The results suggest that if a respondent reported emergent leadership, he or she had greater satisfaction for the "other" subteam. This is not surprising as when there is an emergent leader, it is reasonable to assume that the leader filled a void for effective team or subteam functioning. Yet, one must be cautious in drawing conclusions as there were so few emergent leaders.

12.3 The Model Revised

Below in Figure 12.1 is the research model with paths darkened when there is evidence in the analysis that supports or partially supports that path. Paths not supported by any of the analyses are dotted. Because there are so many hypotheses and paths, it would be incomprehensible to have the hypotheses numbered on the paths. The reader is referred to the tables above for identification of hypotheses with paths.

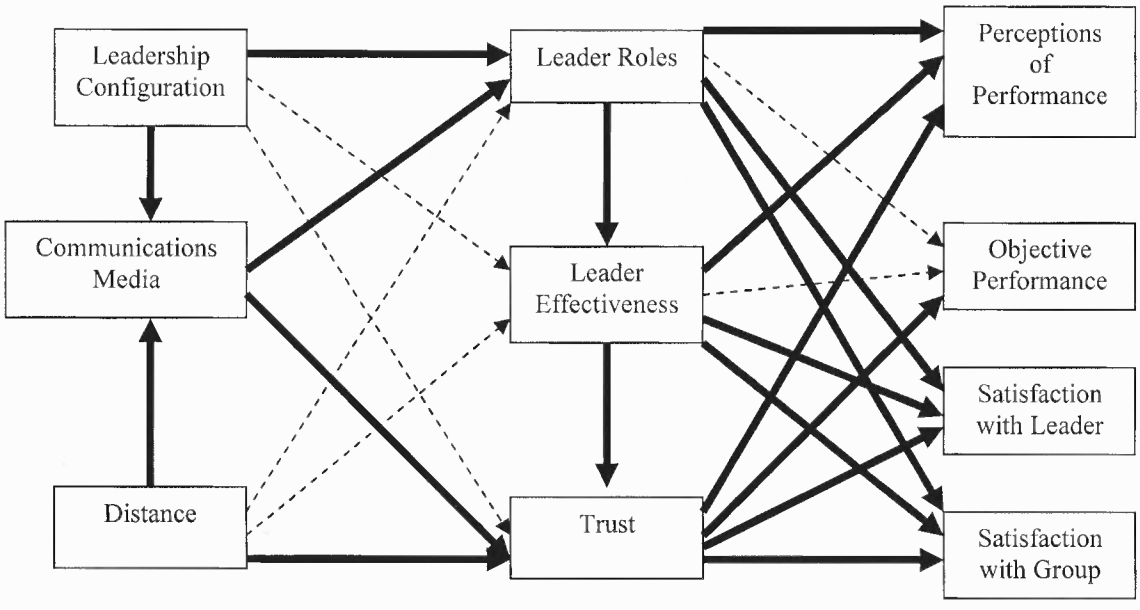

Figure 12.1 Revised research model.

It is interesting to look at the revised model with respect to within subteam focus and with respect to between subteam focus. Figure 12.2 below shows the revised research model with respect to within subteam activity and interaction while Figure 12.3 below shows the revised model with respect to between subteam activity and interaction. Note that the between subteam model has all of the paths supported that the general revised model (Figure 12.1) has. But, the within subteam model does not show any support for the associations of distance with trust, leadership configuration with leader role enactments, or trust with objective performance.

It is not surprising that distance does not affect within subteam trust as within the subteam, the members are collocated. The distance their remote subteam is from them need not impact the trust they have for each other within the collocated subteam. It is interesting that while it is suggested in the results that leadership configuration affects team leader role enactments, it does not affect subteam leader role enactments. It may be because whether or not there is a team leader (Hierarchical or Decentralized configuration), a subteam leader will focus on his or her subteam and therefore his or her leader behaviors will be salient to the members of the subteam. However, in the case of a team leader, if there is a subteam leader (Hierarchical condition) the subteam leader may act as a "buffer" thus occluding the team leader's role enactments from the perceptions of the members, while if there is no subteam leader to act as gate-keeper (Centralized configuration), the team leader focuses directly on the subteams and therefore his or her leader role enactments are salient to the members of the team.

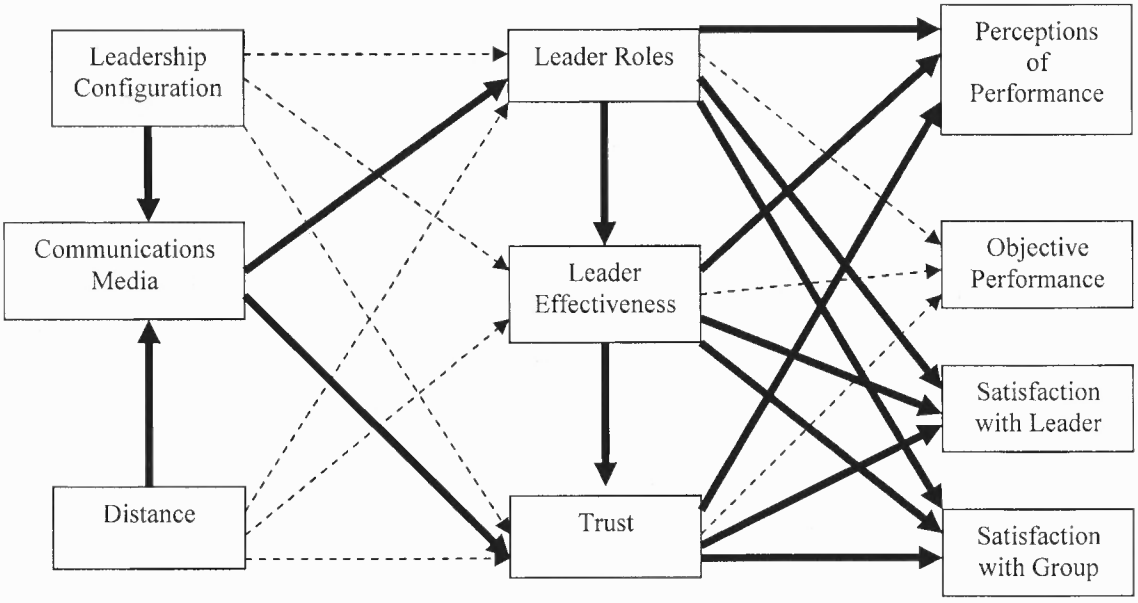

Figure 12.2 Revised research model with respect to within subteam interaction.

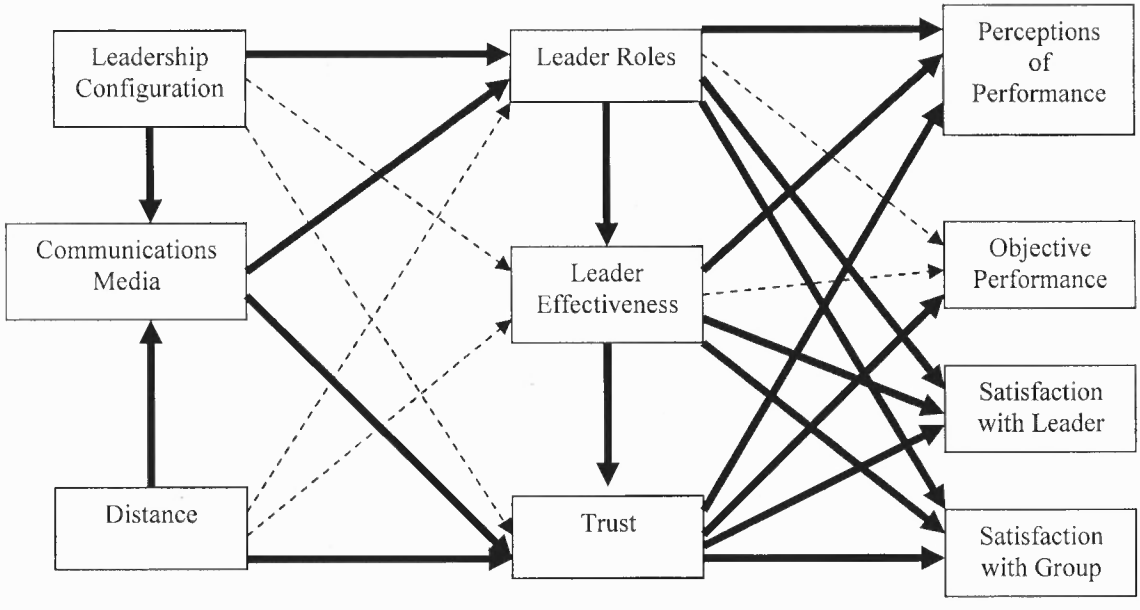

Figure 12.3 Revised research model with respect to between subteam interaction.

12.4 Concluding Remarks

PDTs are complex team structures. This research examined, through a series of field studies using student participants, global PDTs with two collocated subteams each. Leadership can be viewed through a variety of lenses. This research examines leadership through the lens of leadership roles as identified by Quinn (1988). Through qualitative and quantitative analyses a research model was tested and insights have been made into the functioning of PDTs and their leaders.

This research confirms that the leadership roles identified by Quinn (1988) and previously examined in fully virtual and traditionally collocated teams are also enacted in partially distributed teams. While leadership configuration had an effect on role enactment in Study 1, it did not appear to have such an effect in Study 2, perhaps because of the additional training that the Study 2 participants received. This suggests that leaders and members can be successfully trained to work effectively in PDTs.

However, it must be noted that the subjects were students who had instructors supervising their activities. It is possible that some of the leadership roles needed for the team's functioning were enacted by the instructors, relieving the student leaders of the responsibility for that role behavior. For example, some of the monitoring tasks may have been performed by the instructor for a subteam in his or her class. Additionally, instructions were placed on the PDT System for the students, including due dates and templates for task activities. Thus, the PDT System may have also performed some of the leadership roles that, in the field, would have been enacted by a team or subteam leader. Therefore, while the enactment of leader roles in a PDT has been shown in this research, the patterns of enactments may be different in the field.

The findings suggest that trust is important to outcomes in PDTs. This research has identified three types of trust (Expertise, Personal, and Process) and found that early trust is, indeed, different than later term trust. Thus, to impact positively the outcomes, leaders need to be aware of the types of trust that are most likely to positively influence outcomes at a particular stage of the team's lifecycle. Distance was also shown to affect trust.

An interesting finding is that the results for associations with objective performance of a team are different than results for associations with perceived performance of a team. For example, perceived team leader effectiveness is significantly associated with perceived team performance, but not with objective performance (H3b). It is not surprising, however, when one examines the relationship of perceived team performance and objective performance as they do not measure the same thing although they both measure the higher order construct of performance. Perceived team performance, a subjective measure, reflects the respondent's beliefs about the quality of the process of team functioning. On the other hand, objective performance measures the quality of the product of the team's efforts. Thus, for H3b, it is not surprising that belief that the leader is effective is associated with belief that the team is performaing well, while belief in the team and leader may be completely unrelated to the quality of the output.

The results of this research also suggest that in many ways subteam leaders and team leaders differ. That is, it cannot be assumed that what works for subteam leaders will work for team leaders and vice versa. Being aware of this can aid leaders in planning for and managing their charges.

The results of the qualitative and quantitative analyses of Study 1 and Study 2 inform recommendations to managers for how to manage and conduct a PDT so as to maximize the team's performance:

- Provide a suite of communications media
    - Provide both synchronous and asynchronous media
    - Provide training for those media that members are not familiar with
    - Be certain that all media are equally available to all members and locations
    - Have subteams agree on the communications media to use for between subteam communications
- Promote between subteam communication and team building early in the life cycle of the team to build trust and reduce in-group/out-group effects.
- Keep contact between the subteams salient and frequent
    - Provide a central repository for interim work products so that each subteam is aware of the activities and work of the others.
- Define roles and responsibilities early on in the lifecycle of the team
    - Clarify expectations for between subteam interaction and collaboration.
    - Instruct members as to the issues of PDTs and provide training for solving them.
    - Instruct leaders on the positive leader roles so as to promote positive team outcomes.
- Bridge the cultural distance gap: Train members of a subteam to understand and be sensitive to the culture and work habits of the other subteams.

  - Agree on a working language.
  - Provide editorial support for those whose proficiency in the working language is not adequate.
  - Encourage members to avoid using colloquialisms that are not universally understood.
- This research suggests that PDTs can overcome the adverse effects of temporal distance on trust. Leaders should find ways (e.g., provide asynchronous and synchronous media) to adapt to the issues of temporal distance.
  - Agree up front on core work hours.
  - If flexibility is needed, be fair by alternating which subteam is available off hours.
- Recognize that leadership configuration may affect processes and outcomes.
  - For example, in the Centralized condition (i.e. only a team leader), the leader must make his or her telepresence strongly salient to the remote members early on.
- Reassess the needs of the team periodically.

In sum, this dissertation research provides rich insights into partially distributed teams. Additionally, the subjects were observed to be highly enthusiastic and motivated to work on the project. Thus, this dissertation can guide not only professionals in the field, but also educators looking to provide opportunities for their students to gain experience in a form of group that is becoming more and more common in the field.

CHAPTER 13

LIMITATIONS, CONTRIBUTIONS, AND FUTURE RESEARCH

13.1 Limitations

That the subjects in the studies were students may limit generalizability. Although there were instructions on leader (and member) responsibilities as well as training and orientation for working in PDTs, many of the selected leaders probably did not have prior experience working in either PDTs or, perhaps more significantly, managerial positions. In fact, of the 37 leaders who completed the Background survey in Study 2, only 10 (27%) reported that they had prior experience in managerial positions.

Another limitation is that some of the constructs (e.g., satisfaction with a group and leader) were only measured in Study 2, thus reducing the N (and power) for analyses. Additionally, distance (cultural, temporal) was held constant in Study 1. This contributed to a limitation on the number of team compositions studied. Future research with more variety of team compositions is recommended.

The fact that the leadership configuration manipulation failed in Study 1 is both a finding and a limitation. While it was informative to find that most teams preferred the Decentralized condition, it is a limitation in that their choosing leaders that put them in the Decentralized condition reduced greatly the number of teams in the Hierarchical and Centralized conditions (thus reducing power) for Study 1.

This research only examined teams with two subteams of approximately equal size each. In practice, PDTs may be comprised of many more subteams of different sizes, and even include isolates as well. Also, this research only examined three generic leadership conditions (Decentralized, Centralized, and Hierarchical). In practice, there

may be others such as self-managed teams. Thus, although controlling team configuration and size better enabled us to examine the effects of the independent variables that were manipulated, this also limits generalizability.

The analyses were done at the individual level. It may be that membership in the subteam and/or team affected the individual's perceptions. This was not, in these analyses accounted for. As described earlier, the data were not normal, in general, which prohibited doing nested analyses. However, ways to overcome this limitation will be explored in depth after the completion of this dissertation.

Another limitation is that because of issues of collinearity it was not possible to examine through quantitative analysis the effect of cultural distance on constructs of interest (e.g., trust). It is hoped that in future studies with more variety of team structure and distances it will be possible to examine cultural distance effects.

Although private space on the PDT System was provided to each team, the teams were not required to use it for all collaboration and communication. Analysis showed that, indeed, the teams made use of other communication media (e.g., email, instant messaging). However, this resulted in an inability to capture communication data that might have proven valuable to the research.

A large percentage of the variables were not normally distributed. Therefore, nonparametric testing needed to be done. It is possible that in a larger study, with more variance in team composition and configuration, normality will be achieved.

Finally, the task was four weeks in duration for both Study 1 and Study 2. In practice, tasks could be shorter or much longer than four weeks and the task itself might

be much more complex. Thus generalizability to industry or other settings with different types of tasks and different longevity for PDTs is also compromised.

13.2 Contributions

This dissertation research contributes to the literature by increasing an understanding of leaders and leadership issues in partially distributed teams. It contributes to knowledge about leadership in virtual teams, an important research theme in IS (Sidorova et al., 2008).

This dissertation research has provided evidence that the leader roles identified by Quinn (1988) are also enacted by leaders in PDTs. A scale to measure leader roles that was previously validated for use with traditional and fully virtual teams (Denison et al., 1995) has been validated for use in PDTs. Additionally, scales used to measure trust in traditional and fully virtual teams (Jarvenpaa et al., 1998, Cummings and Bromiley, 1996) have been adapted and validated for use in PDTs. New scales to measure satisfaction with a leader and ineffective bad leadership have been developed.

Ineffective bad leadership has been shown to be negatively and significantly associated with perceptions of leader effectiveness, leader role enactments, and trust in PDTs. This contributes to the extant literature because bad leadership is rarely addressed in general, and specifically not in the context of PDTs.

The research results have suggested that a portfolio of communication options be made available to PDTs and that all media included be available to everyone in the team. The members should have an equal level of comfort using the media which may require

training. Media choices for within and between subteam communications may differ in terms of choices and frequencies with which those choices will be used.

This research has identified three distinct types of trust (Expertise Trust, Personal Trust, and Process Trust) in PDTs. This research suggests that early trust is different than longer-term trust. For example, while Expertise Trust is evident in early trust, in longer term trust, after participants have an opportunity to have experience with each other, it is subsumed by Personal Trust.

How to configure leadership is a challenge when forming PDTs. This dissertation provides insights into the effects of leadership configuration on team outcomes. The model hypothesized that leadership configuration and distance affect outcomes through the processes of leader role enactment, perceived leader performance, and trust.

Thus, leadership theory is enhanced and extended by the findings of the Quinn (1988) leader roles in PDTs and by the findings about bad ineffective leadership. Trust theory has been extended by the discovery of three dimensions of trust, not identified before in the research. Future research is needed to confirm these findings and to see if they extend to other team structures.

Leadership in PDTs has been shown, in this research, to have special challenges. Perhaps the biggest challenge is to bridge the divide (faultlines) between subteams. Building whole team identity and trust are crucial. The results of this research can provide guidance as to the issues that need to be addressed by leaders in PDTs and the means to overcome these impediments.

13.3 Future Research

A great deal of data was collected in the two studies reported on in this dissertation. Additional analysis from the data collected can be performed. The expert graders evaluated the final deliverables for creativity. Therefore, the effect of leadership configuration and distance on creativity can be examined. It is also possible, for future analysis, to analyze the consistency among subteams from each country. For example, are all subteams from China more similar to each other in perceived team effectiveness than they are to subteams from other countries? Although the language of the project was English, for many of the subjects English was a second language. In the Background survey the respondents rated how proficient they are in English. It would be of interest to see if language proficiency affected outcomes and processes. For example, does the proficiency with the language of the task affect whether or not synchronous or asynchronous communications media are preferred? Analysis of culture for the dissertation takes the culture of the country of the subteam. However, the populations of many universities are quite diverse. It would be interesting to analyze culture on an individual basis as well. Additionally, it may be informative to do analyses that consider the effects of group membership when analyzing members' perceptions. Therefore, attempts will be made to do nested analysis in future studies where, it is hoped, a larger N may provide for normal data. Finally, it will be possible to look for possible interaction effects, for example, between leadership configuration and distance.

Additional studies of PDTs are also envisioned. One such study could compare PDTs to face-to-face groups and/or fully distributed teams. It is also planned to expand the study of PDTs. For example, for the dissertation, trust was measured after one week

of the project (early trust) and after the four week project concluded (later term trust). It would prove interesting to measure initial swift trust at the inception of the project as well. It is also desirable to study teams that work over longer periods of time than four weeks and to take longitudinal measures; to study teams that have more than two subteams; and to study teams that are in industry and other organizations rather than just student teams. Longitudinal data may provide evidence as to the directions of significant associations, such as that of trust and perceived performance, which cannot be determined in this dissertation research. Further studies should gather more data on more cultural distances by including more countries and team structures that do not include subgroups from the U.S. as part of the team. Finally, ineffective bad leadership was measured only at the conclusion of Study 2. It is of interest to measure it early in the project and analyze if there is an impact on early development of trust.

Future research should include exploring the use of new technologies (e.g., Web 2.0 technologies) for communications. Social networking sites, for example, may provide a rich medium in which in-group/out-group effects can be ameliorated through the social interaction and collaboration can be enhanced.

In sum, the data collected in Study 1 and Study 2 are rich and hold possibilities for further analysis. Further studies with a variety of team configurations and compositions can also provide for deeper insights into PDTs and the leadership that manages them.

Therefore, research questions to be addressed in future research are:

RQF1: What are the effects of distance and leadership configuration on PDTs in the field?

RQF2: Are there interactions between distance and leadership configuration on outcomes in PDTs?

RQF3: What are the effects of team and subteam membership on perceptions of satisfaction, performance, and effectiveness in PDTs?

RQF4: How do PDTs differ from face-to-face and fully distributed teams?

RQF5: What is the effect of team longevity on outcomes in PDTs?

APPENDIX A

SUMMARY OF EMPIRICAL STUDIES OF LEADERSHIP IN VIRTUAL TEAMS

Table A.1 shows summaries of empirical studies of leadership in virtual teams.

Table A.1 Summary of Studies of Leadership in Virtual Teams

Author	Year	Methods	Leadership Type	IV / Moderator Variables	Dependent Variables
Hiltz, Johnson, and Turoff	1991	Field experiment 2x2 factorial		Designated Leadership Statistical Feedback	Decision Quality Proportional improvement Collective Intelligence
Kim, Hiltz, and Turoff	1998	Laboratory experiment	designated	Coordination mode (sequential vs. parallel) Presence of a Group Leader	Decision Quality Satisfaction
Piccoli and Ives	2000	Field experiment Longitudinal design	self-directed vs. managed	Internal communication Coordination Managerial control	Team effectiveness
Kahai, Sosik, and Avolio	2003	2x2x2 factorial repeated measures design laboratory experiment	Designated	Leadership style (transformational vs. transactional) Anonymity Rewards (individual vs. group)	Participation and cooperation Satisfaction with task and leader
Balthazard, Waldman, Howell and Atwater	2004	1x2 experiment	Shared	Media (FTF vs. VT) Interaction style (constructive vs. defensive) Cohesion	Task performance

Table A.1 Summary of Studies of Leadership in Virtual Teams continued

Author	Year	Methods	Leadership Type	IV / Moderator Variables	Dependent Variables
Hambley, O'Neill, and Kline	2006	2x3 factorial design Laboratory experiment	Designated (confederates blind to the manipulation)	Leadership style (transactional vs. transformational) Communication richness	Team cohesion Team performance

APPENDIX B

SUMMARY OF EMPIRICAL STUDIES OF TRUST IN VIRTUAL TEAMS

Table B.1 shows a summary of empirical studies of trust in virtual teams.

Table B.1 Summary of Empirical Studies of Trust in Virtual Teams

Authors	Year	Methods	IV	DV
Jarvenpaa, Knoll, and Leidner	1998	Quantitative Qualitative	Ability Benevolence Integrity	Trust
Beranak	2000	2x2 factorial field experiment	VTC training Trust training	cohesiveness perception of process satisfaction with outcomes trust trustworthiness
Morris, Marshall, and Kellyrainer	2002	survey	User satisfaction Trust system use (moderates trust)	job satisfaction
Piccoli and Ives	2003	Longitudinal study of temporary virtual teams Trust measured using a previously validated scale (Jarvenpaa and Leidner 1999)	Behavior control Reneging Incongruence Vigilence Salience	Trust

Table B.1 Summary of Empirical Studies of Trust in Virtual Teams continued

Authors	Year	Methods	IV	DV
Aubert, and Kelsey	2003	Field study	Ability Benevolence Integrity Propensity to trust	Trust Performance
Jarvenpaa, Shaw, and Staples	2004	Two field experiments (Study 1 and Study 2)	Situational Structure Study 1 Initial trustworthiness Early communication level Study 2 Early trust Late communication level	Task performance Individual Satisfaction Late cohesiveness Study 1 Late communication level Early trust
Zolin, Hinds, Fruchter, and Levitt	2004	Longitudinal study of architecture, engineering and construction managment students pilot studies in the first two years	Trustor's Propensity to trust (dropped because of an absence of a reliable measure) perceived risk and reward cultural diversity Perceived trustworthiness Perceived follow-through	Trust
Henttonen and Blomqvist	2005	case study: web-based questionnaire and interviews with gvt members in a major telecommunications company		

APPENDIX C

SUMMARY OF EMPIRICAL STUDIES OF SWIFT TRUST IN VIRTUAL TEAMS

Table C.1 below summarizes the studies discussed in Chapter 3 that examined swift trust in virtual teams.

Table C.1 Summary of Empirical Studies of Swift Trust in Virtual Teams

Authors	Year	Methods	IV	DV
Iacono and Weisband	1997	Field experiment	Ability Computer access Computer experience three measures of diversity - graduate/undergraduate; different schools; gender	Performance Trust Initiations Responses
Javenpaa and Leidner	1999	Descriptive case study		
Bradley, Haines, Vozikis	2002	Laboratory experiment	Group type (self-directed or management-directed)	Trust in peers Sense of Belonging Goal Commitment Additionally, at the end of round 7: Solution Satisfaction Decision Scheme Satisfaction
Kanawattanachai and Yoo	2002	Field experiment	Team performance (PERF) (high/low)	Disposition to trust (DT) Trust (CBT and ABT)

Table C.1 Summary of Empirical Studies of Swift Trust in Virtual Teams continued

Authors	Year	Methods	IV	DV
Coppola, Hiltz, and Rotter	2004	Case study		

APPENDIX D

SUMMARY OF BOUNDARY ISSUES AND IN-GROUP/ OUT-GROUP EFFECTS RESEARCH IN THE LITERATURE

Table D.1 Summary of Boundary Issues and In-Group/Out-group Effects Research

Authors	Year	Type of study	Dimensions of Distributedness	IV	DV
Lau, and Murnighan	1998	Conceptual	Demographic faultines		
McDonough, Kahn, and Griffin	1999	Exploratory investigation using interviews and questionnaires	Cultural Geographic	phone calls Fax E-mail Teleconference F2F Mail Company DB Videoconferencing	GNPD (global new product development) team performance
Herbsleb, Mockus, Finholt, and Grinter	2000	Case study	Geographic		
Pauleen and Yoong	2001	Interpretive qualitative methodology - grounded action learning	Organizational Cultural Language Time Geographic		
Watson-Manheim, Chudoba, and Crowston	2002	Pilot study - analysis of literature	Discontinuities (temporal, cross-sectional)		
Espinosa and Carmel	2003	Model development	Time Geographic		
Swigger, Alpaslan, Brazile, and Monticino	2003	Case study	Cultural		
Bos, Olson, Cheshin, Kim, and Nan	2004	Laboratory Experiment	Geographic		

Table D.1 Summary of Boundary Issues and In-Group/Out-group Effects Research continued

Authors	Year	Type of study	Dimensions of Distributedness	IV	DV
Espinosa and Carmel	2003	Model development	Time Geographic		
Swigger, Alpaslan, Brazile, and Monticino	2003	Case study	Cultural		
Bos, Olson, Cheshin, Kim, and Nan	2004	Laboratory Experiment	Geographic		
Chudoba, Wynn, Lu, and Watson-Manheim	2005	Web-based survey	Discontinuities (geography, time zone, organization, national culture, work practices, and technology)	Virtuality	Performance
Paneli and Davison	2005	Field study	Geographic and time		
Espinosa and Pickering	2006	semi-structured interviews	Time		
Huang and Ocker	2006	Case Study	Geographic		
Lings, Lundell, Agerfalk, and Fitzgerald	2006	Qualititative analysis of the literature	Time Geographic Culture		
Lojeski, Reilly, and Dominick	2006	Questionnaire	11 dimensions of virtual distance		
Polzer, Crisp, Jarvenpaa, and Kim	2006	Field experiment using survey	Geographic faultlines	Team configuration	Conflict Trust
Connaughton and Shuffler	2007	Lit review	Culture		
Staples and Webster	2008	Questionnaire – field study	Geographic	Trust	Effectiveness Knowledge sharing Task interdependence Virtualness

Table D.1 Summary of Boundary Issues and In-Group/Out-group Effects Research continued

Authors	Year	Type of study	Dimensions of Distributedness	IV	DV
Webster and Wong	2008	Field Study	Geographic	Type of team (Collocated, Virtual, or Semi-Virtual)	Group Identity Communication Frequency Trust Task Skills
Paul and Ray	2009	Laboratory Experiment	Culture	Cultural Diversity	Perceived Work Atmosphere Participation Task conflict

APPENDIX E

SURVEY ITEMS USED IN STUDY 1 AND STUDY 2

Below are the survey items used in Study 1 and Study 2. Those items which were only used in Study 2 are clearly noted as such. Whenever possible, items were adapted from previously validated scales. These items were part of a larger set of items in the post survey and personal reflections used in the larger study of which this dissertation research is a part.

Leadership role items were adapted from (Denison et al., 1995). Perceived performance items were adapted from (Mortensen and Hinds, 2001). Four rust items were adapted from (Jarvenpaa et al., 1998) and six trust items were adapted from (Cummings and Bromiley, 1996). Finally, satisfaction with the collated subteam/ remote subteam items were adapted from (Fuller et al., 2006-7).

Leadership roles:

	Almost never	2	3	4	5	6	Almost Always
Came up with inventive ideas							
Proposed new concepts and ideas							
Served as liaison to project coordinators (i.e. PDT contacts, course instructor)							
Requested clarifications as needed regarding project							
Made certain members delivered on project goals							
Got members to meet							

expected goals							
Made project priorities and direction clear							
Established project goals							
Set the pace so work was completed on time							
Was effective in coordinating members							
Set milestones and monitored member progress							
Tracked completion of work							
Surfaced key differences among members, then worked with members to resolve them							
Encouraged participation of others in decision making							
Showed empathy and concern in dealing with members							
Treated each member in a sensitive, caring way							
Gave members instructions regarding their work							
Let members know when performance expectations were not met							

Perceived Performance:

Compared with other teams you have worked on, use the following dimensions to rate the performance of your SUBteam.

Efficiency	Low	2	3	4	5	6	High
Quality	Low	2	3	4	5	6	High
Creativity	Low	2	3	4	5	6	High
Adherence to Schedule	Low	2	3	4	5	6	High
Coordination of member efforts	Low	2	3	4	5	6	High
Communication between members	Low	2	3	4	5	6	High

Compared with other teams you have worked on, use the following dimensions to rate the performance of your team.

Efficiency	Low	2	3	4	5	6	High
Quality	Low	2	3	4	5	6	High
Creativity	Low	2	3	4	5	6	High
Adherence to Schedule	Low	2	3	4	5	6	High
Coordination between subgroups	Low	2	3	4	5	6	High
Communication between subgroups	Low	2	3	4	5	6	High

Trust: In Study 1 trust was measured in the post survey. In Study 2 it was measured in both the post survey and the second personal reflection.

1. I would have preferred if some members had less influence over important aspects of the project in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

2. I wanted to more closely monitor the work of members in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

3. I was comfortable when other members worked on a critical task or problem in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

5. I felt that members tried to get out of their commitments in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

6. I felt that members kept their word in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

7. I felt that members were honest with me in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

8. I felt that members negotiated joint expectations fairly in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

9. I felt that members tried to get the upper hand in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

10. I felt confident that members would not exploit me in

My subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree
Other subteam	Strongly Disagree	2	3	4	5	6	Strongly Agree

Leader Performance:

Rate the performance of your SUBteam/ TEAM leader.
Poor 2 3 4 5 6 7 8 9 Outstanding

Satisfaction with a Leader (Study 2 only)

I felt that my subteam/ team leader was fair
Strongly disagree 2 3 4 5 6 Strongly Agree

I was comfortable entrusting critical tasks to my subteam/ team leader
Strongly disagree 2 3 4 5 6 Strongly Agree

Rate your satisfaction with your SUBteam/ TEAM leader
Strongly disagree 2 3 4 5 6 7 8 9 Strongly Agree

Emergent Leadership (Study 2 only)

Did any member(s) not designated in your team contract as a team leader, emerge as team leader(s)?

Did any member(s) not designated in your team contract as a subteam leader, emerge as subteam leader(s)?

<in both cases give an opportunity to name up to 3 people>

Satisfaction with Collocated Subteam/ Remote Subteam: – Study 2 only

I was satisfied with the members of my subteam/ the other subteam
Strongly disagree 2 3 4 5 6 Strongly Agree

I was pleased with the way the members of my subteam/ the other subteam and I worked together
Strongly disagree 2 3 4 5 6 Strongly Agree

I was very satisfied working with
Strongly disagree 2 3 4 5 6 Strongly Agree

Communication Media

To what extend were the following means of communication used between/ within your subteam(s)?

	Never 1	2	3	4	5	5	To a great extent 7
PDT system ("wiki" in Study 1)							
Instant messaging							
E-mail							
Text Messaging							
Facebook							
Phone (Mobile or land-line)							
Internet Phone (e.g. Skype)							
Face-to-Face meetings							
FAX							
Video conferencing							

Teleconference calls							
Course management System (e.g. ANGEL, Webboard, etc.)							
External forums or bulleting boards							
Other							

(Study 2 only) If you entered a number greater than 1 for "other" in the question above, indicating you used other media, please specify here _____

Ineffective Bad Leadership – Study 2 only

My subteam/ team leader

Lacked the skill or will to sustain effective action
Strongly disagree 2 3 4 5 6 Strongly Agree

Was unyielding and did not adapt to new ideas
Strongly disagree 2 3 4 5 6 Strongly Agree

Lacked self-control and acted without thinking
Strongly disagree 2 3 4 5 6 Strongly Agree

APPENDIX F

STUDY 1 QUALITATIVE ANALYSIS CODING SCHEMA

Each passage coded was linked, by the participant's ID, to a node that identified the participant's status (member, subteam leader or team leader) and one that identified the leadership configuration of the participant's team (Centralized, Decentralized, or Hierarchical).

- Member
- Subteam Leader
- Team Leader
- Centralized
- Decentralized
- Hierarchical

Constructs to examine and the initial NODES for Analysis (each passage tagged with the person's ID and one or more of the Nodes below)

- Emergent Leadership
  - Initiator
  - Scheduler
  - Integrator
  - EmergentTeamLeader
  - EmergentSubteamLeader
- Satisfaction with leader
  - SatisfactionWithTeamLeader
  - SatisfactionWithSubteamLeader
- Satisfaction with a Group
  - (tag also with either "MySubteam" or "OtherSubteam")
- Effective leadership
  - EffectiveTeamLeader
  - EffectiveSubteamLeader
- Trust
  - (tag also with either "MySubteam" or "OtherSubteam")
- Distrust
  - (tag also with either "MySubteam" or "OtherSubteam")
- Bad leadership (nb. Have to link to type of leadership AND bad leadership characteristic)
  - Bad team leader
  - Bad subteam leader
  - lack skill
  - unyielding
  - lack self-control

- Leader Roles
  - Producer
  - Director
  - Coordinator
  - Monitor
  - Facilitator
  - Mentor
  - Innovator
  - Broker
- Communication
  - CommunicationMedia (create node for what is mentioned)
  - CommunicationProblem
  - CommunicationSuccess
- Distance
  - Time
  - Cultural
  - Geographical
- Dissatisfaction with Leader
  - Dissatisfaction with team leader
  - Dissatisfaction with Subteam leader
- Work process

APPENDIX G

PLS RESULTS FOR MODEL WITH RESPECT TO TEAM LEADERS

In Table G.1 below are shown the beta weights and t-values for the paths included in the first valid and reliable PLS model with respect to team leaders, model TmLDR_ModelV2. The table indicates significant paths by bolding the t-values of such paths. The number of observations was N=563. A path is considered significant at the .05 level if t>1.64, based on a t-table in (Rosenthal and Rosnow, 1984). Table G.2 below shows the results of pruning TmLDR_ModelV2 of insignificant paths to arrive at a parsimonious model, TmLDR_ModelV3. Shown are the results of the application of PLS to both models.

Table G.1 PLS Results:: TmLDR_ModelV2

Hypothesis	**Path From**	**Path T**	**Beta Weights**	**t-value t>1.648 => p<.05**
1b	LDRSHP	TLR	.2186	**3.5163**
1e	TLR	PSP	.0332	0.3958
	TLR	PTP	.0789	1.0995
1f	TLR	TLE	.6831	**11.7967**
1g	TLR	SatTL	.5853	**7.0194**
1h	TLR	SatMSub	.1568	**2.0101**
	TLR	SatOSub	.2258	**2.7394**
2b	EPTM	PSP	-.01	0.2487
	LTPTM	PSP	.5158	**12.5328**
2c	EPTO	PTP	-.0106	0.3312
	LTPTO	PTP	.5431	**13.5961**
2f	EPTO	SatTL	.0256	0.618
	LTPTO	SatTL	.0094	0.2449
2g	EPTM	SatMSub	.1847	**2.9067**
	LTPTM	SatMSub	.2481	**4.6595**
2h	ETPO	SatOSub	.2371	**4.4538**
	LTPTO	SatOSub	.3232	**6.2994**
3b	TLE	PSP	.0516	0.6952
	TLE	PTP	.0909	1.2532

Table G.1 PLS Results:: TmLDR_ModelV2 continued

Hypothesis	Path From	Path To	Beta Weights	t-value t>1.648 => p<.05
3c	TLE	EPTM	.0839	1.4396
	TLE	LTPTM	.1878	**3.7473**
	TLE	EPTO	.115	**2.2555**
	TLE	LTPTO	.3032	**5.7911**
3f	TLE	SatTL	.1652	**1.9976**
3h	TLE	SatMSub	.0578	0.7522
	TLE	SatOSub	.1039	1.2887
4a	TIME	EPTO	-.1459	**2.0668**
	TIME	LTPTO	-.0344	0.8632
7a	LDRSHP	MedW	.029	0.679
	LDRSHP	MedB	.0012	0.0308
7b	TIME	MedW	-.0135	0.3244
	TIME	MedB	.0197	0.5701
7c	MedW	TLR	.0046	0.0758
	MedB	TLR	.0511	0.8611
7d	MedW	EPTM	.0641	0.9594
	MedW	EPTO	.0246	0.4032
	MedW	LTPTM	.127	**2.0439**
	MedW	LTPTO	.0605	0.9647
	MedB	EPTM	-.0314	0.4541
	MedB	EPTO	-.0089	0.1427
	MedB	LTPTM	.0086	0.1397
	MedB	LTPTO	.12	**1.8937**

Table G.2 PLS Results: TmLDR_ModelV3

Hypothesis	Path From	Path To	Model V2		Model V3	
			Beta Weights	t-value t>1.648 => p<.05	Beta Weights	t-value t>1.648 => p<.05
1b	LDRSHP	TLR	.2186	**3.5163**	.2194	**3.5141**
1e	TLR	PSP	.0332	0.3958	n/a	n/a
	TLR	PTP	.0789	1.0995	n/a	n/a
1f	TLR	TLE	.6831	**11.7967**	.6825	**12.2278**
1g	TLR	SatTL	.5853	**7.0194**	.5885	**7.1452**
1h	TLR	SatMSub	.1568	**2.0101**	.1967	**2.4315**
	TLR	SatOSub	.2258	**2.7394**	.2939	**4.4401**

Table G.2 PLS Results: TmLDR_ModelV3 continued

Hypothesis	Path From	Path To	Model V2		Model V3	
			Beta Weights	**t-value t>1.648 => p<.05**	**Beta Weights**	**t-value t>1.648 => p<.05**
2b	EPTM	PSP	-.01	0.2487	n/a	n/a
	LTPTM	PSP	.5158	**12.5328**	.5296	**13.7105**
2c	EPTO	PTP	-.0106	0.3312	n/a	n/a
	LTPTO	PTP	.5431	**13.5961**	.5924	**17.3004**
2f	EPTO	SatTL	.0256	0.618	n/a	n/a
	LTPTO	SatTL	.0094	0.2449	n/a	n/a
2g	EPTM	SatMSub	.1847	**2.9067**	.1839	**2.9069**
	LTPTM	SatMSub	.2481	**4.6595**	.2521	**5.0722**
2h	ETPO	SatOSub	.2371	**4.4538**	.2393	**4.3935**
	LTPTO	SatOSub	.3232	**6.2994**	.3351	**6.4809**
3b	TLE	PSP	.0516	0.6952	n/a	n/a
	TLE	PTP	.0909	1.2532	n/a	n/a
3c	TLE	EPTM	.0839	1.4396	n/a	n/a
	TLE	LTPTM	.1878	**3.7473**	.188	**3.7543**
	TLE	EPTO	.115	**2.2555**	.1149	**2.1659**
	TLE	LTPTO	.3032	**5.7911**	.303	**5.6639**
3f	TLE	SatTL	.1652	**1.9976**	.1693	**2.2098**
3h	TLE	SatMSub	.0578	0.7522	n/a	n/a
	TLE	SatOSub	.1039	1.2887	n/a	n/a
4a	TIME	EPTO	-.1459	**2.0668**	-.1466	**2.2483**
	TIME	LTPTO	-.0344	0.8632	n/a	n/a
7a	LDRSHP	MedW	.029	0.679	n/a	n/a
	LDRSHP	MedB	.0012	0.0308	n/a	n/a
7b	TIME	MedW	-.0135	0.3244	n/a	n/a
	TIME	MedB	.0197	0.5701	n/a	n/a
7c	MedW	TLR	.0046	0.0758	n/a	n/a
	MedB	TLR	.0511	0.8611	n/a	n/a
7d	MedW	EPTM	.0641	0.9594	n/a	n/a
	MedW	EPTO	.0246	0.4032	n/a	n/a
	MedW	LTPTM	.127	**2.0439**	.1322	**2.6435**
	MedW	LTPTO	.0605	0.9647	n/a	n/a
	MedB	EPTM	-.0314	0.4541	n/a	n/a
	MedB	EPTO	-.0089	0.1427	n/a	n/a
	MedB	LTPTM	.0086	0.1397	n/a	n/a
	MedB	LTPTO	.12	**1.8937**	.156	**3.1751**

APPENDIX H

PLS RESULTS FOR MODEL WITH RESPECT TO SUBTEAM LEADERS

In Table H.1 below, are shon the beta weights and t-values for the paths included in the first valid and reliable PLS model with respect to subteam leaders, model SLDR_ModelV2. The table indicates significant paths by bolding the t-values of such paths. A path is considered to be significant at the .05 level, if t>1.64, based on a t-table in (Rosenthal and Rosnow, 1984). The number of observations was N=563. Table H.2 below shows the parsimonious model SLDR_ModelV3 with the results of the previous version so that the pruning of insignificant paths is revealed.

Table H.1 PLS Results: SLDR_ModelV2

Hypothesis	**Path From**	**Path To**	**Beta Weight**	**t-value t>1.648 => p<.05**
1b	LDRSHP	SLR	-.0447	1.1817
1e	SLR	PSP	.1793	**3.7996**
	SLR	PTP	.146	**3.2**
1f	SLR	SLE	.1094	**2.0084**
1g	SLR	SatSL	.2497	**2.8932**
1h	SLR	SatMSub	.098	**1.731**
2b	EPTM	PSP	-.0085	0.2127
	LTPTM	PSP	.4822	**10.8448**
2c	EPTO	PTP	-.0034	0.1094
	LTPTO	PTP	.5607	**15.3254**
2e	EPTM	SatSL	.1912	**3.029**
	LTPTM	SatSL	.1602	**2.6918**
2g	EPTM	SatMSub	.1985	**3.0463**
	LTPTM	SatMSub	.261	**4.5637**
2h	EPTO	SatOSub	.256	**4.5625**
	LTPTO	SatOSub	.4175	**7.8773**
3b	SLE	PSP	.0042	0.1141
	SLE	PTP	.0148	0.4068
3d	SLE	EPTM	.0367	0.7125
	SLE	LTPTM	.0688	1.3634
	SLE	EPTO	.0515	1.003

Table H.1 PLS Results: SLDR_ModelV2 continued

Hypothesis	Path From	Path To	Beta Weight	t-value t>1.648 => p<.05
	SLE	LTPTO	.0715	1.495
3f	SLE	SatSL	.0007	0.0161
3g	SLE	SatMSub	-.0474	1.2863
4a	TIME	EPTO	-.1467	**2.2758**
	TIME	LTPTO	-.0376	0.8168
7a	LDRSHP	MedW	.029	0.6813
	LDRSHP	Med B	.0012	0.0298
7b	TIME	MedW	-.0135	0.3243
	TIME	MedB	.0197	0.5563
7c	MedW	SLR	.1046	1.5333
	MedB	SLR	.0515	0.6303
7d	MedW	EPTM	.0633	1.0094
	MedW	EPTO	.0234	0.3982
	MedW	LTPTM	.1249	**1.9371**
	MedW	LTPTO	.0561	0.8767
	MedB	EPTM	-.0267	0.4398
	MedB	EPTO	-.0023	0.0391
	MedB	LTPTM	.0188	0.293
	MedB	LTPTO	.1351	**2.0309**

Table H.2 PLS Results: SLDR_ModelV3

Hypothesis	Path From	Path To	Model V2		Model V3	
			Beta Weight	t-value t>1.648 => p<.05	Beta Weights	t-value t>1.648 => p<.05
1b	LDRSHP	SLR	-.0447	1.1817	n/a	n/a
1e	SLR	PSP	.1793	**3.7996**	.1815	**3.9237**
	SLR	PTP	.146	**3.2**	.1474	**3.3213**
1f	SLR	SLE	.1094	**2.0084**	.1086	**1.9448**
1g	SLR	SatSL	.2497	**2.8932**	.2484	**2.9899**
1h	SLR	SatMSub	.098	**1.731**	.0924	**1.6993**
2b	EPTM	PSP	-.0085	0.2127	n/a	n/a
	LTPTM	PSP	.4822	**10.8448**	.4799	**10.3307**
2c	EPTO	PTP	-.0034	0.1094	n/a	n/a
	LTPTO	PTP	.5607	**15.3254**	.5605	**15.4033**
2e	EPTM	SatSL	.1912	**3.029**	.1917	**2.9623**
	LTPTM	SatSL	.1602	**2.6918**	.1603	**2.7304**

Table H.2 PLS Results: SLDR_ModelV3 continued

Hypothesis	Path From	Path To	Model V2		Model V3	
			Beta Weight	**t-value t>1.648 => p<.05**	**Beta Weights**	**t-value t>1.648 => p<.05**
2g	EPTM	SatMSub	.1985	**3.0463**	.1977	**3.0552**
	LTPTM	SatMSub	.261	**4.5637**	.2597	**4.5833**
2h	EPTO	SatOSub	.256	**4.5625**	.256	**4.5174**
	LTPTO	SatOSub	.4175	**7.8773**	.4175	**8.242**
3b	SLE	PSP	.0042	0.1141	n/a	n/a
	SLE	PTP	.0148	0.4068	n/a	n/a
3d	SLE	EPTM	.0367	0.7125	n/a	n/a
	SLE	LTPTM	.0688	1.3634	n/a	n/a
	SLE	EPTO	.0515	1.003	n/a	n/a
	SLE	LTPTO	.0715	1.495	n/a	n/a
3f	SLE	SatSL	.0007	0.0161	n/a	n/a
3g	SLE	SatMSub	-.0474	1.2863	n/a	n/a
4a	TIME	EPTO	-.1467	**2.2758**	-.1481	**2.193**
	TIME	LTPTO	-.0376	0.8168	n/a	n/a
7a	LDRSHP	MedW	.029	0.6813	n/a	n/a
	LDRSHP	Med B	.0012	0.0298	n/a	n/a
7b	TIME	MedW	-.0135	0.3243	n/a	n/a
	TIME	MedB	.0197	0.5563	n/a	n/a
7c	MedW	SLR	.1046	1.5333	n/a	n/a
	MedB	SLR	.0515	0.6303	n/a	n/a
7d	MedW	EPTM	.0633	1.0094	n/a	n/a
	MedW	EPTO	.0234	0.3982	n/a	n/a
	MedW	LTPTM	.1249	**1.9371**	.1332	**2.5245**
	MedW	LTPTO	.0561	0.8767	n/a	n/a
	MedB	EPTM	-.0267	0.4398	n/a	n/a
	MedB	EPTO	-.0023	0.0391	n/a	n/a
	MedB	LTPTM	.0188	0.293	n/a	n/a
	MedB	LTPTO	.1351	**2.0309**	.1647	**3.0925**

APPENDIX I

CONSENT FORM

Beginning on the next page is the Consent Form that all NJIT student subjects read and completed in order to participate in the experiment portion of the project (i.e., surveys and personal reflections).

NJIT
New Jersey Institute of Technology

CONSENT TO PARTICIPATE IN A RESEARCH STUDY

TITLE OF STUDY: Enhancing the Effectiveness of Partially Distributed Teams: Pilot Studies

RESEARCH STUDY:
I,_____, have been asked to participate in a research study under the direction of Dr. Starr Roxanne Hiltz at NJIT. Other professional persons who work with them as study staff may assist to act for them.

PURPOSE:
The purpose of this project is pilot test data collection methods and instruments in preparation for a larger experiment.

The purpose of the larger experiment is to learn how to enhance the effectiveness of partially distributed global teams. Distributed or "virtual" teams are increasingly prevalent means of managing tasks, from software development to disaster response. For example, disaster response teams are often far-flung, and must collaborate and coordinate efforts across distance. They are an example of a distributed team, which interacts across space, time, and organizational boundaries using electronic communication technologies. When the crisis is of international proportions, the disaster response team is likely to be a *globally* distributed team. One team configuration is the partially distributed team (PDT). A PDT has a hybrid structure consisting of two or more subgroups of geographically separated team members. PDTs constitute a "normal" mode of virtual team configuration and management, since coordination of efforts must be accomplished across multiple sites, such that members must interact with both collocated and remote subgroups. However, behavioral dynamics over time in PDTs, as they are affected by such factors as team and leadership configuration, have largely been ignored. This study seeks to develop guidelines for effective interaction in such teams.

DURATION:
My participation in this study will last for approximately 3- 4 weeks.

PROCEDURES:
I have been told that, during the course of this study, the following will occur:

As part of your assignment, students will be required to reflect and provide feedback on their experiences as part of a distributed team. If you choose to participate in the research this will consist of:

1. Participants will complete a background questionnaire.

2. Participants will complete a post experiment questionnaire at the end of the experiment.

NJIT
Approved by the NJIT IRB on 7/16/07.
Modifications may not be made to this consent form without NJIT IRB approval.

3. Participants agree to share their communications log and reflections on the group process, with the researchers (as well as turning them in to the instructor as part of their grade.)

4. Participants will be debriefed in an online conference and will have an opportunity to discuss their experiences and to ask questions about the research, through interaction with a member of the research team assigned to support students in that course.

PARTICIPANTS:
I will be one of about 200 participants in this trial.

EXCLUSIONS:
I will inform the researcher if I am under 18 years of age (You must be at least 18 to participate)

RISKS/DISCOMFORTS:
We are not aware of any risks or discomforts. Your data will be kept confidential. You are free to withdraw at any time. There may be risks and discomforts that are not yet known. I fully recognize that there are risks that I may be exposed to by volunteering in this study which are inherent in participating in any study; I understand that I am not covered by NJIT's insurance policy for any injury or loss I might sustain in the course of participating in the study.

CONFIDENTIALITY:
I understand confidential is not the same as anonymous. Confidential means that my name will not be disclosed if there exists a documented linkage between my identity and my responses as recorded in the research records. Every effort will be made to maintain the confidentiality of my study records. If the findings from the study are published, I will not be identified by name. My identity will remain confidential unless disclosure is required by law.

All participants will be assigned an ID and the data in the project records that are analyzed and reported will not contain your name.

PAYMENT FOR PARTICIPATION:
I have been told that I will receive no compensation for my participation in this study.

RIGHT TO REFUSE OR WITHDRAW:
I understand that my participation is voluntary and I may refuse to participate, or may discontinue my participation at any time with no adverse consequence. I also understand that the investigator has the right to withdraw me from the study at any time.

INDIVIDUAL TO CONTACT:
If I have any questions about my treatment or research procedures, I understand that I should contact the principal investigator at:

Professor Starr Roxanne Hiltz, Information Systems Department, 4104 GITC, NJIT, University Heights, Newark NJ 07102.
Hiltz@NJIT.edu
Home phone: 973 361 6680

NJIT

Approved by the NJIT IRB on 7/16/07.
Modifications may not be made to this consent form without NJIT IRB approval.

(note: email is the best means of contact).

Note: Dr. Hiltz will be traveling extensively in summer 2006; PLEASE ALSO COPY THE PH.D. student in charge of your class's participation:
LINDA PLOTNICK- linda.plotnick@gmail.com

If I have any addition questions about my rights as a research subject, I may contact:

Dawn Hall Apgar, PhD, IRB Chair
New Jersey Institute of Technology
323 Martin Luther King Boulevard
Newark, NJ 07102
(973) 642-7616
dawn.apgar@njit.edu

SIGNATURE/ AGREEMENT OF PARTICIPANT

I have read this entire form, or it has been read to me, and I understand it completely. All of my questions regarding this form or this study have been answered to my complete satisfaction. I agree to participate in this research study. (If agreeing online: By printing my name below and uploading this form to the designated private conference for research instruments, I signify my agreement to participate.)

Subject Name:_____ Signature:_____

Date:_____

NJIT
New Jersey Institute of Technology

Approved by the NJIT IRB on 7/16/07.
Modifications may not be made to this consent form without NJIT IRB approval.

APPENDIX J

IRB APPROVALS

The following two pages show the IRB (Institutional Review Board) approval and renewal of approval.

NJIT NEW JERSEY INSTITUTE OF TECHNOLOGY

Institutional Review Board: HHS FWA 00003246
Notice of Approval
IRB Protocol Number: E69-07

Principal Investigators: Dr. Roxanne Hiltz. Information Systems

Title: Enhancing the Effectiveness of Partially Distributed Teams: Pilot Studies

Performance Site(s): NJIT Sponsor Protocol Number (if applicable):

Type of Review: FULL [ ] EXPEDITED [X]

Type of Approval: NEW [ ] RENEWAL [X] REVISION [ ]

Approval Date: July 16, 2007 Expiration Date: July 15, 2008

1. **ADVERSE EVENTS:** Any adverse event(s) or unexpected event(s) that occur in conjunction with this study must be reported to the IRB Office immediately (973) 642-7616.

2. **RENEWAL:** Approval is valid until the expiration date on the protocol. You are required to apply to the IRB for a renewal prior to your expiration date for as long as the study is active. It is your responsibility to ensure that you submit the renewal in a timely manner.

3. **CONSENT:** All subjects must receive a copy of the consent form as submitted. Copies of the signed consent forms must be kept on file with the principal investigator.

4. **SUBJECTS:** Number of subjects approved: 200.

5. The investigator(s) did not participate in the review, discussion, or vote of this protocol.

6. **APPROVAL IS GRANTED ON THE CONDITION THAT ANY DEVIATION FROM THE PROTOCOL WILL BE SUBMITTED, IN WRITING, TO THE IRB FOR SEPARATE REVIEW AND APPROVAL.**

Dawn Hall Apgar, PhD, LSW, ACSW, Chair IRB July 16, 2007

NEW JERSEY INSTITUTE OF TECHNOLOGY

Institutional Review Board: HHS FWA 00003246
Notice of Approval
IRB Protocol Number: E69-06

Principal Investigators: Starr Roxanne Hiltz, Information Systems

Title: Enhancing the Effectiveness of Partially Distributed Teams: Pilot Studies

Performance Site(s): NJIT Sponsor Protocol Number (if applicable):

Type of Review: FULL [ ] EXPEDITED [X]

Type of Approval: NEW [ ] RENEWAL [X] REVISION [ ]

Approval Date: July 14, 2008 Expiration Date: July 13, 2009

1. **ADVERSE EVENTS:** Any adverse event(s) or unexpected event(s) that occur in conjunction with this study must be reported to the IRB Office immediately (973) 642-7616.

2. **RENEWAL:** Approval is valid until the expiration date on the protocol. You are required to apply to the IRB for a renewal prior to your expiration date for as long as the study is active. It is your responsibility to ensure that you submit the renewal in a timely manner.

3. **CONSENT:** All subjects must receive a copy of the consent form as submitted. Indications of consent must be kept on file with the principal investigator.

4. **SUBJECTS:** Number of subjects approved: 200.

5. The investigator(s) did not participate in the review, discussion, or vote of this protocol.

6. **APPROVAL IS GRANTED ON THE CONDITION THAT ANY DEVIATION FROM THE PROTOCOL WILL BE SUBMITTED, IN WRITING, TO THE IRB FOR SEPARATE REVIEW AND APPROVAL.**

Dawn Hall Apgar, PhD, LSW, ACSW, Chair IRB July 14, 2008

APPENDIX K

STUDY 1 TASK

Below is the GRRR task used in Study 1 as it appeared on the PDT System.

The GRRR Task

Submitted by rocker on Sat, 2006/10/07 - 9:26pm.

GRRR Project Description

When people suffer a severe disaster they should not be completely dependent on national or international rescue efforts, which may be slow in coming, especially if road and bridges are out. That is the idea guiding this project. With that in mind, a multi-national foundation has issued a Request for Proposal (RFP) for a Grassroots Regional Resource Repository (GRRR). The purpose of such a "self help" emergency preparedness information system is to provide a way for those living in a given geographic region to locate and manage the resources of that region. That way, when a disaster strikes, people (e.g., first responders) can access the GRRR database to assess and deploy available resources quickly and efficiently. GRRR is a shared public data base. Citizens or organizations in a region should be able to enter any resources into it that can be used in an emergency. They should also be able to update the resources as needed. Basic resources include labor, ranging from unskilled (e.g. volunteers to fill sand bags) to highly skilled (e.g. heavy machinery operators, medical professionals); equipment (e.g. construction, transportation); supplies (e.g. food, medicine); and facilities (e.g. temporary shelters, warehouses). Also, additional resource types should be identified and added.

The Region

Peru is South America's third largest country. The narrow, lowland coastal region includes Lima, Trujillo, and Chiclayo, three of Peru's major population centers. The coastline of Peru is plagued by natural disasters including El Niño, tsunamis, and earthquakes. As recent as August, 2007, Peru's southern coast suffered a powerful earthquake measuring 7.7, which killed at least 450 people and injured 1,500 others.

The Challenge

You are an analyst in a multi-national consulting company that is bidding on the RFP for GRRR. You have been asked to work with several other analysts to determine the capabilities/functions to be incorporated into the GRRR emergency preparedness computer information system. While the eventual system will be piloted in Lima, Trujillo, and Chiclayo, you must determine the capabilities/functions for an emergency preparedness information system that can be used in various regions throughout the world. Additionally, you are to address how the management of the data base and the policies to govern it will encourage citizens and organizations in the region to volunteer and regularly update their information. (For example, if a contractor moves heavy equipment to a different location, then this has to be changed in the data base). It has been suggested that incentives be provided to encourage participation on the part of the public. In other words, you must also address management and operational practices for GRRR.

Deliverable:

Your team is to prepare a written report that addresses the results of your initial investigation regarding the RFP. Thus, the report must describe (1) who will use GRRR and why, (2) what capabilities/functions GRRR must include to meet its users' needs, and (3) the management of the information stored in GRRR and policies to govern it. A template that is partially completed is provided. Your team must complete the following major portions of the template:

1. Functional Requirements

2. Management and operation practices

3. Next steps

You are encouraged to include additions to the report, such as user interface screens, web pages, etc. However, this is optional.

Your audience: This RFP is to be written for a **non-technical audience**. It is to include *high-level functional requirements and design* (**NOT** detailed specifications).

APPENDIX L

STUDY 2 TASK

Below is the task used in Study 2 as it was presented to the participants on the PDT System..

BTMAPS Project Description

As part of the global war against terrorism, the Swiss Ministry of Defense wants to have a plan for protecting its citizens against bioterrorist threats. They have decided to use Zurich as a test case because it is the country's largest city and an important global financial center. They have requested proposals for development of a Bioterrorism Management and Planning System (BTMAPS) that will support analysts in detecting bioterrorist threats to Zurich as well as management of resources needed for the associated response. BTMAPS is used to cover threat detection, executive decision-making, and general emergency resource management (e.g., transportation control, law enforcement, care facilities, anti-dote distribution). A separate proposal will focus on the biological and medical analysis as well as treatment aspects of bioterrorist attacks.

The Zurich Metropolitan Area

Zurich is situated where the river Limmat leaves the northern end of Lake Zurich; it is surrounded by wooded hills. The geographic (and historic) center of the city is the "Lindenhof," a small natural hill on the left bank of the river Limmat, about 700 meters north of where the river leaves the lake. Many financial institutions have their headquarters in Zurich, making it the world's primary center for offshore banking. In fact the financial sector accounts for about one quarter of the city's economic activities. The financial success of Zurich is due to many factors, including a very low tax rate and no inheritance tax on private fortunes. Another factor is its Research and Development industry that is fueled by the prestigious ETH Zurich and University of Zurich.

Your Challenge

You are part of a distributed team that is bidding on the Request for Proposal (RFP) for BTMAPS. You have been asked to work with other analysts to determine the capabilities/functions to be incorporated into the bioterrorist threat detection and associated resource management system. The envisioned information system should be able to identify and track emerging infectious diseases that could be the result of bioterrorism attacks, for example by documenting outbreaks, and monitoring epidemic trends (of anthrax, small pox or other deadly diseases) in a timely fashion. The decision-making and resource management (i.e., deciding when an attack has occurred and how to manage the resources needed for response) should focus on Zurich but should include evidence from surrounding areas (e.g., an attack that may have initiated in Paris). If

successful, the new system will be generalized and provided to other metropolitan areas, so your analysis should assume possible future integration with similar systems. In your analysis you should consider the following aspects of the problem:

1. What and how disease/epidemic trends should be monitored.
2. What decisions are needed, when and by whom, and how to support these decisions.
3. What civil or governmental resources that are relevant to a response, how they should be organized, accessed, deployed, and monitored.
4. Who will utilize the system (or parts of the system) – that is, who are the user groups that you are designing the system for?

Deliverables

Your team is to prepare a written report that addresses the results of your initial investigation regarding the Request for Proposal.

A template that is partially completed is provided. You must complete the following major portions of the template:

1. Project Management Approach
2. Functional Requirements
3. High-level Design (i.e. user interface screen mockups)
4. Next Steps

(a) Your audience: This RFP is to be written for a non-technical audience. It is to include *high-level functional requirements and design* (NOT detailed specifications).

APPENDIX M

STUDY 1 LEADER INSTRUCTIONS

Below are the instructions to leaders that were posted on the PDT System. For each team the instructions for their team configuration (Cendralized, Decentralized, or Hierarchical) were posted in the team's private PDT System space.

Centralized Team

Your team has selected you as the overall team leader. Your team consists of two subteams.

As Team Leader you should:
Refer to the instructions and calendar

Coordinate the efforts of your team

- Set schedules and assign tasks to team members
- Inform team members of deadlines, deliverables and goals
- Ensure that each subteam is aware of the other subteam's activities and progress
- Monitor the activities of the team members to ensure that tasks are on-schedule and of high quality

Mentor team members

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables

- Compile and edit documents completed by team members (you may delegate this responsibility but you are responsible for the timely completion by your team member(s))
- Complete activities and submit deliverables by the scheduled deadline

Act as liaison to the researchers

- To ask questions
- To resolve problems that you cannot resolve yourself

Hierarchical Team

TEAM leader

Your team has selected an overall team leader and two subteam leaders (one for each subteam). You are the overall team leader.

As the team leader you should:
Refer to the instructions and calendar

Coordinate the efforts of subteam leaders

- Set schedules and assign tasks to subteam leaders
- Ensure that subteam leaders are aware of each other's activities
- Inform subteam leaders of progress and problems
- Monitor the activities of subteam leaders to ensure that tasks are on-schedule and work is of high quality (Require subteam leaders to submit status reports on a regular basis)

Mentor subteam leaders

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables

- Compile and edit documents completed by your subteam leaders (you may delegate this responsibility but you are responsible for the timely completion by your subteam member(s))
- Complete activities and submit deliverables by deadlines

Act as liaison to the researchers

- To ask questions
- To resolve problems that you cannot resolve yourself

SUBTEAM Leader

Your team has selected an overall team leader and two subteam leaders (one for each subteam). You are the subteam leader of your subteam.

As subteam leader you should:
Refer to the instructions and calendar

Confer and coordinate with your team leader to

- Ensure that your team leader is aware of your subteam's activities
- Keep the team leader informed of status on a regular basis – interval to be chosen by the team leader

Act as the liaison between your subteam and the team leader

- To ask questions
- To resolve problems that you cannot resolve yourself

Coordinate the efforts of your subteam

- Set schedules and assign tasks to your subteam members in accordance with the schedule devised by the team leader
- Ensure that your subteam members are aware of each other's activities
- Monitor the activities of your subteam members to ensure that tasks are on-schedule and work is of high-quality

Mentor your subteam members

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables assigned to your subteam by the team leader

- Compile and edit documents completed by your subteam members (you may delegate this responsibility but you are responsible for the timely completion by your subteam member(s))
- Complete activities and submit deliverables to your team leader by deadlines according to the agreed upon procedures

Decentralized

Your team has selected two subteam leaders (one for each subteam). You are the subteam leader of your subteam.

<u>As Subteam Leader you should</u>:
Refer to the instructions and calendar

Confer and coordinate with other subteam leader to

- Set schedules and assign tasks
- Ensure that the other subteam leader is aware of your subteam's activities

- Keep other subteam leader informed of progress and problems
- Determine who will have responsibility to integrate the parts of deliverables and who will submit the final project

Coordinate the efforts of your subteam

- Inform your subteam members of the deadlines, deliverables and goals
- Assign specific tasks to your subteam members
- Ensure that your subteam members are aware of each other's activities and progress
- Monitor the activities of your subteam members to ensure that tasks are on-schedule and work is of high quality

Mentor your subteam members

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables

- Compile and edit documents completed by your subteam members (you may delegate this responsibility but you are responsible for the timely completion by your subteam member(s))
- Complete activities and submit deliverables by the scheduled deadline according to the agreed upon procedures

Act as liaison to the researchers

- To ask questions
- To resolve problems that you cannot resolve yourself

APPENDIX N

STUDY 2 LEADER AND MEMBER INSTRUCTIONS

Below are the leader and member instructions that were posted on each team's private space on the PDT System. For each team, the instructions for their leadership configuration were posted.

Centralized Condition – Leader and Member Responsibilities

Your team consists of two subteams. **Your team will select ONE leader for the entire team.**

The **Team Leader** should:
Refer to the instructions and calendar

Coordinate the efforts of the team

- Decide what tasks need to be done and ask for volunteers to perform them
    - If there are no volunteers or there are multiple volunteers for a task, the team leader is to assign the task to a member
- Set schedules
- Inform team members of deadlines, deliverables and goals
- Ensure that each subteam is aware of the other subteam's activities and progress
- Monitor the activities of the team members to ensure that tasks are on-schedule and of high quality

Mentor team members

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables

- Compile and edit documents completed by team members (the team leader may delegate this responsibility but is responsible for the timely completion by team member(s))
- Complete activities and submit deliverables by the scheduled deadline

Act as liaison to the researchers

- To ask questions
- To resolve problems that s/he cannot resolve

Members Should:

- Let the team leader know of any talents or experience s/he has that would be helpful for the project
- Meet deadlines set by the team leader and let the leader know as soon as possible if s/he cannot meet these deadlines.
- Provide feedback and constructive suggestions to his/her teammates
- Alert your leader to any difficulties s/he has or help s/he needs.

Decentralized Condition – Leader and Member Responsibilities

Your team will select ONE subteam leader for EACH subteam.

The **SubTeam Leader** should:

Refer to the instructions and calendar

Confer and coordinate with other subteam leader to

- Decide what tasks need to be done and the process by which they will be done.
- Set schedules
- Ensure that the other subteam leader is aware of his/her subteam's activities
- Keep other subteam leader informed of progress and problems
- Determine who will have responsibility to integrate the parts of deliverables and who will submit the final project

Coordinate the efforts of his/her subteam

- Inform his/her subteam members of the deadlines, deliverables and goals
- Ask for volunteers from his/her subteam to perform tasks
    - If there are no volunteers or there are multiple volunteers for a task, s/he is to assign the task to a member.
- Ensure that his/her subteam members are aware of each other's activities and progress
- Monitor the activities of his/her subteam members to ensure that tasks are on-schedule and work is of high quality

Mentor his/her subteam members

- Encourage and assist them

- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables

- Compile and edit documents completed by his/her subteam members (s/he may delegate this responsibility but is responsible for the timely completion by his/her subteam member(s))
- Complete activities and submit deliverables by the scheduled deadline according to the agreed upon procedures

Act as liaison to the researchers

- To ask questions
- To resolve problems that s/he cannot resolve

Members Should:

- Let his/her subteam leader know of any talents or experience s/he has that would be helpful for the project
- Meet deadlines set by the leader and let the leader know as soon as possible if s/he cannot meet these deadlines.
- Provide feedback and constructive suggestions to his/her teammates
- Alert the leader to any difficulties s/he finds or help s/he needs.

Hierarchical Condition - Team Leader and Member Responsibilities

You will select ONE overall team leader and ONE subteam leader for EACH subteam. Three members are needed to fill the three positions.

TEAM leader

The **Team Leader** should:

Refer to the instructions and calendar

Coordinate the efforts of subteam leaders

- Set schedules and assign tasks to subteam leaders
- Ensure that subteam leaders are aware of each other's activities
- Inform subteam leaders of progress and problems
- Monitor the activities of subteam leaders to ensure that tasks are on-schedule and work is of high quality (Require subteam leaders to submit status reports on a regular basis)

Mentor subteam leaders

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables

- Compile and edit documents completed by the subteam leaders (the team leader may delegate this responsibility but is responsible for the timely completion by the subteam member(s))
- Complete activities and submit deliverables by deadlines

Act as liaison to the researchers

- To ask questions
- To resolve problems that s/he cannot resolve

SUBTEAM Leaders

Each **SubTeam Leader** should:

Refer to the instructions and calendar

Confer and coordinate with the team leader to

- Ensure that the team leader is aware of his/her subteam's activities
- Keep the team leader informed of status on a regular basis – interval to be chosen by the team leader

Act as the liaison between his/her subteam and the team leader

- To ask questions
- To resolve problems that s/he cannot resolve

Coordinate the efforts of his/her subteam

- Inform subteam members of deadlines, deliverables and goals
- Ask for volunteers to perform the tasks as delegated by the team leader.
    - If there are no volunteers or there are multiple volunteers for a task, s/he is to assign the task to a member
- Set schedules in accordance with the schedule devised by the team leader/
- Ensure that his/her subteam members are aware of each other's activities and progress
- Monitor the activities of his/her subteam members to ensure that tasks are on-schedule and work is of high-quality

Mentor his/her subteam members

- Encourage and assist them
- Stay in contact and communicate with them

Take charge of completion of activities and submission of deliverables assigned to his/her subteam by the team leader

- Compile and edit documents completed by his/her subteam members (s/he may delegate this responsibility but s/he is responsible for the timely completion by his/her subteam member(s))
- Complete activities and submit deliverables to the team leader by deadlines according to the agreed upon procedures

Members Should:

- Let his/her subteam leader know of any talents or experience s/he has that would be helpful for the project
- Meet deadlines set by the subteam leader and let the leader know as soon as possible if s/he cannot meet these deadlines.
- Provide feedback and constructive suggestions to his/her teammates
- Alert the subteam leader to any difficulties s/he finds or help s/he needs.

APPENDIX O

STUDY 1 FREQUENCIES OF SURVEY RESULTS

Below are the survey questions used in Study 1 with the frequencies (N) of the results. That is, for each choice for each question item, the number of respondents who chose that choice is shown.

To what extent were the following means of communication used *within* your subteam? (1=Never; 7=to a great extent)

	1	2	3	4	5	6	7
PDT System	104	28	22	33	25	28	30
Instant messaging	19	21	18	32	49	60	71
E-Mail	5	5	6	16	38	72	128
Text messaging	142	24	18	24	25	21	16
FaceBook	190	36	19	9	6	5	5
Phone (mobile or land-line)	106	43	29	27	27	25	13
Internet Phone (e.g., Skype)	231	14	4	4	3	3	11
Face-to-face meetings	25	6	6	16	35	44	138
FAX	264	3	1	2	0	0	0
Video conferencing	261	3	3	1	0	2	0
Teleconference calls	253	5	4	4	1	2	1
Course Management System	145	9	18	17	30	19	32
External forums or bulletin boards	218	9	10	11	5	6	11
Other	227	9	9	14	3	1	7

To what extent were the following means of communication used *between* subteams? (1=Never;7=to a great extent)

	1	2	3	4	5	6	7
PDT System	103	12	11	13	28	43	60
Instant messaging	53	12	15	38	35	45	72
E-Mail	13	4	5	21	31	65	131
Text messaging	220	10	9	12	10	3	6
FaceBook	208	26	17	2	8	1	8
Phone (mobile or land-line)	245	11	6	2	3	1	2
Internet Phone (e.g., Skype)	239	11	4	4	2	3	7
Face-to-face meetings	245	2	1	2	2	6	12
FAX	265	3	1	1	0	0	0
Video conferencing	262	4	2	1	0	1	0
Teleconference calls	255	7	2	2	1	2	1
Course Management System	204	4	7	12	8	19	16
External forums or bulletin boards	222	12	5	6	7	7	11
Other	235	9	8	4	7	3	4

Compared with other teams you have worked on, use the following dimensions to rate the performance of your *SUBteam*. (1=low;7=high)

	1	2	3	4	5	6	7
Efficiency	4	2	16	26	60	96	65
Quality	4	3	8	23	80	102	49
Creativity	3	7	26	46	72	69	46
Adherence to schedule	4	4	5	35	51	92	78
Coordination of member efforts	3	5	16	42	58	84	61
Communication between members	2	6	17	30	53	81	80

Compared with other teams you have worked on, use the following dimensions to rate the performance of your *team*. (1=low;7=high)

	1	2	3	4	5	6	7
Efficiency	2	11	21	43	71	81	40
Quality	2	9	15	38	75	84	46
Creativity	7	11	20	56	78	64	33
Adherence to schedule	3	3	16	49	56	77	65
Coordination between subgroups	6	10	31	40	68	74	40
Communication between subgroups	8	20	38	40	69	59	35

Rate the performance of your SUBteam leader. If you have more than one SUBteam leader for your subteam, rate one of them here. (1=poor;10=outstanding)

	1	2	3	4	5	6	7	8	9	10
SUBteam leader	1	3	1	3	9	8	40	56	50	70

Rate the performance of the other SUBteam leader for your subteam. (1=poor;10=outstanding)

	1	2	3	4	5	6	7	8	9	10
SUBteam leader	0	0	0	1	1	2	4	7	4	8

Rate the performance of your TEAM leader. (1=poor;10=outstanding)

	1	2	3	4	5	6	7	8	9	10
Team leader	2	0	0	1	4	6	23	19	29	34

The following 10 questions measure TRUST: The rating scale is 1=Strongly Disagree and 7=Strongly Agree.

1. I would have preferred if some members had less influence over important aspects of the project in

	1	2	3	4	5	6	7
My subteam	93	77	31	34	8	17	8
Other subteam	88	74	29	45	9	14	9

2. I wanted to more closely monitor the work of members in

	1	2	3	4	5	6	7
My subteam	87	60	40	42	19	16	4
Other subteam	66	51	39	53	22	25	12

3. I was comfortable when other members worked on a critical task or problem in

	1	2	3	4	5	6	7
My subteam	5	14	16	44	50	76	63
Other subteam	8	16	27	64	52	56	45

4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in

	1	2	3	4	5	6	7
My subteam	4	13	20	47	38	71	75
Other subteam	13	14	29	62	50	48	52

5. I felt that members tried to get out of their commitments in

	1	2	3	4	5	6	7
My subteam	111	71	29	24	10	17	6
Other subteam	109	62	35	34	12	12	4

6. I felt that members kept their word in

	1	2	3	4	5	6	7
My subteam	5	11	10	30	38	73	101
Other subteam	7	14	10	34	47	66	90

7. I felt that members were honest with me in

	1	2	3	4	5	6	7
My subteam	0	2	4	22	41	75	124
Other subteam	1	3	6	23	45	77	113

8. I felt that members negotiated joint expectations fairly in

	1	2	3	4	5	6	7
My subteam	2	9	5	36	30	71	85
Other subteam	0	8	12	48	61	75	64

9. I felt that members tried to get the upper hand in

	1	2	3	4	5	6	7
My subteam	101	53	32	38	22	14	8
Other subteam	94	61	31	39	23	14	6

10. I felt confident that members would not exploit me in

	1	2	3	4	5	6	7
My subteam	10	9	13	29	38	65	104
Other subteam	15	7	13	36	40	63	94

The following three questions relate to leadership roles:

My SUBTEAM leader

Role	Question	1	2	3	4	5	6	7
Innovator	Came up with inventive ideas	6	7	8	26	70	73	41
Innovator	Proposed new concepts and ideas	4	5	5	27	75	70	45
Broker	Served as liaison to project coordinators	4	4	9	19	46	64	85
Broker	Requested clarifications as needed regarding the project	5	4	12	21	60	70	59
Producer	Made certain that members delivered on stated goals	5	6	5	25	45	75	70
Producer	Got members to meet expected goals	5	7	4	22	44	79	70
Director	Made project priorities and direction clear	5	6	8	20	51	69	72
Director	Established project goals	5	2	7	31	45	78	63
Coordinator	Set the pace so that work was finished on time	4	5	10	23	38	75	76
Coordinator	Was effective in coordinating members to meet deadlines	7	6	4	17	37	86	74
Monitor	Set milestones and monitored member progress	8	8	8	33	60	60	54
Monitor	Tracked completion of work	5	10	5	21	49	78	63
Facilitator	Surfaced key differences among members, then worked with members to resolve them	9	10	22	43	52	48	47
Facilitator	Encouraged participation of others in decision making	7	4	14	30	44	66	66
Mentor	Showed empathy and concern in dealing with members	8	2	10	32	57	64	58
Mentor	Treated each member in a caring, sensitive way	6	4	6	26	42	78	69
Director	Gave instructions regarding their work	7	5	17	24	50	65	63
Monitor	Let members know when performance expectations were not met	8	11	23	34	44	60	51

My other SUBTEAM leader

Role	Question	1	2	3	4	5	6	7
Innovator	Came up with inventive ideas	0	0	3	3	7	6	8
Innovator	Proposed new concepts and ideas	0	1	2	3	8	5	8
Broker	Served as liaison to project coordinators	0	0	2	4	9	5	7
Broker	Requested clarifications as needed regarding the project	0	0	2	4	7	7	7
Producer	Made certain that members delivered on stated goals	0	1	3	4	8	3	8
Producer	Got members to meet expected goals	0	0	3	3	7	6	8
Director	Made project priorities and direction clear	0	1	3	2	7	6	8
Director	Established project goals	0	3	2	3	4	7	8
Coordinator	Set the pace so that work was finished on time	0	1	2	2	7	7	8
Coordinator	Was effective in coordinating members to meet deadlines	0	1	2	3	6	6	9
Monitor	Set milestones and monitored member progress	0	0	4	4	8	4	7
Monitor	Tracked completion of work	0	2	2	3	8	6	6
Facilitator	Surfaced key differences among members, then worked with members to resolve them	0	2	3	4	5	6	7
Facilitator	Encouraged participation of others in decision making	0	1	2	4	7	5	8
Mentor	Showed empathy and concern in dealing with members	0	0	2	4	7	6	8
Mentor	Treated each member in a caring, sensitive way	0	0	2	5	5	5	10
Director	Gave instructions regarding their work	0	1	2	2	7	7	8
Monitor	Let members know when performance expectations were not met	0	1	2	6	5	5	8

My TEAM leader

Role	Question	1	2	3	4	5	6	7
Innovator	Came up with inventive ideas	2	1	6	15	25	28	23
Innovator	Proposed new concepts and ideas	3	0	7	12	31	26	21
Broker	Served as liaison to project coordinators	2	0	4	16	20	28	30
Broker	Requested clarifications as needed regarding the project	2	2	3	15	22	30	26
Producer	Made certain that members delivered on stated goals	2	2	3	16	18	25	34
Producer	Got members to meet expected goals	2	1	5	16	17	29	30
Director	Made project priorities and direction clear	3	0	3	19	18	27	30
Director	Established project goals	2	0	4	17	23	24	30
Coordinator	Set the pace so that work was finished on time	2	1	4	21	19	27	26
Coordinator	Was effective in coordinating members to meet deadlines	2	0	7	13	19	30	29
Monitor	Set milestones and monitored member progress	3	1	7	21	14	28	26
Monitor	Tracked completion of work	2	1	4	19	18	30	26
Facilitator	Surfaced key differences among members, then worked with members to resolve them	5	3	11	20	23	17	21
Facilitator	Encouraged participation of others in decision making	2	2	5	17	21	26	27
Mentor	Showed empathy and concern in dealing with members	2	0	7	23	15	29	24
Mentor	Treated each member in a caring, sensitive way	2	1	9	17	16	28	27
Director	Gave instructions regarding their work	2	1	4	22	25	18	28
Monitor	Let members know when performance expectations were not met	2	2	6	22	24	21	23

APPENDIX P

STUDY 2 FREQUENCIES OF SURVEY RESULTS

Below are the survey questions used in Study 2 with the frequencies (N) of the results. That is, for each choice for each question, the number of respondents who chose that choice is shown.

The ten following questions ask about early TRUST for both within a subteam and between subteams. Early trust was measured at the end of the first week, in Personal Reflection 1. The rating scale is 1=Stongly disagree and 7=strongly agree.

1. I woujld have preferred if some members had less influence over important aspects of the project in

	1	2	3	4	5	6	7
My subteam	68	33	18	15	10	1	1
Other subteam	69	27	19	18	10	3	0

2. I wanted to more closely monitor the work of members in

	1	2	3	4	5	6	7
My subteam	52	22	26	22	14	5	5
Other subteam	43	28	19	22	21	5	8

3. I was comfortable when other members worked on a critical task or problem in

	1	2	3	4	5	6	7
My subteam	6	13	19	23	29	24	32
Other subteam	9	14	24	27	24	25	23

4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in

	1	2	3	4	5	6	7
My subteam	9	11	15	22	27	32	30
Other subteam	12	9	24	34	21	27	19

5. I felt that members tried to get out of their commitments in

	1	2	3	4	5	6	7
My subteam	58	30	16	24	6	10	2
Other subteam	62	41	15	16	6	5	1

6. I felt that members kept their word in

	1	2	3	4	5	6	7
My subteam	3	9	10	17	20	41	46
Other subteam	4	8	10	19	21	37	47

7. I felt that members were honest with me in

	1	2	3	4	5	6	7
My subteam	2	1	11	10	21	41	60
Other subteam	3	2	11	12	21	43	54

8. I felt that members negotiated joint expectations fairly in

	1	2	3	4	5	6	7
My subteam	0	4	10	26	26	35	45
Other subteam	0	4	12	27	26	33	44

9. I felt that members tried to get the upper hand in

	1	2	3	4	5	6	7
My subteam	49	33	20	23	7	8	6
Other subteam	53	26	20	26	8	9	4

10. I felt confident that members would not exploit me in

	1	2	3	4	5	6	7
My subteam	3	12	12	15	21	30	53
Other subteam	2	12	15	18	21	24	54

To what extent were the following means of communication used *within* your subteam? (1=Never;7=to a great extent)

	1	2	3	4	5	6	7
PDT System	10	24	15	17	27	21	35
Instant messaging	15	13	9	22	22	26	42
E-Mail	3	3	6	12	14	37	74
Text messaging	67	18	8	16	16	18	6
FaceBook	90	21	9	16	7	3	3
Phone (mobile or land-line)	63	20	7	23	10	14	12
Internet phone (e.g. Skype)	121	10	3	7	2	5	1
Face-to-face meetings	19	2	7	11	17	30	63
FAX	142	0	1	2	3	1	0
Video conferencing	132	2	8	6	1	0	0
Teleconference calls	138	1	4	3	1	2	0
Course Management System	111	7	5	5	8	9	4
External forums or bulletin boards	124	1	5	13	3	3	0
Other	132	2	1	5	3	4	2

To what extent were the following means of communication used *between* subteams? (1=Never;7=to a great extent)

	1	2	3	4	5	6	7
PDT System	5	9	9	20	19	33	54
Instant messaging	22	6	10	21	17	30	43
E-Mail	2	3	3	17	15	34	75
Text messaging	115	4	6	5	6	8	5
FaceBook	97	17	15	9	5	3	3
Phone (mobile or land-line)	124	6	4	4	4	4	3
Internet phone (e.g. Skype)	131	4	1	5	4	2	2
Face-to-face meetings	124	4	4	5	3	3	6
FAX	142	0	1	4	2	0	0
Video conferencing	137	2	1	5	2	1	1
Teleconference calls	141	1	0	4	2	1	0
Course Management System	131	1	5	5	3	3	1
External forums or bulletin boards	131	1	1	7	6	2	1
Other	133	1	2	1	8	2	2

Compared with other teams you have worked on, use the following dimensions to rate the performance of your *SUBteam*. (1=low;7=high)

	1	2	3	4	5	6	7
Efficiency	1	0	8	17	31	47	45
Quality	1	0	9	16	42	43	38
Creativity	1	5	11	30	34	31	37
Adherence to schedule	2	4	6	20	23	50	44
Coordination of member efforts	2	3	12	12	29	53	38
Communication between members	1	6	8	15	27	46	46

Compared with other teams you have worked on, use the following dimensions to rate the performance of your *team.* (1=low;7=high)

	1	2	3	4	5	6	7
Efficiency	1	2	15	17	43	42	29
Quality	2	3	12	17	33	49	33
Creativity	2	3	14	22	44	43	21
Adherence to schedule	4	2	12	15	40	46	30
Coordination between subgroups	8	3	16	23	31	42	26
Communication between subgroups	8	6	18	20	35	31	31

Rate the performance of your SUBteam leader. If you have more than one SUBteam leader for your subteam, rate one of them here. (1=poor;10=outstanding)

	1	2	3	4	5	6	7	8	9	10
Subteam leader	3	0	3	0	7	6	19	33	24	35

Rate the performance of the other SUBteam leader for your subteam. (1=poor;10=outstanding)

	1	2	3	4	5	6	7	8	9	10
Subteam leader	0	0	2	1	0	0	1	6	5	3

Rate the performance of your TEAM leader. (1=poor;10=outstanding)

	1	2	3	4	5	6	7	8	9	10
Team leader	3	2	1	5	1	6	12	20	24	33

The following 10 questions measure longer term TRUST: The rating scale is 1=Strongly Disagree and 7=Strongly Agree.

1. I would have preferred if some members had less influence over important aspects of the project in

	1	2	3	4	5	6	7
My subteam	56	37	21	15	7	10	3
Other subteam	48	42	20	21	8	7	3

2. I wanted to more closely monitor the work of members in

	1	2	3	4	5	6	7
My subteam	47	23	29	11	26	10	3
Other subteam	30	29	26	22	14	17	11

3. I was comfortable when other members worked on a critical task or problem in

	1	2	3	4	5	6	7
My subteam	3	5	11	18	31	42	39
Other subteam	8	8	10	25	35	34	29

4. Even if I could not monitor them, I was comfortable giving a critical task or problem to other members in

	1	2	3	4	5	6	7
My subteam	4	3	8	30	23	42	39
Other subteam	8	9	22	24	22	39	25

5. I felt that members tried to get out of their commitments in

	1	2	3	4	5	6	7
My subteam	50	37	19	18	11	9	5
Other subteam	45	29	23	20	15	10	7

6. I felt that members kept their word in

	1	2	3	4	5	6	7
My subteam	2	4	14	15	21	44	49
Other subteam	6	6	11	25	21	42	38

7. I felt that members were honest with me in

	1	2	3	4	5	6	7
My subteam	1	2	5	10	18	49	64
Other subteam	4	8	6	13	21	45	52

8. I felt that members negotiated joint expectations fairly in

	1	2	3	4	5	6	7
My subteam	4	3	5	20	31	37	49
Other subteam	4	5	8	28	32	35	37

9. I felt that members tried to get the upper hand in

	1	2	3	4	5	6	7
My subteam	61	30	18	20	8	9	3
Other subteam	60	27	18	22	8	11	3

10. I felt confident that members would not exploit me in

	1	2	3	4	5	6	7
My subteam	6	9	13	16	19	35	51
Other subteam	8	5	14	22	14	37	49

The next three questions measure satisfaction with a subteam and team (1=Strongly Disagree; 7=Strongly Agree):

I was satisfied with members of

	1	2	3	4	5	6	7
My subteam	1	1	5	8	17	35	64
The other subteam	5	10	6	15	17	30	48

I was pleased with the way the members of _____and I worked together.

	1	2	3	4	5	6	7
My subteam	0	0	6	12	12	37	64
The other subteam	3	6	14	13	22	26	47

I was very satisfied working with

	1	2	3	4	5	6	7
My subteam	0	3	3	10	15	38	62
The other subteam	5	6	8	15	23	33	41

The next three questions measure the eight leadership roles:

My SUBTEAM leader

Role	Question	1	2	3	4	5	6	7
Innovator	Came up with inventive ideas	2	3	6	24	27	22	24
Innovator	Proposed new concepts and ideas	1	1	6	19	34	31	16
Broker	Served as liaison to project coordinators	3	5	5	16	18	33	28
Broker	Requested clarifications as needed regarding the project	2	4	6	20	22	28	26
Producer	Made certain that members delivered on stated goals	1	2	6	24	18	35	22
Producer	Got members to meet expected goals	1	2	4	23	24	31	23
Director	Made project priorities and direction clear	1	1	6	15	23	39	23
Director	Established project goals	1	3	7	15	15	37	30
Coordinator	Set the pace so that work was finished on time	2	1	6	18	20	31	30
Coordinator	Was effective in coordinating members to meet deadlines	1	0	8	15	21	31	32
Monitor	Set milestones and monitored member progress	1	4	9	21	21	29	23
Monitor	Tracked completion of work	2	3	7	18	24	26	28
Facilitator	Surfaced key differences among members, then worked with members to resolve them	6	9	14	20	17	22	20
Facilitator	Encouraged participation of others in decision making	2	5	5	19	12	37	28
Mentor	Showed empathy and concern in dealing with members	2	5	7	17	18	31	28
Mentor	Treated each member in a caring, sensitive way	1	5	4	15	17	36	30
Director	Gave instructions regarding their work	1	5	6	17	20	31	28
Monitor	Let members know when performance expectations were not met	2	12	5	25	14	24	26

My other SUBTEAM leader

Role	Question	1	2	3	4	5	6	7
Innovator	Came up with inventive ideas	1	0	3	0	2	2	0
Innovator	Proposed new concepts and ideas	0	1	1	2	1	3	0
Broker	Served as liaison to project coordinators	1	0	1	1	2	3	0
Broker	Requested clarifications as needed regarding the project	0	0	2	2	3	1	0
Producer	Made certain that members delivered on stated goals	0	1	0	2	2	3	0
Producer	Got members to meet expected goals	0	0	2	1	1	3	1
Director	Made project priorities and direction clear	0	0	1	2	1	3	1
Director	Established project goals	0	0	0	3	3	1	1
Coordinator	Set the pace so that work was finished on time	0	0	1	1	2	2	2
Coordinator	Was effective in coordinating members to meet deadlines	0	0	2	1	1	2	2
Monitor	Set milestones and monitored member progress	0	1	1	1	0	3	2
Monitor	Tracked completion of work	0	1	0	2	2	0	3
Facilitator	Surfaced key differences among members, then worked with members to resolve them	1	0	2	1	2	1	1
Facilitator	Encouraged participation of others in decision making	0	1	0	3	1	2	1
Mentor	Showed empathy and concern in dealing with members	1	0	3	0	3	1	0
Mentor	Treated each member in a caring, sensitive way	0	0	1	2	2	2	1
Director	Gave instructions regarding their work	0	0	1	1	4	2	0
Monitor	Let members know when performance expectations were not met	0	0	0	5	1	2	0

My TEAM leader

Role	Question	1	2	3	4	5	6	7
Innovator	Came up with inventive ideas	4	6	8	12	19	28	14
Innovator	Proposed new concepts and ideas	2	6	6	15	18	30	14
Broker	Served as liaison to project coordinators	2	3	8	7	12	29	30
Broker	Requested clarifications as needed regarding the project	2	2	10	8	12	33	24
Producer	Made certain that members delivered on stated goals	2	6	6	5	12	35	25
Producer	Got members to meet expected goals	2	5	9	4	16	30	25
Director	Made project priorities and direction clear	2	2	8	6	9	35	29
Director	Established project goals	2	2	8	7	9	32	31
Coordinator	Set the pace so that work was finished on time	3	3	9	5	11	35	25
Coordinator	Was effective in coordinating members to meet deadlines	3	2	5	14	9	30	28
Monitor	Set milestones and monitored member progress	2	3	7	9	13	37	20
Monitor	Tracked completion of work	3	3	5	11	10	30	29
Facilitator	Surfaced key differences among members, then worked with members to resolve them	6	8	15	8	12	24	18
Facilitator	Encouraged participation of others in decision making	3	1	13	11	14	29	20
Mentor	Showed empathy and concern in dealing with members	4	5	11	11	10	30	20
Mentor	Treated each member in a caring, sensitive way	3	5	6	9	9	34	25
Director	Gave instructions regarding their work	3	2	8	10	15	27	26
Monitor	Let members know when performance expectations were not met	6	7	10	9	13	27	19

The next three questions measure satisfaction with a subteam leader:

I felt that my subteam leader was fair. (1=Strongly Disagree; 7=Strongly Agree)

	1	2	3	4	5	6	7
Subteam leader	1	1	0	10	7	33	56

I was comfortable entrusting critical tasks to my subteam leader. (1=Strongly Disagree; 7=Strongly Agree)

	1	2	3	4	5	6	7
Subteam leader	1	0	4	8	9	32	54

Rate your satisfaction with your SUBteam leader. (1=Not at all satisfied; 7=completely satisfied)

	1	2	3	4	5	6	7	8	9	10
Subteam leader	1	0	1	2	5	7	12	20	20	40

The three questions above are repeated to measure satisfaction with a co-subteam leader. Logic in the survey skips these three questions if there are not two subteam leaders in a single subteam.

I felt that my *other* subteam leader was fair. (1=Strongly Disagree; 7=Strongly Agree)

	1	2	3	4	5	6	7
Other subteam leader	0	0	2	2	1	1	2

I was comfortable entrusting critical tasks to my *other* subteam leader. (1=Strongly Disagree; 7=Strongly Agree)

	1	2	3	4	5	6	7
Other subteam leader	0	0	1	2	0	3	2

Rate your satisfaction with your *other* SUBteam leader. (1=Not at all satisfied; 7=Completely satisfied)

	1	2	3	4	5	6	7	8	9	10
Other subteam leader	0	0	0	1	1	1	0	2	2	1

The next three questions measure satisfaction with a team leader.

I felt that my team leader was fair. (1=Strongly Disagree; 7=Strongly Agree)

	1	2	3	4	5	6	7
Team leader	2	1	5	5	11	27	40

I was comfortable entrusting critical tasks to my team leader. (1=Strongly Disagree; 7=Strongly Agree)

	1	2	3	4	5	6	7
Team leader	3	3	7	4	6	29	39

Rate your satisfaction with your TEAM leader. (1=Not at all satisfied; 10=Completely satisfied)

	1	2	3	4	5	6	7	8	9	10
Team leader	3	0	4	5	0	0	6	13	21	35

The final series of questions measure ineffective bad leadership. The scale ranges from 1=Srongly Disagree to 7=Strongly Agree.

My SUBTEAM leader

	1	2	3	4	5	6	7
lacked the skill or will to sustain effective action.	60	27	10	5	2	3	1
was unyielding and did not adapt to new ideas.	67	24	7	2	5	1	2
lacked self-control and acted without thinking.	72	24	3	6	0	2	1

My OTHER subteam leader

	1	2	3	4	5	6	7
lacked the skill or will to sustain effective action.	3	1	1	2	0	1	0
was unyielding and did not adapt to new ideas.	3	1	2	0	2	0	0
lacked self-control and acted without thinking.	3	1	1	2	0	1	0

My TEAM leader

	1	2	3	4	5	6	7
lacked the skill or will to sustain effective action.	48	21	8	6	3	3	2
was unyielding and did not adapt to new ideas.	51	19	10	7	1	1	2
lacked self-control and acted without thinking.	56	18	7	4	3	1	2

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