

Leadership for Distributed Teams

LEADERSHIP FOR DISTRIBUTED TEAMS

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Preface

Leadership for distributed teams is by some coined an oxymoron. I myself have experienced quite some leadership from a distance, first of all during the time I worked for Delft University, which I did partly from my home office. During the last two years, when I was no longer employed at Delft University, the importance of leadership increased, but I had fewer opportunities to travel to Delft because of other obligations. If it was leadership that enabled me to write this dissertation then I can simply say leadership at a distance is not an oxymoron, but rather an opportunity.

As I am aware that this page will be read by many, I will mention many that have helped me during the process of doing research and writing this dissertation.

This research would not have been possible without the support of The Netherlands Organization for Scientific Research (NWO). This research project was financed through the research track Society and the Electronic Highway (MES). Nor would this research have been possible without the support of Delft University of Technology, and specifically my colleagues at the unit of Organizational Behaviour and Innovation (OBI). Many thanks go out to Erik Andriessen and Deanne den Hartog, who have overviewed this project as my promoters. Your helpful comments during this project have made me find my way from the development of the initial proposal to the end result that lies in front of you. I am also very grateful to my copromotor Robert Verburg, who also fulfilled the role of daily supervisor. Robert, without your support and patience I might not have made it to the finish, thank you very much. I would also like to thank my colleagues at the unit OBI. Thank you for the good times during lunch and the outings with the unit. Helen, thank you very much for all your support, especially during the last two years when you were my ‘lifeline’ to Delft. I would like to thank Miranda for her helpful comments to improve the English in earlier versions of this manuscript. Last but not least I would like to thank Mr. Beenkens, my roomie and first Paranimf. I have had a wonderful time sharing my office with you, and I doubt that I will ever have as much fun with a colleague again.

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I am grateful to all the leaders who were willing to talk about their experiences with leading distributed teams and to share their wisdom. Many of them also went to great

length to enable me to gather survey data from members of their respective teams, in which time was always scarce. Although I can't mention everyone personally, many thanks go out to the team leaders and their teams from the following organizations: Philips, Shell, Océ, IBM, Logica CMG, Exact Software, Accenture, DSM and Honeywell.

At the home front I would like to thank my friends, not because they read the manuscript so often, or because they gave me feedback on my research (they were not so much interested). I mostly thank them for being there when times were tough. They listened to me talking about the obstacles I encountered and, sometimes to my frustrations during this research. They listened, when actually they just asked themselves when I would get a 'real job'. Thanks in particular to Suzanne (my second paranimf), Jasper, Jeroen, Bram and Loes, Alexander, Joep † and Susanne and Jeanine. Of course I could not have finished this project without the everlasting support of my wife, Annebelle. Many thanks go out also to my parents for their support during this project.

Contents

Leadership for distributed teams: an overview of research	7
1.1 Introduction and structure of the dissertation	8
1.2 Developments that have lead to distributed teams	10
1.2.1 ICT developments	11
1.2.2 Globalization	12
1.2.3 Cost reduction, offshoring and outsourcing	13
1.2.4 Business continuity	14
1.2.5 Flexibility and project based organizations	15
1.2.6 Using networks of expertise and task forces	15
1.2.7 Summary and discussion	16
1.3 Leadership in distributed teams: insights for practitioners.....	16
1.3.1 Normative contributions about leadership in distributed teams	16
1.3.2 Summary and Discussion	20
1.4 Insights from empirical studies of leadership in distributed teams	20
1.4.1 Experimental studies on distributed team leadership	21
1.4.2 Field studies of distributed team leadership	22
1.4.3 Summary and Discussion	24
1.5 Conclusions	25
The impact of team structure on distributed team work: a leader perspective of challenges and how to overcome them.....	29
2.1 Introduction	29
2.1.1 Central concepts	29
2.2 Methodology.....	31
2.2.1 Procedure	31
2.2.2 Sample	31
2.2.3 Analysis	34
2.3 Results	35
2.3.1 Geographic Distance.....	35
2.3.2 Mediated communication	37
2.3.3 Time differences	43
2.3.4 Member cultural diversity	44
2.3.5 Emergent themes	50
2.3.6 Getting things done: effective leadership for distributed teams	52
2.3.7 Getting things done: the added value of face-to-face meetings.....	56
2.4 Discussion.....	58
2.4.1 Theoretical and managerial implications.....	59
2.4.2 Limitations and further research.....	60
2.4.3 Conclusion	61
Development of a research model to study leadership in distributed teams.....	63
3.1 Introduction	64
3.2 On the configuration of distributed teams	65
3.2.1 Defining distributed teams.....	65

3.2.2 Geographic distance	66
3.2.3 ICT mediation and face-to-face contact	67
3.2.4 Time differences.....	70
3.2.5 Team member diversity.....	71
3.2.6 General team characteristics.....	72
3.2.7 Task characteristics	75
3.2.8 Summary and Discussion	76
3.3 Challenges for distributed teams: work relationships and shared understanding ...	77
3.3.1 Effective working relationships	77
3.3.2 Shared understanding	80
3.3.3 Summary and Discussion	82
3.4 Leadership, team processes and outcomes	83
3.4.1 Leadership, team performance and innovation	83
3.4.2 Mediators in the leadership-performance relationship: shared understanding and knowledge perception	88
3.5 A contingency approach to leadership in distributed teams.....	90
3.5.1 Moderators for the impact of leadership on shared understanding and knowledge perception: geographic distribution and specialization	91
3.6 Conclusion.....	93
The impact of leadership on innovative behavior and distributed team performance: an empirical study of mediators and moderators	95
4.1 Introduction	95
4.2 Methodology	95
4.2.1 Sample.....	95
4.2.2 Measures.....	96
4.3 Results	101
4.3.1 Team level analyses	102
4.3.2 Individual level analyses	104
4.4 Discussion	112
4.4.1 Main findings	113
4.4.2 Conclusions	115
Leadership for distributed teams: an integrated discussion	117
5.1 Introduction	117
5.2 Transformational leadership at a distance.....	119
5.3 The importance of shared understanding and trust for team effectiveness	120
5.4 Are distributed teams like any other kind of team?	123
5.5 Practical implications	126
5.5.1 Transformational leadership.....	126
5.5.2 Shared understanding and trust	127
5.5.3 The nature of distributed teams	127
5.6 Reflection	128
5.7 Future research	130
Concluding remarks	134
References	136
Appendix I: Project proposal	149

Appendix II: Online checklist for interviews	151
Appendix III: Interview script for study 1	155
Appendix IV: Coding scheme for qualitative analysis	157
Appendix V: Scale characteristics for distance leadership.....	162
Appendix VI: Scale characteristics for shared understanding	164
Appendix VII: Scale characteristics for trust in the knowledge of team colleagues.....	165
Appendix VIII: Scale characteristics for innovative behavior	166
Appendix IX: Scale characteristics for team performance	167
Appendix X: Scale characteristics for team member specialization.....	168
Summary (in English)	169
Samenvatting (in het Nederlands).....	173
About the Author.....	178

Chapter 1

Leadership for distributed teams: an overview of research

This chapter introduces this dissertation and reviews the literature on leadership in distributed teams. Distributed teams are teams of which team members are working geographically separated from each other. The term distributed team is related to the term virtual team, which is defined as a group of people, working on an interdependent task, while being geographically separated and of which members therefore communicate and coordinate predominantly by means of Information and Communication Technology (ICT) (Dubé & Paré, 2004; Martins, Gilson, & Maynard, 2004; Powell, Piccoli & Ives, 2004). The term virtual team is sometimes used for different phenomena, i.e. electronic work groups, distributed teams, and therefore as a definition it is potentially confusing. For the remainder of this dissertation I therefore use the term distributed team, while leaning heavily on many sources from the virtual teams' literature. The core characteristics of teams in this dissertation are geographical separation of team members and predominant use of ICT in communication.

Distributed teams are increasingly used in organizations as a result of developments in ICT (enabler), globalisation, cost reduction, business continuity, flexibility and using networks of expertise (drivers). Due to their geographic distribution, members of such teams predominantly communicate via ICT mediated communication means, which is much different from conventional teams, in which face-to-face interaction is the norm. Theory on leadership and management is developed largely on the basis of conventional (co-located) work forms and therefore not much is known about how to deal with such teams from a leader perspective. Although several authors present theory about complications for leaders in distributed teams (e.g. Bell & Kozlowski, 2002) most papers on leadership are prescriptive in nature. Empirical studies mostly use the model of transactional versus transformational leadership in experimental designs. These (mostly) experimental studies do not incorporate the variation in context of distributed teams in organizational practice and lead to inconsistent findings (Zhang & Fjermerstad, 2006). Field research has paid attention to context, but has been particularly scarce and largely explorative in nature. There is a need for more field research, using existing leadership theory, while taking into account the context of distributed teams to develop theory and to enable leaders to deal with such teams. Also there is a need to further explore the concept of "distance leadership". Distance leadership is a leadership approach aimed at leading team members at locations geographically separated from the leader and each other and should not be confused with hierarchical leadership distance. Research is needed to explore

the concept “distance leadership”. What does it entail and how does distance leadership relate to existing leadership concept? The purpose of this dissertation is to address this gap by presenting two field studies of leadership in distributed teams.

1.1 Introduction and structure of the dissertation

Distributed teams exist in many forms, with different types of tasks and purposes. One such task, often found in global organizations is strategic management and business alignment across geographically separated regions. Next is a quote with an example of such a team.

Within division A of Organization I, a range of co-polyester elastomeric products are developed, produced and sold worldwide. The organization has a matrix structure, within which three independent profit and loss centers are installed (America's, Europe and Asia). Within the matrix structure the director of each region, also has responsibility for a product line. For this purpose we have a global team, the Global Product Team A. This team incorporates regional product managers, the business manager Europe, the head of R&D, our manufacturing head and dedicated support from the finance side, as well as several application development and business development engineers. We meet regularly to discuss Division A's Global Strategy; we monitor growth and we try to find solutions for problems in this team. It's really a leadership team for Division A.

[Taken from an interview with the CEO of Division A, February 2007]

The above example shows how an organization that has historically been based in The Netherlands, developed into an organization with sites worldwide. The geographically distributed nature of this organization results in a need to coordinate activities that used to be local activities across distance. In this case, by means of a global management team. Researchers have noted that distributed teams, which use technology to interact across distance are becoming commonplace in organizations (Gibson & Cohen, 2003). Such teams have numerous advantages for organizations, such as tapping into scarce human resources, providing a flexible means to integrate experts on an ad hoc basis, cost reduction and reducing time to market. However, in order to achieve these advantages, organizations face challenges with effectively managing such teams. Because of geographic separation, communication through lean media and much diversity in backgrounds of team members, distributed teams often have problems with effective communication (Cramton, 2002;

Kayworth & Leidner, 2000) and coordination (Maznevski & Chudoba, 2000). Moreover, research indicates that such teams have difficulty to develop into cohesive teams, with adequate levels of trust among distributed team members (Jarvenpaa & Leidner, 1999).

Theory on management and leadership is largely based on research in traditional (non-distributed) organizations with leaders that are able to interact directly with their subordinates (Bell & Kozlowski, 2002). Within distributed teams direct face-to-face interaction is scarce, and this puts conventional leadership theory and practices under pressure (De Rooij, Verburg, Andriessen, & Den Hartog, 2007). Although many traditional leadership principles may still apply, leaders of distributed teams often find themselves facing new unfamiliar challenges, which may require special sets of skills (Cascio & Shurygailo, 2002). Such challenges include effective communication via mediated means, not having team members around to quickly discuss things, and having to cope with different time zones (Duarte & Snyder, 2006).

The increased use of distributed teams raises questions about the role of leadership, such as: (1) “In what way does the distributed nature of these teams affect a leader’s possibilities to influence followers?” (2) “Do insights from conventional leadership research hold up for distributed teams?” and (3) “What kinds of leadership behaviours can help a group of distributed individuals to develop into a smoothly operating team?” Researchers indicate that overall relatively little is known about leading and managing distributed teams (Axtell, Fleck, & Turner, 2004; Kirkman, Rosen, Tesluk, & Gibson, 2004), that there is a paucity of development of theory, and that more research in this area is clearly needed (Kahai, Fjermestad, Zhang & Avolio, 2007).

As said, the purpose of this dissertation is to fill the gap of leadership research in distributed teams by addressing the following general question: “*What is effective leadership for distributed teams?*” This question is answered by means of a 3-step approach. The first step is a literature review of papers in which empirical studies of leadership in distributed teams are described. This first step will be reported in this first chapter. Chapter 2 reports an explorative qualitative study, aimed at describing the distributed team context and its implications for leadership. It pays attention to the perspective of leaders of distributed teams in organizations by discussing team context and implications for team processes and leadership. Next, Chapter 3 links insights from leadership research and studies aimed at the distributed team context by addresses how leaders can influence team processes and outcomes and the role of team context in this. In the chapter, a research model with hypotheses concerning team context, leadership, team processes and outcomes is presented. These hypotheses are tested in Chapter 4, which describes the second study. In chapter 5 an integrative discussion of the results of the two empirical studies will be presented.

This dissertation contains two empirical studies. The first study, which is reported in Chapter 2, is explorative and qualitative in nature. It explores the impact of the structure of distributed teams on leadership and team processes. This study will conclude with several important challenges for distributed teams and a list of actions and behaviours that are perceived important to overcome these challenges in distributed teams. The second study, reported in Chapter 4, is aimed at testing several hypotheses concerning leadership, team processes and team effectiveness, which are presented in Chapter 3.

In this introductory chapter a review of leadership research in distributed teams is presented. One important enabler and several drivers of distributed team work are discussed. Second, an overview of empirical research on leadership in distributed teams is presented followed by an overview of relationships that have already been examined in empirical studies. This review shows that more empirical research, taking the context of distributed teams into account, is necessary to further our understanding of leadership in distributed teams.

1.2 Developments that have lead to distributed teams

Developments in ICT, with advanced tools becoming available to facilitate communication and coordination at a distance have enabled the use of distributed teams. Other developments (drivers) have lead to the widespread use of such teams (Andriessen, 2002; Solomon, 2001). In the following section six developments, one enabler and five drivers, that have lead to the inception of distributed teams will be discussed: (1) ICT developments, (2) globalisation, (3) cost reduction, (4) business continuity, (5) flexibility and (6) using networks of expertise at the centre of productive work.

As a result of these developments distributed teams are increasingly used in organizations to coordinate all kinds of activities, such as research and development (R&D) (Von Zedtwitz, Gassmann, & Boutellier, 2004), management tasks (in which national or regional business units have to align strategic issues), purchasing (raw materials or half products), knowledge management and protection of intellectual property (IP), sales activities, and ICT support tasks to support internal and external operations (De Rooij et al., 2007). This part of the chapter will also provide some examples of distributed teams that are in use in organizations today. Several of these examples originate from the first study (reported in Chapter 2). These examples show that the six developments are sometimes difficult to separate conceptually, and teams are often formed as a result of multiple developments.

1.2.1 ICT developments

The large-scale use of diverse applications in the area of information and communication technology has been one of the key factors in the emergence of distributed teams. With the internet an infrastructure has emerged that enables many organizations to launch distributed teams. Few technical obstacles remain for communication and collaboration across geographic boundaries, as these processes are supported by high tech collaboration solutions (Verburg, Andriessen, & De Rooij, 2005). Table 1.1 provides an overview of widely used communication and coordination tools that are available to support work in distributed teams. Some applications are developed specifically for communication or coordination, but an increasing number of applications (e.g. groupware) facilitate both by providing a virtual space where team members can communicate, interact, exchange documents and coordinate tasks.

Table 1.1: Communication and coordination tools for distributed teams (adapted from Dennis & Valacich, (1999) and Vartiainen, (2004).

Communication tools	Coordination tools
Telephone (one-on-one/voice over IP)	Shared directory in internet
Telephone conferencing or voice over IP (VOIP)	Shared databases
Videoconferencing rooms	Project management groupware
Online chat	Workflow management software
Desktop videoconferencing	Learning environment
Text messages (SMS)	Team website (team space)
Multimedia messages (MMS)	Team workspace
Special discussion lists	Shared team calendar
(Desktop) web conferencing (webcam and voice)	Group Decision Support Systems (GDSS)
(Desktop) data conferencing (Netmeeting, shared excel, or Web-x)	Electronic Whiteboards or Smart boards
Instant messaging	Wiki
E-mail	

The rapid developments in technology and the internet have accelerated the prevalence of work over distance and most large corporations nowadays use distributed teams to some extent (Duarte & Snyder, 2006; Gibson & Cohen, 2003; Hinds & Kiesler, 2002; Townsend, DeMarie, & Hendrickson, 1998). With the enormous increase in people and organizations who are connected to the internet, and the increase in bandwidth that has been realised over the last decade, very advanced tools for distant collaboration such as high quality (desktop) videoconferencing, electronic whiteboards, smartboards, and groupware are now available (Andriessen, 2002). These tools enable increasingly complex work to be performed over distance. Electronic whiteboards for instance enable team members to discuss issues with the exchange of drawings and sketches, in which changes can be made visible across distance in real time (Olson & Olson, 2001).

1.2.2 Globalization

Many international and global organizations can be found in business nowadays. Figure 1.1 shows that economic activity in the world's six largest economies has increased tremendously over the last three decades (OECD, 2008). A steep increase in gross domestic products is noticeable in the United States and even more so in China. Since 2000, economies in the Asian region such as China and India have almost doubled their GDP's.

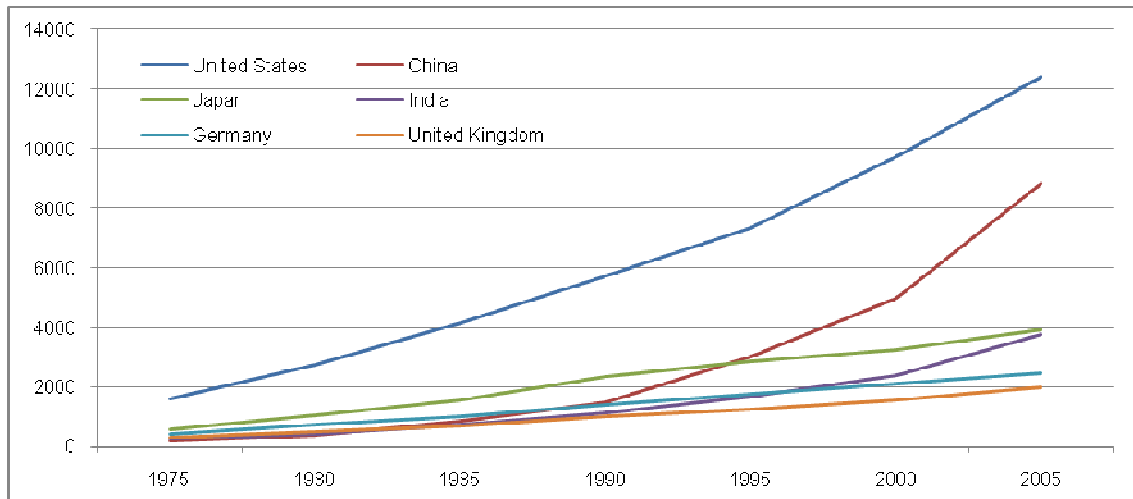


Figure 1.1: Size of GDP (in purchasing power parities) of the world's six largest economies from 1975 to 2005 in billions

This increase in GDP is the result of a sharp increase in international trade between Western and upcoming Asian economies. Large foreign investments are made by countries of the G7 (see Figure 1.2, OECD Globalization Indicators, 2007) and numerous organizations now work together with supplier and customer organizations worldwide. Some organizations even have facilities in all continents themselves, such organizations are called global organizations.

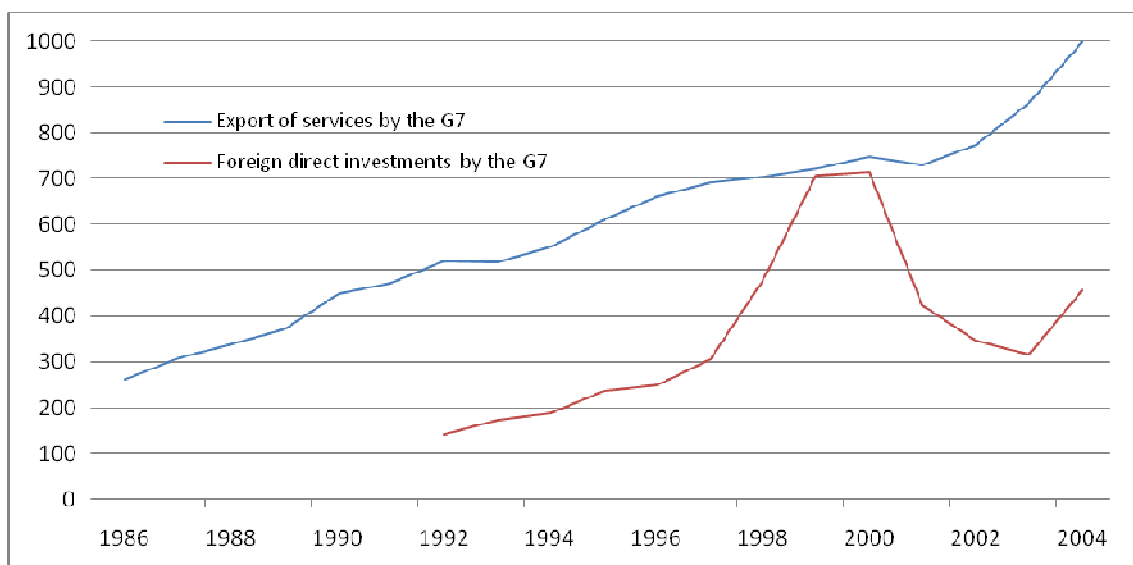


Figure 1.2: Exports of services and outward flows of FDI by the G7 countries (billions of USD current prices)

Examples of leading global companies are IBM, Microsoft, British Petroleum, Coca Cola, Shell, Heineken, Philips and DSM. Within such organizations an increasing number of activities need to be aligned across business units. Here we will discuss some examples of distributed teams that were in operation in some of the global companies that were involved in the studies in this dissertation.

Globally distributed (management) teams are used for purposes such as product development and innovation management, other teams are formed for problem solving or for customer services (Finholt, 2002). Such activities are often performed in global platform teams. Some of these teams are more continuous in nature and coordinate a product line with continuous products, with new releases each year. Others, which are focused on development and production of a specific (one time only) product, have more discrete life cycles (for instance, up to 1 year). One organization with a large number of projects participating in the first study (see Chapter 2) focuses on development and production of a wide range of electronic equipment, ranging from lighting products to household electronics and MRI scan equipment. Within this organization we looked at large distributed project teams within two business areas, either working on the development of new lamp concepts, or on the development of television sets.

Such teams are generally quite large, with hundreds of people involved worldwide. Most of these teams were distributed over three regions: the US, Europe and Asia with many distributed locations on each continent. Distributed teams such as these often involve also cooperation with a number of supplier and customer organizations in the different regions. Such teams tend to be coordinated by a platform team, or core team, which is much smaller in size (approximately 5-10 members). Within another organization, which is working on development and production of advanced plastics, global management teams are also found. These teams are formed with the purpose of aligning business within several overall product areas across Europe, the US and Asian continents. Such teams need to deal with large differences in cultural backgrounds of team members. In many cases time differences need to be overcome as well.

1.2.3 Cost reduction, offshoring and outsourcing

Reduction of costs is a central theme in most organizations. With globalization the need to travel and coordinate across distance has increased tremendously over the last decades, with higher costs of operation as a result. With increased travel across the world, economic activities have grown worldwide, and international collaboration has increased, specifically between “the West” and upcoming Asian economies (India, China).

Although air travel became cheaper over the last decades due to its increased scale and more efficient airplanes, this development seems to have come to an end. Shrinking international oil reserves, with oil prices rising have recently been the cause of cost increases of travel by airplane. With the increasing need to work across distance and

increased costs of travel due to scarcity of fossil fuels, organizations will increasingly use communication and coordination technology to facilitate work at a distance (Duarte & Snyder, 1999; Gibson & Cohen, 2003; Hinds & Kiesler, 2002; Townsend et al., 1998).

Distributed teams enable international organizations to reduce costs in several ways, for instance by offshoring, i.e. moving activities to somewhere on a different continent, with cheaper labour. A second strategy that organizations may adopt is to outsource activities. This essentially means that some activities will take place outside the boundaries of the organization, while the organization focuses increasingly on core activities. Examples of activities that are outsourced by organizations are for instance, payroll, administration, or support of IT systems. Outsourcing can take place in several ways, for instance by selling part of an organization to an external party, or by terminating activities to hire them elsewhere. Parts of activities can also be outsourced to external organizations that move these activities to lower cost areas, which combines outsourcing and offshoring. The trends themselves can be seen as part of globalization and cost reduction. However, companies that outsource work do not necessarily have a globalisation strategy. Outsourcing of activities in organizations generally has two basic reasons: not enough personnel available in the local labour market and attempts to reduce costs of operation.

Distributed teams which are involved in offshoring or outsourcing have in common that their tasks can be coordinated relatively easily via mediated means. Although the work is essentially executed by separate (distributed) organizational entities, the interdependence of these activities forces these entities to at some level work like a team. Such teams are found in numerous organizations, including several organizations involved in this research project. These teams usually have to cope with time differences between locations. Although most teams of this kind only incorporate team members from two different cultures, the differences between these two cultures are often quite large. More on the characteristics of these teams is presented in Chapter 2.

1.2.4 Business continuity

Organizations increasingly adopt a strategy in which up to 24 hours of continuity of activities is possible. Although working in different shifts to cover a 24 hour day has been around for a long time, a relatively recent trend is to enable this by using time differences across geographically distributed locations, to minimize costs and impact on workers. Software production organizations are one example of companies that increasingly adopt this strategy, mainly to reduce cost and to reduce the ‘time-to-market’ of new software products. Software support departments are another example in which 24 hour coverage is achieved through using distributed teams. This for instance is used for system and software support for organizations that have activities or customers in multiple regions and time zones. Multinational organizations nowadays run advanced Enterprise Resource Planning (ERP) systems (Bal & Foster, 2000). Given the widespread use of such systems within

organizations, and the potential detrimental effects when these systems fail, organizations require global support, technical as well as functional for many sites worldwide. Increasingly this goal is achieved by installing distributed teams. These teams may include members from several dominant business areas worldwide, for example in the America's, within Western Europe and in (Southeast) Asia.

1.2.5 Flexibility and project based organizations

Besides increased globalization, a parallel trend is seen in decentralization of activities (Hertel, Geister, & Konradt, 2005). Teams are increasingly becoming the mechanism of choice to flexibly coordinate work (Turner & Muller, 2003). With the emergence of high quality ICT applications organizations are now able to facilitate work over distance more flexibly, by means of distributed (project) teams. Such teams are assigned to a specific task for as long as needed (Majchrzak, Rice, Malhotra, King & Ba, 2000). Teams are also a mechanism to coordinate interdependencies with supplier and customer organizations worldwide for development and production of new products. Developing such 'network organizations' also enables organizations to involve local markets early on in their product development. This may help organizations to understand whether their products are suitably for local markets or not, while also making sure that their products will pass local regulations and technical norms.

1.2.6 Using networks of expertise and task forces

An important reason for the emergence of distributed teams is a scarcity of highly trained (technical) experts in the Western European countries and the US, as was already discussed under offshoring. However, rather than developing teams with a longer lifecycle, with continuous tasks, distributed teams are increasingly used to bring together rare expertise on an ad hoc basis. An example of a team, which was formed to enable technical experts to combine their efforts at a distance was provided by Majchrzak et al. (2000). These researchers report about a group of eight globally distributed scientists from different organizations that rapidly developed a revolutionary rocket engine design. This example demonstrates how a complex and innovative design was performed with the expertise of eight highly specialized scientists, who were brought together with a tool called the "internet notebook". However, the design was not only a result from a careful combination of expertise but required a number of interdependent iterative 'distributed' brainstorming sessions among the team of rocket scientists. This example illustrates that innovative work, which requires input from 'rare technical experts' who are geographically separated, can be performed by means of ICT.

1.2.7 Summary and discussion

This section reviewed 6 important developments that have led to the increasingly widespread use of distributed teams. ICT developments are seen as an enabler for distributed teams (Kirkman et al., 2002). Important drivers that have led to the widespread use of distributed teams are globalisation, cost reduction, business continuity, flexibility and using networks of expertise. Although some of these developments are not recent, the combination of these developments created an increase of interaction, connectedness and interdependence of work across the globe, leading to increased reliance on distributed teams. Based on these developments work across distance is likely to become even more prominent in the future and therefore organizations need to understand how distributed teams can be managed effectively. In the next section we will review theory and research aimed at leadership in distributed teams.

1.3 Leadership in distributed teams: insights for practitioners

Since the 1950's several different approaches have been taken to study leadership and success in organizations. Starting with the 'great man' theories, leadership researchers studied personality traits, specific behaviors, styles, and types of power and influence. Also, situational and contingency approaches were used to investigate the role of context factors (such as level of maturity of followers, or task interdependence) in the success of leaders (Bass & Stogdill, 1990). One of the most dominant and widely applied approaches to leadership today is described in the full range leadership model by Bass (1985) and Bass and Avolio (1990). The model is focused on two leadership styles: transactional and transformational leadership.

Contrary to this wealth of research and theory development on leadership in conventional contexts, there has been a paucity of theory development and leadership research in distributed teams (Zhang & Fjermestad, 2006). Several articles were published around leadership in distributed teams. These papers proposed several leadership concepts, such as 'remote leadership' (Connaughton & Daly, 2004b) and E-leadership (Avolio & Kahai, 2002). However, this line of work has been mostly practitioner oriented, proposing leadership behaviors, actions and tactics beneficial for most distributed teams. The next section will review a number of normative (how to) papers on leadership at a distance.

1.3.1 Normative contributions about leadership in distributed teams

Some of the work is aimed at leaders in organizational practice and is normative in style; focusing on 'how to' lead distributed teams, i.e. Cascio & Shurygailo, (2002) Zigurs,

(2003). For instance, Cascio and Shurygailo (2003) take a practical orientation for the management of distributed teams, i.e. in their terminology remote teams and matrixed remote teams. Zigurs (2003) discusses the implications for leadership in distributed teams in four categories: roles, presence, processes and technology.

Other work aims to develop scientific propositions, translating insights from the traditional team literature to the distributed team context (Bell & Kozlowski, 2002). Additionally this paper provides a list of propositions about effective leadership behaviors for distributed teams.

On the basis of three papers this section provides an overview of important leadership activities in 9 categories of leadership activities: (1) providing engaging direction, (2) structuration of communication, (3) looking for substitutes for leadership, (4) monitoring the team environment, (5) facilitating relationship building, commitment and cohesion, (6) providing recognition, (7) being pro-active and (8) relating to different cultures and (9) overcoming multiple responsibilities.

Providing engaging direction. According to Bell and Kozlowski (2002) distributed team leaders have to provide clear and engaging direction, combined with specific individual goals which enable individual members to monitor their own progress in order to develop 'self managing' teams. The authors suggest to develop appropriate habitual routines with rules and guidelines. Short lifecycles of distributed teams may complicate the development of working relationships and the development of working routines. The authors indicate that leaders need to facilitate this by setting out goals for the team and individuals.

Structuration of communication. According to Cascio and Shurygailo (2003) communication in distributed teams should be structured and leaders should develop long-term meeting schedules in which distributed and physical meetings are planned appropriately. Although this is important for all teams, distributed teams are expected to need more structure in this area because informal (random) meetings between distributed team members do not occur easily. According to Zigurs (2003) standards should also be developed for communication of contextual cues, in order to prevent misinterpretations. In addition, Zigurs (2003) suggests that team processes should be structured through process structuring tools, while maintaining possibilities to adapt tools to individual needs. Finally, according to Zigurs leaders should be aware of the implications of the choice for a communication medium, and choose the right medium for the message.

Looking for substitutes for leadership. According to Bell and Kozlowski (2002) the lack of face-to-face contact in the distributed team environment forces team leaders to look for substitutes for leadership. Leaders need to develop teams that are capable of self-managing, by paying attention to selecting individuals who can manage themselves, and by providing appropriate training. Zigurs (2003) suggests that leaders should make sure that both task and relational roles are provided for, either by team members or through

technology. She also indicates that emergent leadership and self leadership should be nurtured.

Monitoring the team environment. According to Bell and Kozlowski (2002), leaders of distributed teams need to constantly monitor any changes in the environment of the distributed team. Distributed team members are not able to see what is happening and what can influence work at other locations. For instance, if suddenly several team members fall ill at one location, this can severely disrupt the daily routine. It is important for remote team members to have this information so they can adapt accordingly. Changes at one location have to be signaled as soon as possible and communicated to the rest of the team, in order to increase awareness about the changing circumstances at the other locations. Distributed team leaders can fulfill a central role in obtaining relevant information and communicating this to their team.

Facilitating relationship building, commitment and cohesion. For relationship building Cascio and Shurygailo, (2003) underline the importance of a face-to-face kickoff meeting to enable team members to meet each other in person. Leaders have a challenge in distributed teams to counter the development of any 'us versus them' tendencies. Team leaders also need to motivate their team members to commit strongly to the overall team effort and they need to facilitate team coherence (Bell & Kozlowski, 2002). When teams are also distributed in time, leaders will have more difficulty with performance management, as they may encounter delay of information of events, which is also provided without information about the immediate context in which something occurred. It is therefore important for distributed teams that members communicate timely and with as much context information as possible. According to Ziguers, (2003) team leaders should therefore provide training on communication and participation in distributed teams, thereby recognizing that insights from conventional teams cannot be applied directly to the distributed team context. Moreover, leaders should use team building exercises, and face-to-face meetings to establish relationships, where possible. In general, special emphasis should be put on continuous relational development.

Providing recognition. According to Cascio and Shurygailo (2003) leaders are also challenged in providing adequate recognition for the efforts of all members, particularly for the team members who are less visible. Leaders therefore have to be instrumental in their recognition of the importance and equality of all team members. Further, leaders of distributed teams should allocate travel responsibilities fairly over members, regardless of where they are located. In addition, according to Cascio and Shurygailo, leaders should adopt a 'share the pain' attitude for the planning of meetings when possible. This implies that for face-to-face meetings the need to travel rotates across the team and for mediated meetings not always the same individuals have to suffer from the time differences. This can be achieved by either having these meetings very early or very late during their working day.

Being pro-active. According to Bell & Kozlowski (2002), distributed team leaders need to be pro-active, by devoting extra resources to structure performance management processes and by means of extra reviews and feedback opportunities. Furthermore, they need to anticipate problems and provide clear goals and direction. Leaders also have to prevent team members from becoming detached from the team by informing them about important changes in the environment. Moreover, with time differences affecting the team, leaders have to facilitate synchronous (mediated) interaction to facilitate bonding between team members. Leaders also have to be available for remote team members the same way they are available for co-located members and need to actively communicate and develop checkpoints in time, to get in contact with remote members, as they may sometimes be reluctant to contact their leader themselves. Finally, leaders should anticipate unintended consequences and use debriefing to discuss how the team deals with them.

Relating to different cultures. When members of distributed teams are diverse in functional backgrounds, come from different organizations and from different (national) cultures, leaders will have to relate to the worldviews of individual members, and to adapt their own behavior to person and situation. In such cases, Bell and Kozlowski (2002) suggest that leaders can try to develop a 'third culture'. This third culture, which refers to a team or organization culture (Schein, 1999), should facilitate mutual respect, trust and obligation and should bond the team members together. The focus here should also be to empower team members and to link them together as insiders of the group. Cascio and Shurygailo (2003) indicate that much of existing theory on management and leadership is developed in individualistic cultures, while 70% of the world population is living in collectivistic cultures. Distributed teams which increasingly integrate team members from countries all over the world provide extra complexity for leaders.

Overcoming multiple responsibilities. Team members and leaders of distributed teams may have multiple roles and responsibilities, within, but also largely outside the scope of the distributed team. According to Bell and Kozlowski, they may therefore experience role ambiguity and role conflict. To counteract, team leaders have to create clarity about individuals roles and responsibilities within the team. For members who also have responsibilities outside of the team, leaders need to have an overview of the time they can get from these members, and develop backup plans in case they are not available.

Leaders also have to coordinate with other (team) leaders to whom their team members are also reporting. This will help to increase clarity. Within matrixed remote teams with multiple managers, sometimes from multiple organizations, providing structure for the team is important (Cascio & Shurygailo, 2003). In these teams, extra effort is needed for clarifying roles, responsibilities and (external) interdependencies. The authors suggest that analyses of processes and stakeholders can help clarify who is dependent on whom, and in what way, which will help to prevent misunderstandings and conflicts.

1.3.2 Summary and Discussion

This section reviewed some practitioner-oriented work on distributed team leadership. In general, the distributed team environment seems to be more demanding for leaders in practically every aspect of leadership, than the environment of conventional teams. In essence, leaders have to more explicitly provide structure, develop working relationships and develop effective communication patterns with few opportunities for direct (face-to-face) interaction. Important leader behaviors were collapsed in 9 categories: providing engaging direction, structuration of communication, looking for substitutes for leadership, monitoring the team environment, facilitating relationship building, commitment and cohesion, providing recognition, being proactive, relating to different cultures and overcoming multiple responsibilities. The next section will go into results of empirical studies on leadership in distributed teams.

1.4 Insights from empirical studies of leadership in distributed teams

A literature search resulted in a list of 157 empirical studies in the distributed teams domain. The studies can be roughly divided in four main focus categories, which are described in Table 1.2.

Table 1.2. Types of studies performed in the distributed team domain.

Category	Type of study	Example	Number of studies
1	Studies that focus on how distributed teams differ from conventional teams in terms of communication, coordination and collaboration	Hinds & Mortensen, (2005)	45
2	Studies that focus on the communication technologies needed to facilitate work and enable knowledge sharing	Davidson & Henderson, (2000)	31
3	Studies that focus on team structure and processes and/or their relationship with team outcomes	Maznevski & Chudoba, (2000)	58
4	Studies that have focused on leadership in distributed teams	Kahai, Sosik, & Avolio, (2003)	23

Empirical studies that focused on leadership in distributed teams are relatively scarce. As can be seen from Table 1.3, only 23 studies were found to be aimed at leadership in distributed teams. Most of the studies found were experimental in nature, focusing mostly on two leadership models, using student teams. Only few field studies paid attention to leadership in distributed teams in organizations. As a result, our knowledge of the specific requirements of leaders for distributed teams in practice is still quite limited.

Table 1.3: Overview of empirical studies of leadership in distributed teams.

	Experimental studies with student teams	Field studies with teams or leaders in organizations
Transformational, Transactional and Inspirational Leadership	1. Hoyt and Blascovich, (2003) 2. Kahai, Sosik, and Avolio, (1997) 3. Kahai et al., (2003) 4. Sosik, Avolio, Kahai, and Jung, (1998) 5. Sosik, Kahai, and Avolio, (1998) 6. Sosik, Kahai and Avolio (1998b) 7. Sosik, Avolio, and Kahai, (1998) 8. Sosik, Kahai and Avolio (1999) 9. Kahai, and Avolio (2006).	15. Joshi, Lazarova, and Liao, (2009)
Participative versus Directive Leadership	10. Kahai, Sosik, and Avolio, (2004) 11. Hambley, O'Neill, and Kline, (2007) 12. Kahai, Sosik and Avolio (1997)	
Other model/mixed method/explorative	13. Eveland and Bikson, (1998) 14. Carte, Chidambaram, and Becker (2006)	16. Kayworth and Leidner, (2000) 17. Kayworth and Leidner, (2002) 18. Connaughton and Daly, (2004a) 19. Connaughton and Daly, (2004b) 20. Connaughton and Daly, (2004c) 21. Yoo and Alavi, (2004) 22. Kirkman, Rosen, Gibson, Tesluk, and McPherson, (2002) 23. Malhotra, Majchrzak, and Rosen, (2007)

1.4.1 Experimental studies on distributed team leadership

The Full Range Leadership Model by Avolio and Bass (2004) covers (among others) two major leadership concepts that have been used in research in distributed teams; transformational and transactional leadership. Transformational leadership incorporates four behavioral components. The first, *idealized influence* describes how a leader instills pride, shows faith and respect, and transmits a sense of mission, which make followers want to identify themselves with the leader. The second component, *intellectual stimulation* describes leaders encouraging followers to think in new ways, and to continuously question their own beliefs, assumption and values, and where necessary, those of their leader. The third aspect, *inspirational motivation* involves a leader articulating shared goals and mutual understanding of what is right and important and setting high expectations. Finally, the fourth aspect of transformational leadership is coined *individualized consideration*. It describes a leader who shows a high personal concern for followers and who spends time teaching and coaching (Bass, 1985; Avolio & Bass, 2004; Zhang, Fjermestad, & Tremaine, 2005).

Transactional leadership comprises three behavior categories. The first, *contingent reward*, describes leaders providing clear goals and clarity about rewards when these goals are met. The second category, *management by exception active*, describes leader behaviors aimed at actively ensuring that the standards are met. Finally, the third aspect is called

management by exception passive. This described leaders who refrain from intervening until standards are not met (Bass, 1985; Avolio & Bass, 2004; Zhang et al., 2005).

In the studies that have used the Full Range Leadership Model in the distributed team context, leadership approach was mostly manipulated to investigate the association between leadership, intermediate variables such as group potency or collective efficacy (Sosik, Avolio, Kahai, & Jung 1998), participation (Kahai, Sosik, & Avolio, 2004), team interaction styles (Hambley, O'Neill & Kline, 2007), identification with the leader (Joshi, Lazarova & Liao, 2009), group cohesiveness and trust, (Hoyt & Blascovich, 2003) and outcome variables such as leadership satisfaction, group creativity, and performance (Hoyt & Blascovich, 2003; Kahai et al, 2004).

Overall the results of these studies indicate a positive association between transformational leadership and group potency, originality and team effectiveness. In addition, task interdependence was found to moderate the effect of transformational leadership on group potency and effectiveness and anonymity was found to moderate the effect of leadership style on group effectiveness (Sosik et al., 1998). Trust mediated the relationship between leadership style and satisfaction and cohesiveness (Hoyt & Blascovich 2003).

However, when separate dimensions of transformational leadership, i.e. intellectual stimulation, and individualized consideration were used in analyses, some effects became less clear. For instance, intellectual stimulation and individual consideration were found negatively associated with group creativity (Sosik, Avolio & Kahai, 1998). Although the circumstances in these studies were highly controlled, the findings of this group of studies are not overly consistent (Zhang et al. 2005). Zhang and colleagues have suggested several possible explanations for these inconsistent findings. One of these is the use of transactional and transformational leadership as opposing approaches, rather than complementary ones. Not having involved context factors of the distributed teams in analyses may be another possible explanation.

1.4.2 Field studies of distributed team leadership

The literature search yielded 9 field studies on leadership in distributed teams. The first study is a quasi experimental field study, reported by Kayworth and Leidner (2000, 2001). For this study researchers assembled twelve globally distributed teams to work on 12 different mandatory tasks. Leaders were assigned to the teams, but their leadership approach was not manipulated. The results suggest that effective team leaders demonstrate the capability to deal with paradox and contradiction by performing multiple leadership roles simultaneously (behavioral complexity). Highly effective distributed team leaders performed a mentoring role, while exhibiting a high degree of understanding towards other team members. These leaders were also able to assert their authority without being perceived as overbearing or inflexible. Finally, leaders provided regular, detailed, and

prompt communication with their peers and explained expected role relationships and responsibilities of the distributed team members (Kayworth & Leidner, 2002).

The second field study by Connaughton and Daly (2004b; 2004 c) uses an explorative qualitative approach. This study focused on effective leadership strategies and communication behaviors for the distributed team environment. The results of this study were summarized in a number of practitioner oriented (normative) propositions about distanced leadership. The findings show that trust in particular is built in face-to-face meetings, over time. Less time was found available for distributed team leaders for informal social conversations, yet these conversations were found to be very important, especially for building and maintaining relationships. In order to reach an understanding communication was essential in distributed teams, and 'over-communicating', i.e. using several media to convey the same, single message, was found to be effective for this purpose. In order to have effective communication in the teams, preparations for meetings were crucial, as well as honoring commitments, communicating decisions to remote team members and keeping each other informed.

On the basis of their study, Connaughton and Daly (2004b; 2004 c) suggest that leaders can facilitate their teams by developing rules for communication and interaction and by providing structure for electronic meetings in the form of regularly scheduled meetings, with rules about preparation for and involvement during them. Cultural nuances were found very important in communication and therefore the researchers suggest that leaders need to understand these fully in order to deal with them effectively. Results suggest that subtle differences in the way messages are communicated, easily lead to misunderstandings. More everyday aspects of intercultural collaboration and differences in holidays and weekends across cultures were found important for leaders to understand and to respect. For teams with multiple leaders, coordination between leaders was important to prevent unclear management. Leaders visited teams as a means to show the importance and to increase the visibility of dispersed team members. Such visits increased mutual visibility and awareness of circumstances. Results of this study also indicated the importance of investing in relationship building and in involving remote team members in decision making to prevent misunderstandings and conflicts.

Another field study by Connaughton and Daly (2004a) examined identification with the team leader among 86 distanced and proximate employees in geographically dispersed teams. The study focused on the relationship between members' identification with their team leader and four other variables: trust, isolation, accessibility, and information equity, on the basis of survey data. Results of this study indicated that identification and trust are closely related constructs, both under distanced as well as proximate settings. Perceived isolation was inversely related with leader identification under proximate conditions. Accessibility was positively related to identification with the leader under both distanced

and proximate settings. Finally, perceived information equity was positively related with leader identification in distanced and proximate settings.

The field study by Joshi, Lazarova and Liao (2009) was based on a web survey with 247 employees from 91 distributed teams in a fortune 500 company. It is one of the first studies to consider the role of distributed team characteristics (geographic dispersion) in the relationship between leadership and team outcomes. The results indicate that leaders of distributed teams can play a pivotal role in creating identification among individuals within teams, even after controlling for geographic distribution. Trust partially mediated the association between inspirational leadership and team identification. Results of this study provide support for the role of team identification in accomplishing shared team goals.

The field study by Yoo and Alavi (2004) focuses on the role of emergent leaders in distributed teams, using ad hoc teams consisting of senior executives of a US federal government agency. The study indicated that overall, emergent leaders sent more and longer email messages than their team members did. The number of task-oriented messages sent by emergent leaders was also higher than of non-leaders. No differences were found between emergent leaders and non-leaders in terms of expertise-related messages. Also, no significant differences in relationship oriented and technology management messages between emergent leaders and other team members existed.

Table 1.4: Distance leadership aspects: an integration of normative literature and explorative research.

Leadership Focus	Types of activities and behaviors
Providing engaging direction	Developing routines, rules and guidelines
Structuration of communication	Pre-arrange meetings, develop standards for communication
Looking for substitutes for leadership	Selecting team members capable of distributed work
Monitoring the team environment	Spot changes in the team environment that can affect the team and communicate these to the team
Facilitating relationship building, commitment and cohesion	Organizing a face-to-face kickoff meeting, use informal communication
Providing recognition and visibility	Make distributed team accomplishments visible, visit remote team members
Being pro-active	Actively and clearly communicate to team members, about task and needed steps and provide timely checkpoints
Relating to different cultures	Adapt communication style to members of different cultures, respect national, cultural holidays
Overcoming multiple responsibilities, coordinating with multiple leaders	Actively coordinate with leaders working in co-location with distant team members
Clarification of dependencies	Articulating relationships and role responsibilities

1.4.3 Summary and Discussion

Theory driven leadership research in distributed teams has mainly used the Full Range Leadership Model and the Directive and Participative Leadership Model in studying ad hoc student teams. This first category of studies found that transformational leadership has a positive effect on team members participation and satisfaction and on team outcomes, such as team effectiveness, performance and quantity and quality of results. However, these

results were not very consistent and dependent on the measurement level (Zhang & Fjermestad, 2006). Also, as these studies have mostly contrasted transformational and transactional leadership, the combined effect of these two types of leadership has not received much research attention. Furthermore, contrasting face-to-face with electronic groups is a simplification of the reality of distributed teams, which rarely exists in any of these pure forms. In order to increase our understanding of transformational and transactional leadership in distributed teams, the Multifactor Leadership Model should be further investigated, preferably in teams in organizations, in which team characteristics are systematically taken into account. The single field study using the Full Range Leadership Model by Joshi et al. (2009) indicated that transformational leadership is important for developing trust in distributed teams.

The second category of studies, which used mainly qualitative approaches found that building relationships in distributed teams is complex and that leaders can play an active role in this by actively communicating, by organizing face-to-face meetings and involving team members during these meetings, for instance by underlying the importance of everyone in the team. Effective leaders acted as mentors for their team members and showed understanding for them. Identification with the team was found important, as well as the role of team leaders to actively facilitate this. Another important finding is that leaders of distributed teams try to provide structure for their team, by planning meetings, preparing them and enabling team members to participate and to have maximal input. These studies suggest that team leaders fulfill several roles behind the scenes, i.e. composing agenda's, setting up the technology and knowledge repositories and matching those with communication purposes and finally developing rules for communication, in order to facilitate interaction that would likely happen naturally under proximate conditions.

1.5 Conclusions

Even though our knowledge of distributed teams is increasingly based on empirical research, many early studies were based on distributed student teams (Martins et al., 2004; Hertel et al., 2005; Powell, et al., 2004; Zhang & Fjermestad, 2006). Leadership in particular has received very little research attention. The work to date indicates that leadership in distributed teams is different in significant ways from leadership in conventional face-to-face teams. Not only does the context within which a distributed team operates render certain leadership behaviors more important than others, it also tends to interact with leadership behaviors to change their effects (Kahai, Fjermestad, Zhang, & Avolio, 2007). Roughly, the few studies found can be categorized in two groups (1) explorative, qualitative field studies and (2) experimental studies, using the Full Range

Leadership Model in student teams. This limits our understanding of leadership in such teams and generalization of findings.

Although results from experimental studies using the full range leadership model have not been fully consistent, overall these studies do suggest that transformational leadership is promising in explaining favorable team processes and outcomes in the distributed team environment. However, qualitative field studies suggest that existing leadership models may not be able to provide the complete answer to effective leadership for distributed teams, as very concrete leadership actions, i.e. structuration of meetings and organizing face-to-face meetings are also necessary to ensure the smooth functioning of distributed teams. The often used Full Range Leadership Model in itself does not address these concrete actions and may therefore not fully represent the array of effective (and necessary) leadership behaviors in distributed teams. Development of a leadership concept which covers effective 'distance leadership' behaviors might therefore add to existing models.

As indicated, the inconsistencies found in studies using the Full Range Leadership Model, may be explained partially by the lack of incorporation of context variables in these studies (Zhang & Fjermestad, 2006; Joshi et al., 2009). The distributed team environment is often more complicated than that of co-located teams. This environment leaves much room for variation in team structure. Little is known from research about the implications of this variation in context on team processes and the role of team leaders. This suggests a need for more field research, both qualitative and quantitative, which is aimed at investigating the role of this context, i.e. geographic distance, mediated communication, time differences and cultural diversity and variation in these characteristics in distributed teams in relation to leadership.

Experimental studies have investigated the role of several mediators (trust participation and flow) for the leadership – outcome relationship. However, more concepts could be considered as potentially explaining the effect of leadership on team outcomes. Martins et al. (2004) conclude from their literature review that interpersonal processes have received relatively little research attention in distributed teams and that this provides a promising direction for future research.

Based on these findings, for this dissertation we choose to take a hybrid approach to the study of leadership in distributed teams. First, a qualitative study will be performed to investigate the role of distributed team context for leadership. This study will also explore and refine the concept of 'distance leadership'. Next, a research model will be developed which incorporates a number of hypotheses about leadership in distributed teams. Finally, the distance leadership concept will be transformed into a measurement scale which will be used in a quantitative study to determine its associations with existing leadership scales, team processes and outcomes.

The next chapter will present findings of an explorative qualitative field study aimed at uncovering the role of context of distributed teams in possibilities leaders have to manage such teams, challenges they face and leadership actions and behaviors aimed at overcoming these challenges.

Chapter 2

The impact of team structure on distributed team work: a leader perspective of challenges and how to overcome them

The first chapter outlined why more field studies are needed in the area of leadership in distributed teams. The present chapter will report findings of an explorative study aimed at describing the leadership context of distributed teams. The study focuses on team characteristics and challenges for leaders of distributed teams. The study also aims to further explore the concept of distance leadership, which was introduced in the previous chapter. This is done by describing leadership activities and behaviors that leaders undertake to overcome the challenges they face in their teams. The teams included in this study were all distributed in nature. Members of the teams were working from at least two geographically separated locations. Team members were distributed over at least two different countries and in some cases worked from 10 different countries. The chapter is structured around four important and widely adopted distributed team characteristics, that were put forward in Chapter I: (1) geographic distribution (2) mediated communication, (3) time differences, and (4) team member cultural diversity. These are the most important characteristics that differentiate distributed teams from conventional teams (Bell & Kozlowski, 2002; Dubé & Paré, 2004; Martins et al., 2004). The qualitative data gathered in this study were analyzed with the help of a software package for large sets of unstructured material. The results are presented in the form of frequencies of occurrence of observation, combined with examples of quotes from interviews. The results suggest that distributed teams often face problems mostly in two leadership domains: building effective working relationships and developing shared understanding.

2.1 Introduction

In the next section the central concepts and the focus of this study are introduced briefly, followed by the research questions. Next, the methodology of the study is presented, followed by the results and discussion.

2.1.1 Central concepts

In line with the previous chapter we define distributed teams as: groups of people, working on an interdependent task, while being geographically separated and therefore

communicate and coordinate predominantly by means of Information and Communication Technology (ICT). Apart from being geographically distributed and ICT mediated, these teams also often span boundaries of time and culture (national, organizational and occupational). According to Cramton (2001) distributed teams may have trouble in reaching a shared knowledge base. Cultural differences have also proven to complicate coordination of distributed teams (Maznevski & Chudoba, 2000; Kayworth & Leidner, 2000) and to create obstacles for effective communication (Sarker & Sahay, 2004). Although distributed teams generally have more difficulty with team processes, such as communication and coordination than co-located teams, little attention has been given so far to methodological aspects of doing field research in distributed teams. In such teams multiple boundaries, i.e. geographic, time, and culture, can coexist (Espinosa, Cummings, Wilson, & Pearce, 2003). It is difficult to methodologically separate the effect of individual boundaries when they coexist.

Few attempts were made to empirically study the impact of the distributed team environment on the leader role and of the specific requirements necessary for effectively leading such teams. Here, we address the role of context of distributed teams by presenting results of a qualitative analysis, based on semi-structured interviews with distributed team leaders ($n=50$) focused on (1) the impact of the four team characteristics on work in the team, (2) the most important challenges for distributed teams, and (3) leadership behaviors aimed at overcoming these challenges. The central research questions that will be addressed in this chapter are the following:

- (1) How do leaders from distributed teams in organizations perceive the impact of geographic distribution, time dispersion, cultural differences and mediated communication on distributed team work?
- (2) What are the most important challenges of distributed team work, as perceived by distributed team leaders?
- (3) What, according to distributed team leaders, are effective leader behaviors to overcome these challenges?
- (4) What can we learn from this first study in terms of promising areas for research?

The qualitative study reported in this chapter aims to expand knowledge of the effect of distributed team characteristics on team functioning, with a focus on problems with team work, which are associated with these characteristics. The second aim of this study is to uncover the actions leaders take to overcome these problems to further develop the concept of 'distance leadership'. The third goal of this study is to provide direction for future research, by highlighting interesting directions to pursue.

2.2 Methodology

2.2.1 Procedure

A series of semi-structured interviews with distributed team leaders ($n=50$) were organized. Before the interviews, information about the team and management structures and overall tasks of these teams was gathered by using a short on-line questionnaire, to prepare for the interviews (see appendix II). Interviews focused on the effects of distributed team complexity on coordination and leadership. A general interview script was designed (see Appendix III). Interviews addressed the context of the teams' structure (team member distribution, member diversity, life cycle, etc.) and the effects of these context variables on work in the teams. During interviews team leaders were asked whether they considered any of these context characteristics to have an effect on their ability to work effectively in the team (e.g. *can you tell me about the effect of cultural diversity on work in this team?*). On average interviews in this study took between 1 and 1.5 hours. All interviews were transcribed and then analyzed with the support of a software package which was designed to deal with large sets of unstructured material (ATLASTI), in order to structure and quantify responses.

2.2.2 Sample

The team leaders participating in this study originated from nine different multinational organizations, labeled organizations A through I. For details on the sample see Table 3.1.

Table 2.1: Overview of research sample.

Org.	Business Area	Leaders	Types of team and tasks
A	IT services, software development	14	Software development, quality control, business development, innovation management, asset commercialization, business process optimization, maintenance, knowledge sharing
B	Manufacturing of scanners, printers and copiers	5	Software development, project management
C	Petrochemical industry: fuels and chemicals	3	Development of HR tools, knowledge sharing and improving expertise
D	Production of lighting products, and consumer electronics	11	Cost reduction, product development platform, product implementation, service and support, business improvement/quality management, software development
E	Development of innovative IT systems for security of industrial (production) systems	5	Development of software, technical drawings and hardware designs
F	Development of ERP and accounting software	2	Software development offshoring
G	Development, production, testing and implementation of software	3	Software development offshoring
H	IT services, software development	1	Software development offshoring
I	Development and production of	6	Purchasing, global strategic management,

	industrial chemicals, resins, fibers elastomers and plastics		global sales, global software support
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Team leaders were identified via industry contacts of the research team. Key persons in several multinational companies were asked whether they knew individuals who were leading distributed teams or projects within their company. These individuals were sent a project proposal to clarify the focus of the research project (see appendix I). Fifty team leaders within these nine companies were willing to participate. Approximately 75% of the leaders in this study are from a Dutch background. The Netherlands is a small country, which has historically been driven to develop partnerships with foreign countries. Several multinational organizations found their origin in the Netherlands and still have head offices in the Netherlands. It was therefore not surprising that many distributed teams and leaders of such teams are found in the Netherlands. Leaders from other countries and cultures were also included, i.e. United Kingdom, USA, Belgium, Germany, Switzerland, Italy, and South Africa.

The teams covered diverse task domains and operated on different hierarchical levels within the organizations involved. Teams were involved in tasks such as development of diverse software applications, production of technical drawings, high level management of product development (plastics, lamps and flat televisions), asset commercialization, innovation management, knowledge sharing, human resources, global purchasing, IT support, global management, and global cost reduction and business improvement initiatives. The three most often found types of teams in our sample are described in more detail below.

The Offshoring Team. Offshoring teams are used predominantly in the software development industry. Software organizations in Western Europe face increasing competition and as a result have to work increasingly with smaller budgets and within shorter time frames. Additionally, these organizations have problems with finding enough highly trained technical personnel. As a result of these developments, software companies increasingly adopt a global strategy. This strategy enables them to work with highly trained workers in countries such as India.

Several companies involved in this study had distributed software development teams. These teams are focused on off-shoring a large part of their software development work to regions outside Western Europe. Off-shoring teams were found also within organization E, which was working on building technical facilities for the process management of petrochemical plants. A large part of the work before installation of a plant is technical work, that mainly consists of making technical drawings with Computer Aided Design (CAD) programs. This type of work is comparable to software development, in that the

work requires skilled technical experts, and that the product of the work (drawings) can be easily transferred via mediated means.

Offshoring teams were found in five organizations in our sample (A, E, F, G and H). All were aimed at involving well trained young experts, mostly engineers, from developing countries in the (South)-East Asian region, such as India, Malaysia and Thailand. These teams were organized mostly from two main locations in a team structure with a front office and back office, sometimes with a third location at a clients' site. The front office location is responsible for gathering system requirements and translating these in a functional and technical systems design. This design is then handed over to the back office, which is responsible for developing the software. This team structure was found in teams that offshore work to Asia from sites in the Netherlands, the United Kingdom and South Africa. The front office was usually involved with functional and technical software designs, often at a location at the customer organization, as this part of the overall task requires intensive contact with the client. The back office was involved mainly as a centre for the production of code and for testing of software. These teams had to cope with time differences of somewhere between 3.5 and 6 hours between locations.

Although most teams only involved two different cultures, the differences between these two cultures were often extensive. Most teams involved members from the Netherlands and India, and in some cases South Africa and India. These cultures are considerably divergent on dimensions of culture, i.e. Hofstede, (1993; 1997). Software development teams were coordinated mostly from the Netherlands, UK or South Africa. In most cases a local supervisor was assigned to the Asian sub-team. This person would report directly to the project management. In some cases, a person was sent, for instance from the Netherlands to India, to fulfill a role as 'linking pin' between the remote teams. In other cases a technical person from the Asian sub-team was sent to the design centre, or customer location to fulfill a similar role.

The Global Management (Platform) Team. Large multinational organizations increasingly use management teams to coordinate all kinds of global activities. Such global activities are increasingly organized in a project-team structure. The sample included global management teams with several purposes such as global product development and innovation management. Organization D in this study uses a large number of global projects for development and production of a wide range of electronic equipment, ranging from coffee machines to flat televisions, lamps, and MRI scan equipment.

Within this organization we looked at large distributed projects within two business units. These were either working on the development of new lamp concepts, or on the development of flat (LCD or Plasma) televisions. These projects were generally large in size, which implies that many people (over a 100) from many locations are involved. Most of these projects were distributed over three regions: the US, Europe and Asia with many

distributed locations on each continent. Projects such as these also often involve cooperation between a large number of supplier and client organizations in all regions.

These projects were largely coordinated using a management platform team, or 'core team', which was much smaller in size (approximately 5-10 members). Within one of the sub-divisions of organization I, which worked on development and production of engineering plastics, global management teams were found. These teams were formed with the purpose of aligning business within several overall product areas across Europe, the US and Asian continents. The teams focus on development of a global strategy and on aligning regional business units with this overall strategy. Distributed teams such as these are not project teams, but are more continuous in nature, three locations were typically involved and in general team size was about 7-8 members.

The Global ICT Support Team. Multinational organizations nowadays run advanced work flow and Enterprise Resource Planning (ERP) software packages to manage the flow of goods and information in the organization and to structure all kinds of administrative processes (see Chapter 1). Given the widespread use of such packages within organizations in the sample, these organizations require global support, technical as well as functional, for all sites worldwide. For this purpose these organizations have started global ICT support teams, aimed at providing software support 24 hours per day. These teams generally span the three dominant business areas worldwide, implying they have working locations somewhere in the America's, within Western Europe and in Southeast Asia. We encountered teams such as these within organization I, which was in the process of building a global ICT support organization. This organization counted approximately 100 individuals at head quarters and smaller groups in Switzerland, the USA, Brazil and Singapore. Teams within this organization supported specific pieces of an ERP package and covered at least 3 geographically separated locations. A 'follow the sun' approach was used, to achieve 24 hours of service per day.

2.2.3 Analysis

Analysis of interviews started with the general list of four distributed team characteristics, derived from literature: (1) geographic distribution, (2) mediated communication, (3) time differences and (4) member cultural diversity. The first step was to take six random interviews and to analyze these for occurrence of statements (problems or opportunities) about any of the four general categories. Every occurrence was highlighted in the text and was assigned a preliminary code (for instance: Multicultural Teams: Language Problems). Analyses of these first six interviews resulted in a list of 20 codes, nested each in one of the four categories in the coding scheme. The next step was to analyze three other random interviews on the basis of this coding scheme. The researcher and a colleague analyzed the interviews separately and afterwards discussed the interviews and the coding scheme. On the basis of this test the coding scheme was further refined with several new categories.

The resulting coding scheme can be found in Appendix IV. The coding scheme was then entered into the software package for analyzing the unstructured material (ATLASTI).

Next, the total set of 50 interviews (including the interviews used in previous analyses) was analyzed with this coding scheme. For categories of problems this was an iterative process; whenever a statement about a problem occurred, which could not be placed in any of the existing sub categories, a new category would be defined. A fifth category was labeled 'rest category'. This category was used to capture all problems that could not be related directly to any of the four general categories, but nevertheless were relevant (for instance: Rest Category: Turnover). Finally, a sixth overall category was defined, which entails 'distance leadership'. This final category was used to select all excerpts in transcripts about leadership behaviors, styles, strategies, or competencies, which were mentioned as relevant for leading distributed teams. This led to a set of 20 specific categories of leader behaviors.

2.3 Results

Results of this study are presented in the order of the research questions presented, starting with the perceived impact of the four team characteristics that were presented in the beginning of the chapter: (1) geographic distribution, (2) mediated communication, (3) time differences and (4) member cultural diversity. Next, the second research question will be addressed by a more in-depth analysis of the most important issues that result from these team characteristics. Overall, leaders perceived their distributed teams to have problems specifically with developing shared understanding and with building effective working relationships. Next, the third research question will be addressed by presenting implications for leadership and by discussing in general, which leadership activities and behaviors were mentioned to be used in an attempt to overcome these most important problems. Different categories of leadership behaviors were identified, these will be discussed more in detail. Finally, the results section will go into the implication of this study for future research.

2.3.1 Geographic Distance

Thirty-five percent of the leaders in this study mentioned problems linked to geographic distribution. Two themes were: (1) complex team structures, and (2) the development of sub-teams. In general, only few leaders mentioned geographic distance as a direct cause of problems with work in their team. The ones that did, mentioned the need to travel and the time associated with travel as barriers for distributed team work.

Complex team structure. In almost all teams involved in this study, distribution of team members was linked to complexity of team structure. Many teams in the sample had a complex management structure with multiple managers, all working in matrix structures (65 %). This complexity caused problems for managers and team members in determining responsibilities and the nature of reporting relationships. Within these teams, members had up to three (organization A) or even four supervisors (organization I). Team members typically had a functional leader at their physical work location. This person generally has responsibilities for administration of payroll and sick leave and other human resource management issues. This person may also manage people's day-to-day activities at that location, and hence may compete for resources with the leader of the distributed team. Typically, the distributed team leader managed activities in the distributed (project) team, and thus becomes the second leader a distributed team member reports to; in this case for the activities he/she performs in the distributed team. This is the least complicated management structure found in the sample. In some cases team members reported up to four different managers for different purposes. Having more than one supervisor does not necessarily lead to problems with coordination, as long as the supervisors can divide or share their responsibilities. In many cases however, the multiple leader structure did lead to problems. The leader of team 34, working on business improvement processes within organization E states:

When you pull a distributed team together you will find that they have different managers and other people all pulling them into different directions, so when you let go of the strain they will go back into that old structure. There is always a danger if you agree something, that their managers or colleagues will pull them in a different direction. It's like a big magnet pulling them in directions you don't want to take them.

Sub-teaming. Of the small group (11 %) of leaders that mentioned geographic distance as a source of problems, most indicated that the physical boundaries of the team are often also perceived as psychological team boundaries. This means that distributed team members have much more contact with their co-located colleagues than with their distributed counterparts. As a result, geographically separated sub-teams are a common phenomenon within distributed teams. Within distributed teams client contact is often intense for team members from one location, while almost absent for members at a remote location. As stated, a common form of distributed team structure is the offshoring team with a front office and back office model. This model was seen in many distributed teams working on software development within organizations A, E, F, G and H. The front office is the location where almost all client contact is handled. At the front office, requirements are gathered and technical designs are made. These designs are then sent out to the back office where most of the software code is produced. One important aspect mentioned by

team leaders was that members from the 'back office' have virtually no contact with the client, which can frustrate people in their development as engineers (e.g. in organization E). For example, the leader of team 43 stated:

Well, they [team members in the back-office] tend to get involved in producing the deliverable and sometimes commissioning the deliverable or installing it. As a development engineer you really need to be involved in developing the requirements upfront. They won't get exposure to that.....there is a bit of a time bomb going on there. The engineers will want more and more exposure and experience. Therefore you will see a lot of engineers in the back office leaving the company or the country altogether. They will probably face a very high attrition rate.

As stated, geographic distribution of teams is often associated with a high reliance on mediated communication and increased cultural diversity. Next, we will go into these topics.

2.3.2 Mediated communication

Teams in this study all communicated via mediated means (e.g. e-mail, telephone and audio- and videoconferencing) to a large extent. The most popular communication tools used in the teams were telephone (with or without sharing of documents, by means of net-meeting or web-x), e-mail, and instant messaging. Occasionally, almost all team leaders organized face-to-face meetings with parts of the team, or with the whole distributed team present. Some leaders also indicated that they sometimes 'made a tour' and visited all the remote locations personally, for instance once a year, to meet with team members. Analysis of the data revealed three general problems related to mediated communication: lack of visual cues, lack of informal encounters and lack of awareness.

Lack of visual cues. Not being able to see team colleagues and not being able to be with them 'physically' was often mentioned by leaders with regard to mediated communication. In total 75% of the leaders in this study mentioned a lack of visual cues as causing problems with communication. Visual cues are important for communication at different levels. Nonverbal communication signs were mentioned to help in assessing whether a message was understood or not. Power differences and associated status was also mentioned to be lost to a large extent in distributed teams, because the person speaking and others' reactions to him or her, can't be observed. As a result of this absence of visual cues, a lot is asked of the communication skills of individual team members. For example, the leader of a team working on global innovation management, in organization A stated:

During a physical meeting you can easily see the power balance; when he says so, the material will be there to back it up. That physical component is missing in a distributed team. Therefore it is more about the reliability of the input someone delivers. It's all about content: is there really something?

Leaders indicated that due to a lack of visual cues and knowledge about the other team members (e.g. credibility and status), more proof of quality of input was required, which takes more time. A lack of visual cues in communication also provides a challenge in determining the importance of issues. Respondents mentioned that being face-to-face with colleagues provides for a lot more opportunities for picking up information, for instance by noticing body posture, gestures and occasional frowning. Not having this kind of information generally slows down the process of communication and sense making. One example of this was given by the leader of a team coordinating several distributed (student) projects within organization A:

Telephone works okay, but there is no 'body language'. The process of communication is also slower, you need a 'formal okay' from every participant, and it is a bit like the Eurovision Song Festival.

According to respondents, communication during teleconferences without visual cues was slower than face-to-face communication. Because information can be transferred over fewer channels, there was also a tendency to get distracted during distributed meetings, for instance, by checking e-mail or going for coffee. The negative effect of people being distracted during meetings gets worse in distributed teams because there is no visual control of active involvement in meetings by colleagues. The leader of a global purchasing team in organization I mentioned:

What you notice is that, during face-to-face meetings people feel some kind of social pressure to participate. When you are at a distance you easily lose focus and then come back to the meeting. You are missing out on the non-verbal part of communication. Therefore you are trying real hard to read between the lines: is that possible? With Europeans and Americans I can do this to some degree, but with Asian people it's really hard.

Losing focus and not really 'being there' during a meeting is a problem that was mentioned by several respondents; they mentioned that during meetings they typically received fragments of people's attention. This was especially problematic during teleconferences with many people attending. In these cases only few people had to actively contribute to the meetings, and respondents mentioned that going for a cup of coffee during the meeting

was done quite often. To overcome problems of distraction, many leaders used visual support on the background (e.g. presentations would either be sent over, or applications such as web-x or net meeting were used to share presentations). These applications also enabled leaders to shift control over the visual input from one member to the other, to support their specific piece of input. Communicating without visual cues was generally perceived as taking a lot of effort. Team leaders indicated that this was especially the case in new teams, when people are not yet familiar with each others' voices. For example, the leader of team 34 of organization E stated:

After a while it worked, when people became more familiar with people's voices. You could not see people's eyes, but you could hear it from the voice, if people have something to say or not... you would get a feeling, but it took a lot of effort.

A lack of visual cues in communication at a distance was perceived as problematic by 68 % of the leaders, in that they saw this as hampering effective communication. Lack of visual cues extends further than not being able to see others' nonverbal responses. It is also about not being able to see what is happening at other locations. Leader 40 of organization A mentioned:

With a teleconference you can't just jump in on every issue, and you can't see if anyone else wants that, you can't facilitate that. Jokes and humor during a meeting are also lost to a large extent. If something funny happens at one location and people start laughing, the other sites have no idea what it is all about.

This example refers to a lack of visual cues about circumstances at other distributed team locations. As such, the lack of visual input prevents awareness of what is happening at the remote site, which is what we turn to in the next section.

Lack of Awareness. The analysis showed that 63% of leaders mentioned problems with awareness in their teams. Different types of lack of awareness were mentioned including awareness of specific aspects of a test setting and visuals of what is happening, awareness of circumstances that have an impact on work and progress at other locations in general, and awareness of personal circumstances of distributed team colleagues. As an example the leader of team 4, who lead a platform team on global product development within organization D, mentioned:

What I ran into at a certain point was that, when talking to these people, you miss pieces of information, practical information in specific. People who make the lamps themselves run into specific problems, or they can see things about the lamps when they are taking their

measures, which are absolutely crucial during our meetings. We are then missing out on that information.

Discussing technical issues of test equipment over telephone was perceived to be very difficult. Respondents indicated that they sometimes felt frustrated because they could not get to the bottom of an issue, simply because they were not able to see what was happening. In these cases they were totally reliant on other people being able to explain them what they were seeing. Developing knowledge about a team colleague as a person, also proves to be far more difficult in distributed teams. Although leaders were often not very specific about 'why' knowing the other person is so important for distributed team work, they experienced an absence of knowledge of team colleagues as a barrier to effective teamwork:

People need to know who they are working with. Many of them know each other to a certain degree through phone and video conferencing. However, there is a small group of team members in the project who know each other only by name, because they haven't 'met virtually' yet. Knowing how people will react and why will make work easier. (Leader of team 13, organization. B)

The respondent who stated the quote directly above was working on the head quarters location of organization B. Part of his team of software developers, were located in Paris (France), and others in Venlo (Netherlands). He mentioned that being in a satellite site can be a disadvantage when it comes to getting the information you need. In this team there was a strong interdependence between the two physically separated parts of the team, yet the part in Venlo had much better access to information.

At the Venlo site support departments like project management and services are close by, these people can be on the floor very quickly. At the Paris site few support departments are present; therefore problems will stay unnoticed for a longer time. That is why we have to communicate these things to Paris in time: 'look; services has a problem'. Otherwise this will stay unnoticed.

In this example the leader was not missing much information himself, but he did signal team members missing information. He indicated that he had to make sure that he would share the context information with the distributed part of his team. In the context of other teams, which were much larger and far more complex, leaders were dependent on their colleagues to get the information they needed for decision making and planning of activities. Many leaders indicated that they experienced problems, because they did not

have adequate control over what was actually happening at other sites, which sometimes made them feel uneasy. For example, the leader of team 35 of organization D explained:

The biggest danger is that things are happening to you without you knowing that these things are actually happening at all. You can't see what they are doing at the other side. They can tell you, but it's good to check personally every now and then.

Given the distance between locations and the problems leaders encountered to develop awareness, they mentioned that they either had to be able to trust individuals to honor their commitments, or to be able to trust key persons at the remote locations to be their eyes and ears, and to 'filter out' the most important information and communicating this information. One of the leaders who was managing a large installation project in the petrochemical industry within organization E explained:

I was far from an ideal project manager. In fact, a lot of things happened in India of which I didn't have a clue, but I trusted the local leader with my life, and he has never let me down. I just didn't have time to go there. It can work when you trust people.

Lack of informal encounters. According to respondents, distributed teams provide almost no opportunity for informal encounters; 35 excerpts were found in interviews, coming from 50% of the leaders in the sample. Informal encounters can happen coincidentally, but can also be part of more 'formal' meetings, for instance, in the form of dinners during evening programs in face-to-face sessions. Leaders in this study indicated that informal encounters are a natural vehicle to organize things; often just seeing a team colleague can be enough to remember to do something. Informal encounters were also perceived to be a flexible means of communication. Just dropping by at someone's office for several minutes for quick questions can help a team leader or member to clarify something quickly and effectively. Team leaders also mentioned that they perceived just sitting down with someone to be easier than initiating a phone call.

If we were not working remotely, it would be much easier to just sit down for a couple of minutes over coffee and just ask: hey, why hasn't that session been planned yet? In the present situation I will have to start making phone calls, and I don't have that 'chit-chat' level I am used to, like hey, nice weather huh! It's easier when you are together; a phone call immediately makes it formal. (Team leader of a team involved in innovation management from organization A).

Random encounters between geographically separated members of distributed teams were almost absent. As was mentioned by the leader of the team in the quote directly above, the

only alternative is to formally initiate contact. Furthermore, leaders perceived that within distributed teams in which people have not yet developed working relationships, this was more difficult. Team members who do not really know each other do not start making phone calls for small issues, mostly because the chit-chat level described in the above quote is not there. One strategy that was mentioned by only a few leaders was to engage in higher levels of informal contact via telephone and other mediated means. The leader of a team involved in asset commercialization in organization A, indicated that he tried to make the mediated communication moments more informal:

Being informal makes the work more interesting, it also helps me relating to the younger people in my team, I am always the older one.

Leaders in this study generally shared the perception that the value of random encounters in a traditional work environment is enormous. This was explained clearly by the leader of team 18, which was working on development of backlights for flat televisions within organization D:

The coincidental contact is kind of a hidden plus. I often travel to Eindhoven for person A or B, but when I am there I also walk in the office of C and D. This can work two ways. The coincidence of contacts sometimes leads to interesting facets. Someone might ask you: hey come and look, what I have found here! Someone would not have made a phone call just for this. The serendipity of contacts is often underestimated. Structuring meetings (size, and depth) only works with a degree of coincidence surrounding it.

Because of this lack of informal encounters, work in distributed teams also seems to take longer as was mentioned by a team leader of organization A:

It is not having constant access to people, people are just not around. There are no coffee breaks during which you can discuss things. In a distributed team everything takes longer. That is for a large part due to the lack of social and informal encounters, and the lack of visibility.

Respondents perceived that informal encounters in their teams were strongly linked to face-to-face meetings. As stated earlier, informal get-togethers are often combined with official face-to-face meetings. The informal nature of such encounters is what really helps to build a team, as the leader of a software development team in organization A mentioned:

Face-to-face contact is important, you talk on a more informal level and you have lunch together. You also talk about your private life and you have fun, which almost immediately makes you willing to do a bit more for each other.

This leader further indicated that informal communication in face-to-face interaction helped to develop a connection between team members. Many leaders in this study mentioned that informal meetings are often used for conversation about team members' private lives. Knowing about each other and having a more personal bond with team colleagues was mentioned to help build a more cohesive team, in which members are willing to do more for each other.

2.3.3 Time differences

Only 35% of the leaders in our study mentioned time differences explicitly as a cause of possible problems in their team. Time differences were also mentioned in some cases to be an advantage for the team in that these enabled a team to work 24 hours a day. Given the East-West dispersion of most of the teams in the sample, teams had at least several hours of time difference across locations. Time differences can be both a barrier and an enabler. From a point of view of business continuity, time differences can help organizations to work around the 24 hour clock, by mobilizing team members from different, time dispersed locations in a 'follow the sun' approach. However, communication within the team is only possible during 'overlapping' hours.

Follow the sun. Being able to work across different time zones in a 'follow the sun' concept was mentioned by several leaders as an enabler for their team. For instance in the case of a team involved in global ICT support within organization I, working across time zones enabled them to be in the air for 24 hours a day. Similar strategies were used in teams working on software development within several organizations involved in this study. Within organization F, software development was coordinated across the Netherlands and Malaysia, whereas several teams in organizations A and G worked across the Netherlands and India. In general this was mentioned to provide the opportunities to work more hours during a single day.

Planning meetings. For coordination via synchronous communication means, such as telephone, time differences across locations can complicate the planning of meetings. Time differences are not that much of a problem to overcome, as long as only two distributed sites are involved, with for instance a 3.5 hours time difference (Netherlands and India). However, several of the teams in this study were working from three or more sites globally. Within these teams meetings typically had to be planned with three time zones involved, i.e. US east coast, The Netherlands, and Singapore. In these cases organizing

meetings was mentioned to be more problematic, as in some cases synchronous communication was possible only during one hour per day. The leader of a global ICT support team (team 31) mentioned:

We organize these meetings at 14:00 hours, the Netherlands time. At that point it's early for the US and late for Singapore. This way we can involve the whole world, without people having to show up at absurd hours.

Long working days. Given the position of Dutch distributed team leaders, working with both the US and Asia does have an effect on their working days. Respondents found it increasingly hard to separate work and private life. For some, this was not much of a problem, they liked the flexibility in distributed teams. However, the leader of team 31 indicated what the effect of a global organization meant for him personally, on a normal working day:

This way we usually have meetings with Asia in the morning and with the US at the end of the day. The drawback is that business goes on for 24 hours. The phone starts ringing at 7 am and when there are problems I will still be on the phone late at night with people from the US. This way, private and business can no longer be separated.

2.3.4 Member cultural diversity

Teams in the sample varied extensively in their amount of cultural diversity. A few teams encountered small cultural differences. This was for instance the case in teams which were working from several sites within the USA, or the Netherlands. Almost all teams in the sample included members from at least two highly diverse cultures, and in some cases teams were working from distributed sites across 10 countries, including Europe, the Middle-East, South Africa, Southeast Asia and the USA.

Analyses of interviews lead to a list of eight sub categories of problems that could be connected to cultural diversity. Most of these categories involved specific communication problems, linked to differences between members from different cultures (see Appendix IV for an overview of codes). Apart from problems resulting from differences in communication styles and the need for procedures, the problems found related mostly to language differences, and differences in the preferred management style. In general, leaders in this study mentioned most often that they encountered problems with communication styles, problems with language and problems with differences in the importance and perception of hierarchy across cultures.

Communication Styles. Differences in communication styles between members from different cultures were mentioned by 50% of the leaders in this study as a problem for

working with and managing these teams. These problems were coded in two categories (Multi-Cultural Teams - Communication Styles and Multi-Cultural Teams - Information Seeking and Providing). Many of the teams in this study were working from the Western European continent with several countries in Asia, such as China, Korea, India, Malaysia, and Thailand. As a result, most problems with communication were mentioned in the context of teams working across Europe and Asia.

Most of the leaders in this study had a Dutch background, but other cultural backgrounds were also included (e.g. United Kingdom, USA, Belgium, Germany, Switzerland, Italy, and South Africa). The dominance of Dutch leaders in the sample may impact the results of this study; therefore the 'Dutch way of communicating' was discussed also in interviews. Distributed team leaders from the Netherlands generally share the opinion that their own way of communicating can be described as to-the-point and direct. However, perspectives from more 'self critical' Dutch leaders and leaders from other cultures working with Dutch team members, indicated that the Dutch way of communicating can also be perceived as quite harsh in other cultures. For example:

During my stay in India I have participated in several teleconferences with my colleagues from the Netherlands. You notice that sometimes the Dutch can be quite harsh, and although the Indians stay polite, you can easily see that they really can't stand it. [leader of team 20, organization A]

Leaders mentioned that in the context of multi-cultural teams, differences in communication styles are generally respected. However, these differences were not always fully understood, and problems therefore emerged quite often, for instance, when people were offended by something that a remote team member said. Problems in distributed teams were also often mentioned as a result of people not taking the initiative to communicate something. From a Dutch' perspective members from Asian countries did not communicate as quickly as they would do themselves, especially in the case of problems.

In India, people are inclined to keep their pants up. They will not start telling you: "I have got a problem". [The leader of team 29, organization G].

The lack of communication about problems or uncertainties and a reluctance to ask questions about complexities, were often mentioned as problematic. Respondents perceived that, not knowing about problems at other sites was detrimental for team functioning, mostly because problems that could be fixed in a premature stage, would get out of hand over time, resulting in increasingly bigger problems. One of the most often

mentioned results of not communicating problems (10 % of team leaders) was that rework needed to be performed, for instance on software programming.

During my stay in India I started walking around there to be available for questions. Over there people are inclined to just start working and not to ask any questions. When I was there I could answer many questions, and when I could not, I would simply contact the Netherlands. During my stay I really made it a point that people should ask questions (remotely) and should not just start doing something when they were not sure. [Leader of team 5, organization G].

Differences in communication styles, and reluctance to ask questions and to openly share opinions were felt strongly also during teleconferences. Leaders mentioned that these differences were not all related to culture, but were in some cases a combination of a cultural difference and a difference in experience and domain knowledge across locations. Asian people, who were less experienced, were found highly respectful to more senior team members, who were often located in Europe. Cultural norms in such cases would lead them to listen to the more senior members and not be too critical. These differences in communication style can result in situations in which teleconferences are dominated by Western European and US team members, at the cost of contributions from Asian colleagues. The leader of team 10, leading a corporate innovation team within organization A explains:

People from Europe and the US can act reasonable well in a teleconference, but you also see differences there. People from the US often like to say something one-on-one, before the meeting, so they can refer to this during the meeting. Asians hardly ever have the floor during teleconferences.

Reluctance to speak up and contribute to meetings and to share information were seen as detrimental to distributed teams, because not all opinions and ideas were brought out. Differences in communication style were further complicated by the lack of visual cues during teleconferences. Respondents mentioned that during face-to-face meetings, non verbal communication aspects would help team members to figure out if someone understood a message, and whether he or she agreed. Team leaders in many cases mentioned that they suffered from problems in reaching an understanding during distributed meetings:

For example this sometimes happens when you ask: do you understand it now? They [remote colleagues in Malaysia] then say yes, but they will nod no. This also happens with e-mail and during same-time communication. If you ask, without checking again whether it

really came across, you may think it did. In reality it turns out that they have interpreted it slightly different. [Leader of team 8, organization D].

Language Problems. The language used during international meetings was English for all the teams in this study. However, within most teams, several individuals would work from each remote location. This structure leads to the use of local languages for day-to-day interaction, and for local discussions during distributed meetings. Leaders of 37% of the teams mentioned that difficulty in grasping the English language, and language differences in general, lead to problems. The (perceived) inability to communicate in English was found to exacerbate problems by lowering team member participation:

Language is important, even though you do not speak a language perfectly it is important that you are comfortable trying it, and to make mistakes. Nobody minds mistakes. The Italian lady we have on the team right now was very conscious about her inability to speak good English and we would almost never hear from her. [Leader 2, organization A].

Problems with member participation, due to language problems, can also cause a loss of information during meetings. Team leaders indicated that during face-to-face, as well as during distributed meetings, it would often occur that some members would have a discussion in their own language, which other team members could not understand. The leader of team 23, working on sourcing of products in China for organization D stated:

There is a barrier; they tell it in Chinese and later translate it into English. What comes out is not exactly what they meant. My interpretation comes on top of that. There will be a type of misunderstanding, because we are not using the same words, or have the same meaning for words. We talk sometimes and afterwards, I realize that this is not exactly what he meant. He could explain it in Chinese. We have a translator from the suppliers, based on these words you have to make an assessment, and they expect a solution.

Respondents indicated that not being able to speak in one's 'natural language' limits the repertoire of communication in a distributed team. This in turn complicates transfer of messages, as subtleties in messages are often lost when translated. However, some team leaders mentioned that the problems were not tied to language alone. One mentioned that on top of this, differences exist in rules about communication and about giving the communication partner room, for instance to prevent that others' involved encounter 'loss of face'. Cross cultural differences in communication conventions therefore complicate communication further. It is sometimes difficult to make sense of communication across two highly diverse cultures, as the leader of team 23 explains:

Sometimes I ask them a question with 10 English words, and this takes me 20 seconds, and I want a yes or no answer. Then they talk together for three or five minutes, and then the answer that comes out is no! Why does it take so long, I ask? Yes, but Chinese don't say yes or no, they use different words and contexts. Sometimes in meetings it takes hours, and I think I could have done this in half an hour.

Problems with sense making do not only occur in the context of working across Europe and Asia, rather this was mentioned in many teams and it occurred across many different cultures, especially when it involved the use of specific terminology and acronyms. For example:

A lot of specific terminology is used. Either one group or the other thinks it is standard and that everybody understands, but a lot of times they are not clearly understood. I said to my team; if someone used a three or four letter acronym that you don't know, you have got to stop them. We have thousands of them in our organization, even to the extent of what a person's title is, they usually use three letter acronyms and they are not widely understood in the US. We have our own acronyms that I am sure are not understood over there, there are so many of them that it becomes sometimes a barrier to communication. [Leader of team 47, organization I]

In general, leaders indicated that working in distributed teams with the culture and language barriers is more interesting, but at the same time often frustrating for them, as the leader of an asset commercialization team explained:

Language is a very big challenge. The subtleties that I have come to know in Europe, I feel a bit like an idiot in cultural land, when you go to Asia. You are not aware of all the subtleties. You feel less effective. I think you are more challenged by the changing technologies to get people to work in the same way.

Differences in Hierarchy. Respondents mentioned that members from different cultures have different perceptions regarding hierarchy and power distance in organizations (Hofstede, 1993). Distributed teams bring individuals from sometimes highly diverse cultural backgrounds together in a setting with multiple leaders involved. For example, 37% of the leaders in this study mentioned the presence of differences in decision models and degrees of hierarchy across cultures. These differences were seen to complicate the role of a distributed team leader. Respondents indicate that it is crucial for leaders to be aware of these differences, and to be able to adapt accordingly. Given the multi-cultural composition of their team, respondents mentioned that they had to employ different leadership approaches for members from different cultures. For example:

In England from a management perspective I am the boss and I'll tell you what to do and it is up to you to decide how to do it. In Holland it's like; let's all discuss together what we are going to do. Just observing these basic things is important. If you are having a conference call with a group of Dutch people you have to be sure that everyone has been able to give their input (Jan is this what you think, or what are your thoughts?). In England it's like the boss says this; let's go and do it, end of story. [Leader of team 44, organization A].

Several leaders from organization I mentioned that working in distributed teams with multiple reporting relationships can lead to complex situations in leading people, especially with different cultures involved. The preferred leadership approach can vary to a large degree across cultures, from a preference for directive leadership to more participative and coaching styles. For instance, the leader of team 26 working on global sourcing (purchasing) of chemicals in organization I, gave the following example:

An interesting case: an American buyer likes to know who his superior is, and he receives quite a bit of status through his boss, that is very important! In this structure formally I am this gentleman's boss, but I am located very far away (Netherlands). In the central organization in the US there is another person with a prestigious title, who is sent out to the world with a mission: 'structuring a piece of purchasing cake'. This person starts interacting with this buyer in my team in a directive manner. The American is more dominantly directive, while the buyer also interacts with a boss at a distance (me) who is interacting with him in quite a democratic way. This can cause people to start asking: 'Who is it that I am really reporting to'?

Table 3.2 summarizes the challenges that were put forward by respondents. Many of the challenges were related to distance, complex team structure, cultural diversity and mediated communication. The challenges resulting from these team aspects mostly involve lack of clarity, misunderstandings about several issues and lack of awareness of context and team colleagues. Lack of (personal) working relationships hampers quick informal contact and effective communication between virtual team members. The findings show that the simultaneous occurrence of geographic dispersion, mediated communication and cultural diversity potentially causes great challenges for leaders of distributed teams. This suggests that studying geographic distance in isolation of other team characteristics is an oversimplification of the reality in distributed teams.

Table 2.2: Distributed team characteristics and challenges.

Distributed team aspects	Challenges for distributed teams
Complex team structure with multiple leaders. Geographic distribution, with sub teams demands for a team structure with multiple leaders.	Misunderstandings about responsibilities, about which order to follow, or about priorities.
Time differences across locations.	Difficulty with planning meetings, long working days.
Cultural diversity in communication styles. Cultural diversity increases with geographic dispersion, but the link between distance and diversity is dependent on region in the world.	Misunderstandings in communication, dominance by certain groups in meetings, missing information.
Language differences. The number of different languages in a team increases with geographic dispersion and number of locations. Yet, the level of grasping the dominant team language may be of greater importance.	Misunderstandings, loss of subtleties in communication and lack of participation.
Cultural differences in hierarchy perception. Cultural diversity increases with geographic dispersion, but the link between distance and diversity is dependent on region in the world. Some pairs of cultures are more diverse in hierarchy perception than others.	Misunderstandings about which order to follow, problems with prioritization.
Mediated communication: lack of visual cues. Reliance on ICT is related to geographic dispersion. Less rich or synchronous media convey information over fewer channels.	Problems with perception of power balance, distractions, problems with coordination and conveying messages, increased potential for misunderstandings with different cultures involved.
Mediated communication: lack of awareness. Reliance on ICT is related to geographic dispersion. Less rich or synchronous media convey information over fewer channels.	Not understanding problems, not knowing the people on the team, not knowing what is going on.
Mediated communication: lack of informal encounters. Reliance on ICT is related to geographic dispersion. When face-to-face encounters rarely occur, informal communication also generally occurs less,	Lack of informal (coincidental) contacts. Less informal communication and lack of 'chit-chat' level. Time delay as a result of a lack of effective working relationships, which prevents team colleagues to contact each other directly.

2.3.5 Emergent themes

When we look at the quotes derived from interviews with leaders, most of these involve an element of misunderstandings, or a lack of understanding or awareness. This (lack of) understanding involves information in two main areas. The first area involves information about team colleagues and interaction processes. It covers the way in which team members will interact with each other, or the social-emotional side of teamwork (Bales, 1953). It involves knowledge about individual team colleagues, their area of expertise, their strengths and weaknesses and their personal lives. Here we will refer to it as *working relationships*. The second area involves information about the task and how this task should be handled. It concerns information about the overall task, the elements that constitute the task, who will be responsible for which element and how and when these task elements should be fulfilled. As such, it involves a shared understanding about task oriented or instrumental team processes (Bales, 1953). Here we will refer to it as *shared*

understanding. In order to be effective both aspects of teamwork need to be addressed by team leaders.

Developing working relationships. Analysis of interviews reveals that developing working relationships in a team and getting to know each other is an important theme. Together with discussing strategic issues, building relationships seems to be the most important motive for leaders to organize face-to-face meetings. Leaders in this study were almost unanimous in their perception of the value of organizing face-to-face meetings for distributed teams, especially for personal interaction. Over 60 excerpts were found in interviews related to face-to-face meetings, coming from 75% of team leaders in this study. Face-to-face meetings were often described as the means to overcome many of the previously mentioned problems with lack of visual cues, informal encounters and awareness, but also for solving other issues that could result from cultural differences. Leaders in this study indicated that face-to-face meetings were often organized at strategic moments, for instance, when important decisions had to be made to get the team into the next phase (milestones meetings). Face-to-face meetings were often organized to handle the strategic issues in the team, while mediated meetings, i.e. teleconferences, were used more for ongoing management and smaller day-to-day issues. Apart from the business reasons for organizing face-to-face meetings, team leaders indicated that face-to-face sessions were organized to get to know team members. The leader of one of the teams working on asset commercialization in organization A explains:

In my opinion, meeting the people face to face is what is important, not what you're getting done. That is also the case with going to Italy. You get to know the people and you have a chance to get comfortable with them.

Developing shared understanding. The presence of multiple cultures within distributed teams can be a source of enrichment when it comes to sharing content, exchanging views and learning from each other. This study clearly indicates that reaching an understanding or common ground across cultures can be quite complex. These cultural differences are in distributed teams often exacerbated through the need to communicate via mediated means. The leader of a distributed corporate innovation team within organization A explains:

It's harder to reach an understanding; other cultures definitely enrich a team, because you are more disconnected. People have to consciously let go of the cultural paradigms that prevail in their individual cultures. That's what gives the team 'balls'; you get more ideas. How you deal with these ideas and how they somehow get a place in the paradigm of their

own cultures is highly variable. It's easier to deal with an idea within one culture, than with multiple cultures.

Problems with shared understanding can involve a lack of understanding about technical issues, or a more general lack of understanding as a result of language problems, or the use of acronyms. Not being able to develop shared understanding is extra problematic in distributed teams, especially when team members think they have reached an agreement, which is then explained differently by different individuals. In many cases this had to do with small differences in interpretation across cultures, which could be connected to a lack of verbal repertoire in the team language, a lack of cultural awareness and missing out on non-verbal cues.

2.3.6 Getting things done: effective leadership for distributed teams

This section addresses the third research question: what can team leaders do to overcome these challenges? For answering this question subjects were asked the following question: *“What do you as a leader see as effective behaviors in overcoming these challenges?”* The answers to this question were categorized in 12 categories. Five of these overall categories had over 16 quotes each from leaders, with a total of 99 quotes, these were the following: (1) developing awareness of members and context; (2) developing an effective communication climate; (3) motivating team members; (4) formalizing and structuring; and (5) team building. Below we describe these leadership activities in more detail.

Developing awareness. In our dataset 16 excerpts were found in which leaders indicated how they tried to develop awareness about remote team members and their situation, and to develop this awareness on a team level. Leaders indicated that they needed to know what issues their remote colleagues were confronted with, and what kinds of pressures they experienced. They also indicated that they needed to understand the cultural context in which their remote colleagues were working and the impact of this context on their work. Moreover, respondents indicated that they lacked an understanding of strengths and weaknesses of their remote colleagues, which complicated their leadership role. The leader of a team working on media applications to support digital television in organization D mentioned the following:

One time, the husband of one of our colleagues was hit by a car. You can't react harsh to someone in such a situation, knowing they have a problem at home. You need to know about these things, what is happening with their families and so on; just like you would know in the Netherlands.

To increase awareness of these aspects leaders indicated that they engaged in informal conversations with their remote colleagues. Informal conversations were said to help to develop an understanding of the personal situation of colleagues. Such informalities may include their family situation and pressures they face in their private and work life. Another way mentioned to develop awareness is actively seeking information about the cultural backgrounds of remote team members. Finally, leaders mentioned that they had a responsibility to distribute important information about the situation of team colleagues, and of their own situation and local developments throughout the team. This way leaders try to act as an example for their team colleagues, as the leader of a global management team for engineering plastics in organization I indicated:

We try to facilitate as much as possible. One of the roles I play is at the connection point. A lot of info of the other teams comes to me through e-mail. I try to make sure that it gets passed along, I ask people to read it and send it on. It is also a gage to see how well they are doing. When I see them copying each other in messages, then I know they are getting there. In the beginning I see a reluctance to copy people. They might do it hierarchically, and they might copy me, but not the guy in Japan who is doing exactly the same work that they're doing. You have to facilitate this.

Develop an effective communication climate. Because most of the communication incidences in distributed teams take place via ICT, an important responsibility for team leaders is to facilitate an effective communication climate. According to our respondents, such a climate supports bringing out the opinions of all team members, thereby preventing misunderstandings about opinions and agreements made. To encourage development of such a climate leaders managed their mediated meetings, by asking questions, especially when remote members were silent. Another aspect that was mentioned was to ask in-depth questions repeatedly, especially when something was not totally clear, or room was left for interpretation. The leader of a team working on production improvement processes in lamp factories worldwide in organization D explains:

An example: in communication with India we often encounter questions. I always approach this by asking 'the why question' several times, to really get a feeling of what it is they want. Often I notice that the initial question they ask will in the end have nothing to do with the underlying problem. If in such a situation I would react exactly the way I would in The Netherlands (question/answer). I might answer a question, but will not solve the problem.

Leaders also in some cases made it a point to explain things upfront, without questions from remote colleagues. Active explanation of complex issues prevents problems due to

wrong assumptions. During communication, leaders also asked for feedback and for people's opinions, to check whether their message was understood and to find out whether team colleagues agreed with what was said. The leader of a software development team from organization F explains:

As a leader you adjust by adapting the way you ask things, but also by asking a lot of feedback. For instance you indicate, I want this and this. In the Netherlands people will immediately say something like: 'I think that's a bad idea.' In Malaysia people will just say 'okay'. At that point you have to ask: 'What do you think, would you do it this way yourself?'

In general, leaders wanted to create a climate in which asking questions is supported, without loss of face involved when something was not understood. To enable this, leaders indicated they tried to listen very well to what others were saying, and to constantly check whether they had understood the message of team members correctly.

Motivating team members. The third category mentioned often by leaders was how to motivate members of their distributed teams. Leaders try to motivate team members by giving them compliments and by explaining how they can personally benefit from participation in the team. To really give them the feeling that they are part of a larger team, leaders indicated that they tried to increase the visibility of remote members, by showing their accomplishments to the rest of the team. Rewarding team members for their contributions was mentioned both financially as instrumentally. Some leaders visited all their remote sites once a year, to underline the importance of the colleagues working there. During these visits, they would also organize informal moments. Moreover, to motivate team members, leaders indicated that they would communicate more (or more often) than was typical in a co-located setting, and also to pay attention to the fit between the type of communication medium and the communication purpose. Finally, to motivate remote team members, leaders indicated that they needed to be available for them, in case of any questions. Although this is also the case in conventional teams, it was perceived more of an issue in distributed teams. The leader of a team in organization A explains:

The other thing is, especially in the management and leader role, is always being available to people when they have questions. You need to be open, and you need to be accessible. Example: my manager just calling me now, you have that relation, he has a question and he can ask it and then we can move on. Some people tell me: I am a manager and I have an hour of time lost during which people can disturb me, and the rest of the time 'bugger off and don't disturb me'. That is more the traditional way of doing it. Now, more in the

distributed world, people need to be able to reach you. If you can't be reached, then they will do whatever they think is right, and then you get the gaps.

Formalizing and structuring. In order to facilitate shared understanding about roles and responsibilities of team members, respondents indicated that a high degree of formalization was required in distributed teams. They for instance in many cases had very detailed project descriptions, detailing roles, responsibilities and interdependencies. Leaders indicated that the use of knowledge repositories was helpful. Moreover, during work in distributed teams, formal documents were written to develop shared understanding of what was discussed and agreed during mediated meetings. Leaders indicated that for distributed meetings an agenda is important, as well as action items after the meeting. The leader of a global lamp development team in organization D explains:

My experience tells me that it's good to have a well written project description document. If you don't, things you didn't ask for will happen and the things you did ask for will not!

Focusing on the team as a whole. In order to develop a group of geographically distributed individuals into a 'team', leaders suggested that all team members should be treated equally, regardless of their geographical location, including equal access to information. Leaders made it a point that face-to-face meetings are important to forge distributed team members into a coherent team. For example, such meetings involved cultural training or role play, which made team members more aware of cultural differences. Leaders stressed the importance of focusing on the team as a whole and to help team members 'find each other' remotely and to facilitate interaction at a distance. Part of equal treatment was mentioned in 'backing up' remote team members, especially when mistakes were made by the team leader's local team. Also, as an example leaders underlined the importance of involving their remote team members in decision making. The leader of a team working on purchasing in China in organization D explains:

You need to spend time with the people and not be too procedural. You have to stick to the teamwork but also be flexible. It will not work when you tell them: this is my plan and this how we are going to do it. You have to be open and share with them and discuss it. You also need to be flexible on details.

Table 2.3 summarizes the leadership activities and behaviors that have been described in the previous section.

Table 2.3: Distance leadership behaviors.

Leadership focus	Types of activities and behaviors
<i>Facilitating awareness:</i> (1) understand communication and technical issues and pressures people face; (2) understand cultural background (3) understand individual strengths and weaknesses, (4) understand situation at home, (5) keeping the team informed about relevant issues	(1) engage in informal communication with colleagues; (2) actively seek information about cultural backgrounds; (3) distribute information to the team.
<i>Develop an effective communication climate:</i> (1) bring out the opinions of all (culturally diverse) team members, (2) prevent misunderstandings in communication	(1) encourage asking questions, (2) ask in-depth questions (repeatedly), (3) stimulate clarification upfront, (4) ask feedback, (5) develop climate in which sharing of problems is accepted (without loss of face), (6) actively ask for opinions, (7) listen and check whether understanding was reached
<i>Motivating team members:</i> (1) giving remote members the feeling of being part of the team, (2) increasing their visibility, (3) representing the team to outsiders, and (4) being available	(1) give compliments, (2) showing (remote members) gains from participation, (3) provide (timely) rewards, (4) visit remote colleagues, (5) adapt communication style, (5) choose the right tool for the message, (6) over-communicate, (7) make sure remote team members can reach you
<i>Formalizing and structuring:</i> (1) enabling shared understanding about roles, responsibilities, and agreements, (2) developing clear and correct expectations	(1) have a clear project description, (2) describe processes in documents, (3) clarify importance of goals and members' contribution in these, (4) contracts (range, timing, quality), (5) install knowledge repository, (6) use minutes and action items
<i>Focusing on the team as a whole:</i> (1) developing a cohesive team over distance, (2) building relationships with local leaders and team members	(1) support remote team members and provide backup when mistakes are made (locally), (2) visit remote locations, (3) team building activities (e.g. cultural training and role-play), (4) use technology to facilitate empathic feelings, (5) informal, personal communication

2.3.7 Getting things done: the added value of face-to-face meetings

Team leaders of distributed teams indicate that to develop working relationships and shared understanding is difficult, yet important for distributed teams, because team members will have to work in isolation from their colleagues for long periods of time. In our data we found 66 excerpts from 30 interviews, underlining the importance of face-to-face meetings. In this section we will discuss a number of benefits that were attributed to the use of face-to-face meetings. For example, one of the respondents commented the following on face-to-face meetings:

Our first teleconference was not like: that was very useful ... once they have been face-to-face it all works a lot better. When they have seen each other several times they also know what the other thinks is important. [Leader of team 4, organization D]

Enabling distributed contact. According to the leaders in this study, people feel a need to know who is on their team, before they can work like a team. Developing such working relationships was seen as very important for effective distributed team work. Many

respondents indicated that having good working relationships that to a certain degree also become personal, will help people in working over distance with technology. For example, the leader of team 25 from organization F explains:

Face-to-face contact was very important to be able to work together. I really noticed this with our product specialist over here. This person did not go with us to the face-to-face meetings in Kuala Lumpur (KL). He also wouldn't just pick up the phone to call someone in KL to have a discussion, he just kept communicating via e-mail and our system. At some point you really need to have some verbal contact to really make something clear.

Getting to know 'the whole person'. To have knowledge of the personal lives of colleagues in a distributed team, and to know how they will respond, helps team members when they need to seek contact. The above example illustrates that in seeking contact with distributed team colleagues who are virtually strangers, people will often use e-mail, or other text based communication means. These means are perceived as having a lower impact on colleagues, by being less disturbing to ones day-to-day activities. Leaders indicated that when remote team members have seen each other, and they have built some kind of a relationship, they will more likely seek contact via more personal means, like telephone. This was stated to be sometimes necessary to clear up things. Therefore most leaders in this study indicated that they invested in this by letting their team members visit remote locations.

It's often a matter of letting people go there. What you see is that more room is given to how people personally experience something; what is this person like, how does he see this? For that moment there is a whole person. Later when you communicate at a distance with fewer words, you can interpret this in the context of the whole person. [Leader of team 26, organization I].

Team building. Team leaders also indicated to use face-to-face meetings for training and team building activities. These activities are often targeted at cultural differences, to make people aware of their existence. Cultural awareness programs can help develop working relationships and will make team members aware of how to deal with the cultural differences when the team takes its distributed form again. An example from the leader of team 47, working on global ICT support in organization I was:

In any case, the role play and training was very effective, and it is something we need to get more people involved with. Even when you don't walk away with real specifics about one culture or another you are certainly left with the flavour that there are differences that

we need to be aware of and we need to understand that, and not always take offence because we may approach differently in other cultures.

Individual needs and satisfaction with teamwork. Distributed teams are found in many forms. Accordingly, the need for face-to-face meetings is bigger in some teams than in others. In the section on multi-cultural teams we already discussed some of the typical differences in communication style between European and Asian countries. Team leaders indicated that the need for physical contact is perceived somewhat differently across cultures. For example, respondents indicate it is deemed more important in Asian cultures.

You can notice if people have met face-to-face before. That one thing can determine whether a telephone conversation succeeds or not. In China for instance, you have to get drunk together before you can do business. You really have to know each other. In the Netherlands it's different; we don't think it's odd to work with people we don't know. [Leader of team 33, organization D].

Face-to-face contact contributes to team member satisfaction with work in the team. Some team leaders stated that it is not rational, but more an emotional need for people to see each other and to get to know each other before they can work pleasantly in a distributed team. The leader of a team, working on asset commercialization in organization A mentioned:

Clarifying roles has been the focus of these meetings during the last couple of months. But the real reason for having these F2F meetings is to deal with the 'human or social factor' if you like. Working completely virtual, I think would not be satisfactory; I think you need the occasional F2F meetings.

2.4 Discussion

Four questions guided this study: (1) *“How do leaders from distributed teams in organizations perceive the impact of geographic distribution, time dispersion, cultural differences and mediated communication on distributed team work?”*; (2) *“What are the most important challenges with distributed team work, as perceived by distributed team leaders?”*; (3) *“What, according to leaders, are effective leader behaviors to overcome these challenges?”*; and (4) *“What can we learn from this first study in terms of promising areas for research?”*

Although multiple dimensions (e.g. geographic dispersion, time differences, cultural diversity and ICT mediated communication) have been put forward in definitions and literature on distributed teams (Martins et al., 2004; Bell & Kozlowski, 2002; Dubé &

Paré, 2004) when this study began, scarce research attention had been given to the nature of distributed team characteristics and their impact on team functioning. Only few qualitative studies aimed at the consequences of team distribution on team work and on the role of the leader. This study contributes to the existing knowledge base in several ways. First, this study shows that distributed team work is challenged mostly by teams having a complex team structure, a high degree of cultural diversity and a high reliance on ICT mediated communication. Second, these team characteristics were found to have an impact on team functioning mostly via problems with the development of working relationships and through problems to develop shared understanding. Finally, this study lead to a number of practical implications for leaders of distributed teams, in the form of effective leader behaviors for such teams.

2.4.1 Theoretical and managerial implications

Shared understanding in distributed teams. One of the major issues found in this study was the central role of development of shared understanding as a challenge for distributed teams. The concept of shared understanding is related to concepts such as shared mental models and team cognition (Cannon-Bowers, Salas, & Converse, 1993; Klimoski & Mohammed, 1994). These concepts have gained popularity in research over the last decade, primarily as explaining mechanisms for effectiveness of team processes and their link with team performance. However, only few studies focused on the distributed team domain. The fact that problems with shared understanding were often mentioned in distributed teams in this study suggests that shared understanding is perceived as an important factor for distributed team performance. Although this study has not compared distributed teams with different degrees of cultural diversity, it seems likely that an increase in cultural diversity in distributed teams will have a negative impact on the ability of a distributed team to quickly develop adequate levels of shared understanding. Other distributed team characteristics, such as the degree of mediated communication versus face-to-face interaction, and the degree of geographic distribution of the team may have a similar impact. Specifically, the combination of a culturally diverse team composition and a high reliance on mediated communication with few face-to-face meetings may have a strong negative impact on development of shared understanding in distributed teams.

Leaders play an important role in facilitating their teams, and in helping them reach workable levels of shared understanding. Especially in distributed teams, which incorporate many team members from highly diverse cultures, leaders have a challenging task. Leaders in this study suggest that it's important in such cases to target leadership efforts on facilitating a communication climate in which everyone explains issues upfront, which supports asking of questions by all team members involved, and which supports actively asking feedback and checking whether messages are understood. Furthermore,

leaders indicate the importance of being very clear about agreements, by writing these down in team documents. Leaders also indicate that they need to be available for their team members, so they can ask questions when things are unclear. Also mentioned was the need to invest in effective working relationships, and to develop awareness of relevant issues for their team colleagues, such as other pressures that affect their work.

Relationship building in distributed teams. This study shows that relationship building is difficult for distributed teams as a result of limited possibilities to organize face-to-face sessions. The leaders in this study indicated that having adequate intra-team relationships is very important for their teams. At the same time, they indicate that building these relationships is something that happens mostly in face-to-face sessions with the team. After this initial face-to-face contact, relationships in the team generally improved, which in turn enabled team members to more easily find each other, and to contact each other via mediated means. This finding is in line with earlier suggestions from theorists, who posed that face-to-face meetings in the early phases of a distributed team contribute to the development of trust among team members (Suchan & Hayzak, 2001). Research also shows that relationships within distributed teams are important for team functioning, by showing that trust in distributed teams is positively associated with job satisfaction (Morris, Marshall, & Rainer, 2002) and improved working relationships (Sharifi & Pawar, 2002). Similarly, a shared group identity, which is part of effective working relationships, has been suggested to be critical for effective distributed team functioning, through its effect on coordination, and trust (Kramer & Brewer, 1986).

To enable their teams to develop working relationships, distributed team leaders organized face-to-face meetings on a regular basis. The qualitative analysis suggests that apart from discussing strategic issues during these meetings, time should be allocated to social events, and possibly to team building activities. Leaders also mentioned that team members should be allowed to travel to remote locations to develop a feeling the context of work at the remote location, and to develop working relationships with colleagues.

2.4.2 Limitations and further research

The results of this study suggest that the challenges with distributed teamwork and implications for leadership that were found, are relevant for a diverse set of distributed teams. The teams under study were highly diverse. Some teams were ongoing management teams, in which team members already had over five years of shared work experience, while other teams were project-based teams, which had just been formed a few months before and consisted of team members who had never met before. Teams also had quite diverse tasks, varied to a large extent in size, and had more or less opportunity to meet face-to-face, due to geographic distance between team members and differences in travel budgets. Although the presence of diverse teams in the sample, with interviews taken at

different moments in the lives of these teams, enables to generalize the findings for a broad range of teams, it also limits possibilities to link the findings from this study to specific types of teams. Future research could investigate the effect of various team level differences (e.g. overall task, size) on the challenges experienced in these teams in more detail.

Another limitation of our approach is that qualitative data (generally) and interview techniques (specifically) do not lend themselves well to document the prevalence, or development of phenomena. The results of this study can therefore not be used as strong evidence for the role of shared understanding and working relationships over time, but merely represent a perception of leaders about the importance of these concepts.

Third, although teams in our sample originated from different organizations and represented several task domains, most of the teams in this study were either designing new technology or were involved with decision-making or strategic management in technology driven organizations. Exploring distributed teams in other contexts, such as healthcare, the financial industry, or government might add to these results.

Another limitation of this study is that most leaders are from a Dutch background. Although several leaders of other national cultures were also involved, the dominance of Dutch informants is likely to have affected the results of this study. Future research could use a similar research methodology in a study on distributed team leadership in for instance the Asian or US context. Results from such research can be used to put findings of this study in a larger, more international perspective.

Finally, the aim of this study was to investigate leadership in distributed teams from the perspective of team leaders. However, self perceptions of leaders may be subject to distortions or self fulfilling prophecies. This will not likely have an effect on the perception of the distributed team characteristics on team work, but to determine which behaviors are effective in distributed teams may be dependent on the point of reference, i.e. the leader, or followers. Future research which aims to determine effective leadership behaviors for distributed teams, might therefore be further enriched by also integrating the perspective of followers.

2.4.3 Conclusion

This study focused on distributed team characteristics and leaders' perceptions of challenges associated with these teams and how to overcome them. The findings of this study have several important implications for research and practice.

Although time differences can complicate coordination and communication in distributed teams, not many leaders perceived time differences as being problematic in isolation. The impact of geographic dispersion was felt more directly. Based on finding from this first study we suggest that geographic dispersion, member cultural diversity and mediated communication are the most important sources of problems with distributed team

work. As most of the teams under study spanned multiple locations on different continents, these characteristics were present in almost all teams in the sample. This study indicates that these characteristics are associated with problems with day-to-day coordination and especially with relationship building and developing shared understanding. This study indicates that effective working relationships and shared understanding are difficult to develop, yet important for distributed teams and the study provides examples of leadership behaviors that aim to overcome these problems.

The next chapter first provides an overview of the nature of distributed teams and what is known from theory and research about team characteristics and their impact on team processes. Next, the central concepts emerging from the qualitative analysis (developing working relationships and shared understanding) will be further explored by reviewing the literature on these concepts and their relationship with team outcomes. Next, the leadership actions and behaviors that emerged from this study are discussed in light of existing leadership theory. Finally, in the chapter a number of hypotheses about the association between leadership, shared understanding, working relationships and team outcomes is put forward. Hypotheses are also presented about the role of distributed team characteristics in the relationship between leadership and team processes. These hypotheses are then tested in Chapter 4.

Chapter 3

Development of a research model to study leadership in distributed teams

The first chapter concluded that a better understanding of context is crucial for systematic leadership research in distributed teams. Study 1 provided a first step in this direction by providing information on the context of distributed teams and the implications for team processes. There has been an extensive debate on the nature of distributed teams and how to capture this in research. Therefore, this chapter starts with a literature review aimed at the effect of distributed team characteristics on team functioning.

Leaders of distributed teams have all kinds of extra challenges compared to leaders of more conventional (co-located) teams. Study 1 showed that distributed teams are challenged in team processes such as (1) building effective working relationships and (2) developing shared understanding. These two concepts touch upon perceptions and feelings about working relationships, i.e. trusting team colleagues and their knowledge, being able to predict their behaviour in their absence and having a feeling of effective working relationships and cohesion, as well as overall perceptions of team knowledge, i.e. having a shared understanding about the task, goals and about who does what.

After the short literature review on team characteristics, a literature review of concepts related to these two overall concepts (1) working relationships (informal communication, trust, cohesion etc.) and (2) shared understanding (shared mental models, transactive memory and, team collective mind) and what is known about their relationship with outcomes from theory and research is presented. Next, a research model is presented which depicts relationships between two major leadership concepts (transactional and transformational), team processes and outcomes. The model is followed by a number of hypotheses about these relationships. In the chapter the concept of distance leadership is discussed further, as well as its status relative to existing leadership concepts such as transformational and transactional leadership. Finally, a contingency approach is proposed for the study of distributed team leadership, which suggests that the effect of leadership behaviours on team processes and outcomes is dependent on context factors. The chapter concludes with a research model of leadership, team processes (mediators) and outcomes, as well as team and task characteristics, which may serve as moderators for the relationships between leader behaviours and team processes.

3.1 Introduction

As mentioned in the first chapter, distributed teams have several advantages over co-located teams, such as the possibility to save time and travel expenses, increased access to rare expertise, the possibility to recruit the best-suited individuals regardless of their physical location and the possibility to assign individuals to multiple teams at any moment (Cascio & Shurygailo, 2002). In spite of these numerous advantages, organizations experience difficulties with the coordination of these distributed work forms, as they have to work under special circumstances (Martins et al., 2004).

The definition of distributed teams (often referred to as virtual teams) and hence, the circumstances under which these teams operate, have been the subject of much debate. Some theorists have taken geographic dispersion as the core characteristic (Bell & Kozlowski, 2002), while others see mediated communication as the core of distributed teams (Dubé & Paré, 2004). Some theorists have focused exclusively on global distributed teams (Maznevski & Chudoba, 2000), thereby adding cultural differences to the definition of such teams.

Early research mainly focused on contrasting distributed teams with conventional (co-located) teams. This approach is still used in experimental studies, but is not directly applicable to field studies in which task and other characteristics can't be controlled for. Teams in organizations rarely resemble any of the two 'pure forms' and this approach oversimplifies reality. As an example from the first study, teams in organizations are often partially distributed, while some team members in the team are still working in co-location.

In an early attempt to capture the variety in distributed teams, theorists began to describe characteristics of such teams, as part of their degree of "virtualness". Several different typologies of teams were proposed, in which two or more characteristics were used to differentiate four or more types of virtual teams (Bell & Kozlowski, 2002; Cascio & Shurygailo, 2002; Jarvenpaa & Leidner, 1999; Kirkman & Mathieu, 2004). These typologies mainly used two or three team characteristics, however, with more team characteristics used in such typologies, the list of different types of (theoretically possible) distributed teams becomes almost endless.

Other authors have suggested to view team distribution as being dimensional in nature (Hertel, Geister & Konradt, 2005; Martins, et al., 2004; Powell, et al., 2004; Dubé & Paré, 2004). This alternative conceptualization is in line with the earlier typologies, but enables the integration of more (independent) team characteristics into one model. This implies that 'virtualness' is composed of ever more, sometimes independent characteristics of teams, such as time differences, team member diversity (professional, organizational and cultural) and many more (Martins et al., 2004). According to the dimensional approach all teams can (in essence) have some elements of distribution in them, even when team

members are working in the same room, for instance because they work in different shifts, or because communication is taking place via ICT to some degree.

The lack of agreement on definitions of distributed teams and the lack of consistency in which team characteristics are seen as part of such teams is problematic for comparison of studies, and the development of theory has been complicated due to the numerous differences in teams used in independent studies. As these were often not measured or controlled for, these may explain the differences in findings. We will take the distributed team of which team members are geographically separated as the starting point of our research. Depending on the presence and degree in which other team characteristics are also present in distributed teams, such teams can become more complex to manage (yet not necessarily more virtual). The next section discusses the nature of distributed teams.

3.2 On the configuration of distributed teams

3.2.1 Defining distributed teams

Here we take geographic distribution as the core of our definition of distributed teams. However, a direct result of geographic distribution and an important part or many definitions of distributed teams is mediated communication. For the purpose of this dissertation we therefore arrive at the following definition of such teams: *“Distributed teams are teams of which members are geographically distributed and are therefore working predominantly via mediated communication means on an interdependent task and in realizing a joint goal”* (adapted from Bell & Kozlowski, 2002 and Dubé & Paré, 2004). As mentioned in the previous section, by their distributed nature, these teams are often faced with a more complex team structure than is typical in co-located teams.

The distributed teams’ literature is quite consistent in discussing several team characteristic as ‘attributes’ of distributed teams (Martins et al., 2004; Powell et al., 2004; Bell & Kozlowski, 2002; Dubé & Paré, 2004). As can be seen from figure 3.1, distributed teams are often more diverse in terms of team member composition, mostly as a result of spanning country, and cultural boundaries. These kinds of teams also typically include members from diverse functional and technical disciplines. Distributed teams are also increasingly used for collaboration across different organizations, which introduces differences in organizational cultures as well (Schein, 1992).

Table 3.1. *Distributed Team Characteristics (adapted from Dubé & Paré, 2004 and Bell & Kozlowski, 2002).*

	Team Characteristic	Description	Degree of Complexity Low ←-----→ High
Defining Characteristics of Distributed Teamwork	Geographic Distribution	The amount of Geographic Distance, number of locations and member distribution	Small Large Even Uneven
	Mediated Communication	Degree of Mediated Communication vs. F2F	Low High
	Time Differences	The window of synchronicity across all locations	Large Small
Characteristics of distributed teams which are often associated with distributed teamwork	Member Cultural Diversity	The number of different cultures (professional, organizational and National)	Low High

3.2.2 Geographic distance

For the purpose of this dissertation geographic distribution is *the* defining characteristic of distributed teams (Bell & Kozlowski, 2002; Zigurs, 2003) and for a team to receive the status of a distributed status, at least one of the team members needs to be located at a facility geographically separated from the rest of the team.

Geographic distribution of teams is in itself quite a complex phenomenon. For instance, in any team the number of geographically separated locations involved in a team may have a greater impact on the team than the degree of geographic distribution between locations. For example, a face-to-face team which consults one distributed expert for a problem temporarily is fundamentally different from a team in which all team members work in physical isolation during the full life cycle of the team (full dispersion). Moreover, geographic distribution is linked to time distribution (with East-West dispersion), and in a similar vein, though more complex, with cultural diversity.

Although research has indicated that co-located teams report far fewer problems with project management than distributed teams do, geographic distance in itself is not necessarily a barrier for leading distributed teams (MCDonough, Kahn, & Barczak, 2001). Results from research on the relationship between communication behavior and geographic distance in distributed teams have been mixed, sometimes showing less communication and sometimes more with increasing distance.

Geographic distance does have a strong influence on the nature and degree of interpersonal contact. Even small distances between employees in the same building have been found to hinder effective communication and cooperation. Within distributed teams, geographic distance between team members can result in a number of potential barriers, such as a reduction of face-to-face contact between members, which results in an increased reliance on ICT for communication, differences in time zones across locations, and when

spanning national or cultural boundaries, an increase in cultural diversity between team members.

Distributed teams also run a greater risk than co-located teams that dysfunctional 'subgroups' may occur, as also emerged from the first study. Dubé and Paré (2004) provide an example of a distributed team that consists of individuals at two locations. Members at one location worked closely together while largely ignoring team members at a distance. At some point the larger sub-team actually replaced the distant team members by local experts to speed up the decision making process. Given the distributed nature of such teams, with geographic distribution of members, sub teams are likely to develop. In many teams, geographically separated sub teams are a reality from the start. Working relations have often been developed already at local sites, while distributed sites are new to each other. Leaders of distributed teams therefore face the challenging task of developing the distributed parts into a coherent and cohesive team.

As a result of the distributed nature of such teams and the incorporation of different organizational entities, the management structure of such teams is also different. In many cases a distributed team leader is in actual fact a co-located leader for some members of his team, while for other members he fulfils the role of leader at a distance. In this role leaders often share or divide management responsibilities, with other leaders (co-located with their remote team members), who sometimes also come from different organizations.

One way to integrate geographic distribution in research in distributed teams, apart from experimental approaches in which co-located teams are compared with geographically distributed teams, is to use an index of separation which uses the great circle distance, to calculate the amount of geographic dispersion between team members (O'Leary & Cummings, 2007). Such an index considers (1) the number of geographically separated locations (2) the division of team members across locations and (3) the geographic distance between locations.

3.2.3 ICT mediation and face-to-face contact

With an increase in geographic distance between team members, face-to-face contact will become increasingly time-consuming and costly, because large distances have to be traveled. Therefore distributed teams employ a number of tools, of which the simplest and most widely introduced are telephone (conferencing) and e-mail. More recently applications such as (desktop) videoconferencing, net meeting or web-X and, instant messaging have been introduced. Moreover, advanced tools that enable people to virtually look each other in the eye have been developed (e.g. Eyecatcher) over the last few years. Team members, who work via mediated means and who also spend more time interacting via such means in their personal lives, increasingly use weblogs, wiki technology and personal networks. For distributed teams, specific project management software and groupware tools have been introduced also over the last few decades for coordination of

work and tasks (Andriessen, 2002). Technology enables work across distance, and is therefore one of the catalysts of the rise of distributed teams.

However, the role of technology in distributed teams can be interpreted as a 'double edged sword'. On the one hand increasing technological sophistication is an enabler for distributed team work. On the other hand, communication via all kinds of ICT has its limitations when compared to conventional face-to-face contact. Technology use can be interpreted as an enabler for distributed team work in general, but depending on the types and amount of information media are able to transform (e.g. media traits), communication can be more or less problematic, as was found in the first study. These media traits have been described in two leading theories: the media richness theory (Daft & Lengel, 1984) and media synchronicity theory (Dennis & Valacich, 1999). Media synchronicity is the extent to which individuals work together on the same activity at the same time; i.e., have a shared focus (Dennis & Valacich, 1999). The theory helps in examining media capabilities by discriminating these capabilities in five categories:

- Immediacy of feedback: the extent to which a medium enables users to give rapid feedback on the communications they receive. It is the ability of the medium to support rapid bi-directional communication.
- Symbol variety: the number of ways in which information can be communicated – the "height" of the medium -- and subsumes Daft and Lengel's (1984) multiplicity of cues and language variety.
- Parallelism: This refers to the number of simultaneous conversations that can exist effectively -- the "width" of the medium.
- Reprocessability: the extent to which a message can be reexamined or processed again within the context of the communication event.
- Rehearsability: the extent to which the media enables the sender to rehearse or fine tune the message before sending.

Although mediated communication is generally considered as less 'rich' in information than face-to-face contact, its use can also have benefits. For instance, with e-mail, a repository, or a log of communication is automatically generated (reprocessability), which simplifies finding what was discussed or agreed in previous communications. Moreover, e-mail, and all written messages similarly, can help a team member to read back a message before sending it, to rephrase or to discard it all together, after giving it some thought.

Theorists have underlined the importance and potential benefits of fitting the medium to the communication or coordination purpose (Daft, Lengel & Trevino, 1987; Maznevski & Chudoba 2000). However, the fit between media and functionalities with tasks and purposes is complex. Results from our first study suggest that relatively simple media are

used for most communication purposes in distributed teams. According to Martins et al. (2004), media richness is positively associated with team effectiveness, efficiency, frequency of communication, quality of relationships, team commitment, performance and trust. Indeed, Kayworth and Leidner (2000) found that rich computer mediated communication “greatly facilitated teams’ abilities to plan, to exchange ideas, and to reach consensus on a variety of issues”. Technology in general has been found to lead to more equal participation of team members (Zigurs, Poole, & DeSanctis, 1988).

However, Martins et al. (2004) also show that specific aspects of ICT, such as decreased non-verbal cues and decreased visual contact, can cause distributed teams to take longer to reach decisions and to be less able to make inferences about team colleagues’ behaviors and knowledge. Problems with the use of technology were found to hamper communication (Cramton & Orvis, 2003). A profound group history, with previous working relationships and knowledge about team colleagues can help distributed team members with future communication under distributed conditions. The exchange of personal and intimate information is found less in computer mediated groups than face-to-face (Lebie, Rhoades, & McGrath, 1996). This may be related to a lack of context cues, also associated with a reduction of face-to-face contact (Cramton, 2001).

Because distributed teams have limited opportunities to organize face-to-face meetings, it is more difficult to build trusting relationships. It is often advised to meet face-to-face in the beginning during a kick-off to facilitate relationship building, to clarify roles and procedures and for building an interpretative context (Warkentin, Luftus, & Hightower, 1997; Duarte & Snyder, 1999; Gibson & Cohen, 2003; Martins et al., 2004). Reduced amounts of face-to-face communication and lack of awareness of fellow team members were related to problems with developing ‘shared understanding’ (De Rooij et al., 2007) and ‘common ground’ (Olson & Olson, 2001). Sharing information and developing a ‘transactive memory system’ (e.g. knowing who has specific expertise in the team (Lewis, 2004) are expected to be more difficult in this context. Research found that the amount of face-to-face contact can serve as a moderator for the effect of team processes (e.g. empowerment) on team performance, in that empowerment was a stronger predictor when teams met face-to-face less, rather than more frequently (Kirkman, Rosen, Tesluk & Gibson, 2004).

In general, leading distributed teams, and providing for adequate performance management and team development are more difficult as a result of fewer opportunities to meet face-to-face (Bell & Kozlowski, 2002). Distributed teams are dependent on quite sophisticated media to communicate, to work together and to store their common information. Therefore, experience with and competence for handling these tools appear to be especially important in distributed teams (Dubé & Paré, 2004). Research has indicated that a lack of technical expertise and proficiency may have a negative impact on individual

satisfaction with the team and performance (Kayworth & Leidner, 2000; Ryssen & Godar, 2000).

Mediated communication can be investigated by means of incorporating a measure of how much of their time team members spend communicating via mediated means, or by logging all communication incidences. However, the type of communication means and their characteristics, i.e. media richness or synchronicity, impact the possibilities of such means and their impact on the team. The amount of face-to-face contact can be measured, as has been done by (Kirkman et al., 2004). However, issues that need attention are the following: (1) “Are all members present, or just a sub-group”? (2) “What is the purpose of the face-to-face meeting?” and (3) “How much time is spent in physical proximity?”

3.2.4 Time differences

Working across geographically separated locations can result in time differences and therefore several theorists consider time differences also as an important characteristic of distributed teams (Kayworth & Leidner, 2000). In distributed teams, time differences which occur in teams with East-West dispersion are in some cases considered favorable for organizations, for instance by enabling them to continue their operations 24 hours per day, without the need for traditional ‘shift work’. This is facilitated by adopting a ‘follow the sun strategy’, in which locations in the East are followed by the West. Moreover, making use of time dispersion of team members for product development and product support, enables organizations to work more hours during a typical working day in order to reduce time needed for new product development.

When synchronous communication (for instance for real life meetings and decision making) is necessary across locations in such teams, time differences can result into problems. With locations from three or more continents involved in a distributed team, synchronous meetings become more complex to arrange. Research indicates that different time zones can result in difficulties with planning and coordinating, which can be a barrier to successful team performance (Kayworth & Leidner, 2000). Developing adequate team processes, such as effective implicit coordination, has been theorized to be negatively impacted by time dispersion (Espinosa, Cummings, Wilson, & Pearce, 2003; Espinosa, Lerch, & Kraut, 2004). However, few studies to date have addressed the effect of time differences on distributed team coordination.

Several factors influence the possibility for coordination across time zones. For instance, when team members are working interdependently over distance, with a ‘sequential’ type of interdependence, i.e. software support teams and software development teams, coordination can be facilitated by means of groupware tools and workflow management software. In such cases limited ‘real time’ interaction can be enough for a team to perform well. When team members face a ‘team interdependence’ level, such as is found in global management teams, much of the interaction across

locations has to take place in real time. This has to do with the nature of the task, which in this case involves discussion and decision making. Task interdependence will be elaborated on further in this chapter.

Conceptualizing time differences in research can be done by taking the shared interval during which real time interaction is possible across all locations; the ‘window of synchronicity’. Another way is to collapse time differences in a separation index, which reflects the average travel time between any two random team members (see O’Leary & Cummings, 2002 for a detailed overview).

3.2.5 Team member diversity

Distributed teams often incorporate team members who are diverse in (1) professional, (2) organizational and (3) national cultural background. Bringing individuals of highly diverse professional backgrounds together in a team is theorized to be a benefit for innovation. In line with this, Van der Vegt and Janssen (2003) found that the association between task interdependence and innovation is higher for heterogeneous teams than for homogenous teams. However, a consequence of bringing together highly diverse individuals is that due to differences in culture and language, coordination can take longer and misunderstandings are more likely to emerge (De Rooij et al., 2007)

Members of distributed teams often come from different countries, with their own cultural backgrounds. This often implies not only a variation in culture but also in language. Hofstede, (1993, 1997) showed that different cultures can have very diverse perceptions about management, leadership, decision-making and relationships between people. Indeed, the work of Hofstede suggests that members of different cultures can vary to a large extent in their perceptions of (1) power distance, (2) collectivism/individualism (3) masculinity/femininity, (4) uncertainty avoidance and (5) long term orientation. In addition to Hofstede’s work, several other large studies have been performed on the role of cultural differences in (perceptions of) management and organization structure (House, Hanges, Javidan, Dorfman, & Gupta, 2004) and Trompenaars and Hampden-Turner (1998). These studies are examples of a stream of research on cross-cultural management and leadership, which is generally aimed at studying the impact of cultural differences on leadership.

Diversity has been suggested to be advantageous with highly complex tasks in which creativity is important (Bowers, Pharmer, & Salas, 2000), however, limited communication opportunities might prevent effective use of diversity, and might lead to misunderstandings and conflicts (Hertel et al., 2005). Members from different cultures may differ on one or more dimensions, and differences on one dimension may be relatively problematic, while others can be overcome fairly easy. In distributed teams, the impact of cultural differences is magnified through the use of mediated communication means, which often does not

support the exchange of non verbal signals (e.g. body posture, facial expression, personal power and physical setting of meeting).

Some researchers suggest that some cultural backgrounds are more compatible with distributed teamwork. Jarvenpaa and Leidner (1999) show that members from individualist cultures are likely to trust others because they are more willing to respond to ambiguous messages. However, people from collectivistic cultures might be more prone to seeking contact and to identify with the group (Bouas & Arrow, 1996). Distributed team leaders will have to cope also with other, more everyday cultural differences (Connaughton & Daly, 2004b), among these are differences in working hours and working habits, national holidays, ethical norms, and the importance of status.

The degree of geographic distance is not directly linked to cultural diversity, or the nature and degree of differences across cultures. For instance, Western Europe has a higher degree language diversity than North-America; apart from local dialects, US citizens in general share one language, much in contrast to Western Europe which has up to 7 different main languages. Major cultural differences can also exist across regions within one country, and culturally homogenous regions can extent country borders. Research on cultural diversity in distributed teams up till now has found that cultural differences have a negative effect on coordination and communication in distributed teams (Martins et al, 2004; Kayworth & Leidner, 2000; Maznevski & Chudoba, 2001; Sarker & Sahai, 2004). As mentioned, team member diversity can also have a positive impact on creativity and innovation. Therefore, to further our understanding of the effect of diversity on different distributed team outcomes (e.g. team effectiveness, innovation, and satisfaction) more research is needed. Given the differences between tasks, team member interdependence and cultural diversity, arguments can be made both for positive as well as negative effects of diversity on distributed team outcomes.

3.2.6 General team characteristics

Because distributed teams are increasingly used for a wide range of organizational tasks, these can be found in many different forms. Not only can such teams encounter any or all of the above mentioned characteristics, they may also more or less encounter complexity that can be found also in co-located teams.

The literature suggests that the above mentioned characteristics of distributed teams can show a complex interplay with other team characteristics, such as team size and life cycle (Martins, et al., 2004, see Table 3.2). In contrast to the consistency with which the characteristics discussed above have been included in definitions and in research on distributed teams, these additional team characteristics have been noted by some researchers, but have not been universally adopted (Martins et al., 2004).

Table 3.2. General Team Characteristics (adapted from Dubé & Paré, 2004 and Bell & Kozlowski, 2002).

	Team Characteristic	Description	Degree of Complexity Low ←-----→ High	
General team characteristics that further influence distributed team work	Team Size	The number of team members and distribution	Small	Large
	Team Member Roles	Number of simultaneous roles of individual members	Low	High
	Membership Stability	Degree of member stability	High	Low
	Team Life Cycle	Team life cycle	Continuous	Discrete
	Prior Shared Work Experience	Shared work experience outside the distributed team	Extensive Experience	No Experience
General Task Characteristics	Overall Task complexity	The nature and complexity of overall task	Low	High
	Task Interdependence	The degree and type of interdependence between team members across distance	Low	High

As an example team members of distributed teams often work in their teams on a temporary basis and membership stability tends to decrease when team members are assigned to a team on an ‘as needed basis’, which often happens in distributed ‘task forces’. When more urgent matters have to be dealt with in other teams, members are reassigned. Individuals may also be involved as expert or consultant for only a short time, to provide input on a specific subject (Powell, et al., 2004). The lifecycle of distributed project teams is typically shorter than for ongoing teams. Team members are also increasingly part of multiple teams at the same time, sometimes distributed, sometimes co-located. All these characteristics have an impact on the way team members learn to work together, the amount of contact and shared experience they can have, their commitment to a team and their expected tenure with the team. In this section the following team characteristics, which are associated with distributed team work quite often in literature are discussed: team size, team member roles, membership stability, team life cycle and shared work experience.

Team size. The size of distributed teams has been subject of extensive debate in literature, however, few attempts have been made to determine the effect of size on team functioning (Martins et al., 2004). Larger teams can bring in more expertise, but require for more communication and coordination, and are usually more complex. Team size is also strongly related to the way a team is organized, the number of management layers and the overall goal of the team. Because of the possibility to quickly assign an expert (or a group) to a team, there seems to be a tendency to develop larger distributed teams. Literature suggests that in face-to-face teams, increased team size can be a disadvantage for team effectiveness through process losses and production blocking (e.g. not everyone can speak at the same time, Martins et al., 2004). Moreover, (Kirkman & Mathieu, 2005) indicate that

with increased team size, there are fewer opportunities to assemble entire teams face-to-face, due to coordination and logistic problems and high costs. With the use of collaboration tools such effects may be less salient in distributed teams, as suggested by Leenders, Engelen, and Kratzer, (2003), however, the use of audio conferencing tools was found to be more difficult with increased team size (e.g. Riopelle, Gluesing, Alcordo, Baba, Britt, McKether, Monplaisir, Ratner, & Wagner, 2003).

Team member roles. Distributed teams often have members who also have roles in other teams, and may therefore allocate only part of their time to the team. This may imply less identification with and cohesion within the team. In cases where people are involved in multiple teams, they will face the challenge of dividing their time over several teams. Often people will have both responsibilities in local teams and in one or more distributed teams. In such cases team members report to several leaders, who may compete for time of their team members (as was found in the first study).

Membership stability. Stability of team membership is less common in distributed teams than it is in co-located teams. Members whose expertise is suddenly needed can flow into the team and leave just as abruptly when their task is fulfilled. Bettenhausen, (1991) suggests that the flowing in and out of team members triggers adaptation processes that may cost time and energy. If adaptation processes are occurring continuously, these can severely interrupt with the team's ability to reach its desired goals. Fluctuation of membership in the team makes team membership less visible, and communication and coordination more complex.

Team Life Cycle. A distributed team can have a discrete task, for instance on a project basis, with a clear start and finish. Other distributed teams may work on more continuous tasks, such as service and maintenance, or management tasks. When people start working together it takes some time before they develop working relationships and before a team runs smoothly. They often go through stages like orientation, norm development, strategy choice and execution (see e.g. McGrath & Hollingshead, 1994; Tuckman, 1965). Distributed teams tend to focus strongly on the task, at the cost of group maintenance activities (Bell & Kozlowski, 2002). This reflects an over-concentration on task achievement as a consequence of the geographical and social distance in distributed groups. In distributed teams with discrete life cycles less time is typically available for building working relationships, and researchers suggest that developing trust and cohesion in teams can prove to be more difficult under these circumstances (Dubé & Pare, 2004).

Shared work experience. Members of distributed teams may or may not have prior shared work experience with team colleagues. In cases where geographically separated parts of the teams are working in co-location, local shared work experiences are likely to be extensive, while distributed shared experience may be absent all together. These differences require for quick development of work practices, and norms about

communication, specifically between geographically separated parts. Next, we will go into the role of task characteristics for distributed teams.

3.2.7 Task characteristics

As put forward in Table 3.2, task characteristics are an important aspect of life in distributed teams. The role of task characteristics has received a lot of attention in the team's literature (e.g. see Guzzo & Dickson, 1996 for an overview). Numerous types of tasks are nowadays performed in distributed teams. The degree of task interdependence can impact distributed team work by affecting directly the degree of necessary coordination between geographically distributed team members.

Task type. Certain types of tasks are more likely to be carried out successfully in distributed teams, than other tasks. For example, computer supported idea generation can be very effective, mostly because of a lack of production blocking and the possibility to generate ideas simultaneously (Valacich, Dennis, & Connolly, 1994; Valacich, Dennis, & Nunamaker, 1992). Considerable research attention has been given also to the role of tasks in distributed team research and the type of task assigned to a distributed team has been argued to be critical to the success of such teams and for the speed with which distributed teams make decisions (Daly, 1993; El-Shinnawy & Vinze, 1998; Hiltz, Johnson, & Turoff, 1986).

Hertel, et al., (2005) provide an overview of different types of tasks (e.g. idea generation tasks, decision tasks, negotiation tasks and executing tasks) and their fit with distributed teamwork. Research has focused mostly on idea generation and decision tasks, while negotiation and execution tasks have received less attention. Results of research in this area have to be interpreted with caution, as many studies have been performed in laboratory settings and because possible moderators have not yet been considered in research (Hertel et al., 2005). The idea of comparing teams with different tasks can be quite fruitful, however, in distributed teams in organizational practice it is more the *overall task or team objective* that differentiates teams, combined with their structure (e.g. geographic spread, size and diversity, see the first study). The four types of tasks mentioned above are often all performed in the context of a team, in specific phases, or by different groups or individuals. This is the case for project teams especially, which involve members from different areas of expertise, who interdependently develop a product or service. A more general way to look at tasks in research is to determine their effect on team interaction, through the degree and type of interdependence between team members that result from the task.

Task interdependence refers to the degree to which individuals or groups must rely on one another to perform their tasks effectively. As such, tasks can vary in their interdependence and need for coordination. Task may require several sets of skills that rarely reside in more than one individual team members (high specialization), or tasks may

require more common knowledge and experience, which most team members possess. The nature of the tasks determines how much of the unique knowledge of the individual team members need to be transferred to team colleagues. According to Thompson (1967) it is not only the degree of task interdependence, but also the *type of task-interdependence* in a group or organization that determines the way the group or organization should be coordinated. Thompson distinguishes three types of interdependence:

- *pooled interdependence*, where the members of a group make a contribution to the group output without the need for direct individual interaction, e.g. a group of typists;
- *sequential interdependence*, where the output of one is the input for the other, e.g. work on an assembly line;
- *mutual (or reciprocal) interdependence*, where people exchange products or information for a common goal; the group members generally have different but prescribed roles and perform different parts of the task in a flexible order, e.g. a surgical team;
- Van de Ven & Delbecq, (1976) define a fourth category, *team interdependence*, where group members, without having separate roles, jointly diagnose and solve problems, and co-operate to complete a task; this is probably the case in many distributed teams (e.g. a distributed team working on development of new rocket design concept; (Majchrzak et al., 2000)).

When task interdependence is high, the need for coordination is extensive. In such cases, working across distance becomes more tedious. Task interdependence is therefore an important factor to consider in distributed teams' research. Apart from the impact on complexity of coordination, high task interdependence also has a potential positive effect on distributed team work, as the increased need for coordination between members will increase the amount of communication incidences. This increase in communication can be especially beneficial for distributed teams, in which low levels of cohesion often result from few opportunities to meet face-to-face (Bouas & Arrow, 1996). Research indicated that high task interdependence had a positive effect on team effectiveness, especially during the first 12 months of work in a team, later this effect diminished (Kirkman et al., 2004). These results suggest that high task interdependence is especially beneficial for distributed teams during their start-up phase, in which it facilitates the development of relationships and work routines through increased need for coordination.

3.2.8 Summary and Discussion

This section provided an overview of characteristics of distributed teams. Geographic distribution was considered the defining characteristic of such teams, with mediated communication and a lack of face-to-face contact as direct consequences. Distributed teams are complicated to manage due to geographic distribution, mediated communication,

time differences, and diversity in the backgrounds of team members. These characteristics are related with other team characteristics (see Table 3.1. and 3.2), such as team size, team members roles, membership stability, team life cycle and prior shared work experience, which can complicate work further. Task type and task interdependence were considered important for research on distributed teams. The next part of this chapter will discuss in detail the literature about the two categories of team processes found in the first study, i.e. developing working relationships and shared understanding.

3.3 Challenges for distributed teams: work relationships and shared understanding

Depending on the complexity of the team structure and the presence or absence of specific distributed team characteristics, leaders of distributed teams are more or less challenged in managing their team's processes and in reaching desired management goals. The first study showed two main challenges for leaders. The first challenge was to develop effective working relationships. It touches upon overall perceptions and feelings about *working relationships* (knowing team colleagues on a personal level, trusting them and their knowledge, being able to predict their behaviour in their absence and having a feeling of cohesion). The second challenge deals with shared understanding among team members and touches upon perceptions of *shared understanding*, or *team knowledge* (having a shared understanding about the task, team processes, goals and about who does what). As such, these concepts are 'higher level' concepts that include several team processes, i.e. trust development, and their resulting 'psychological states', i.e. high or low trust. Presence of these states enables team colleagues to anticipate actions, to interpret perceptions and to explain behaviours of team colleagues (Espinoza, et al., 2004) and thus to coordinate task activities implicitly (Klimoski & Mohammed, 1994). The next section will elaborate further on effective working relationships and shared understanding by reviewing team processes and psychological states related to these concepts.

3.3.1 Effective working relationships

Relationship building includes interaction processes designed to include feelings of inclusiveness or belongingness to the team (Powell, et al., 2004). These processes have received much research attention in distributed teams, specifically, in research on trust and team cohesion. Literature suggests that distributed teams are more focused on the task than on social relationships within the team, although this effect seems to disappear over time (Chidambaram & Bostrom, 1993). Members of distributed teams report weaker relational

links than members of co-located teams (Burke & Chidambaram, 1996; Warkentin et al., 1997) and these differences have been attributed to the use of mediated communication.

Trust. In distributed teams, trust has received extensive research attention and some researchers have defined it as ‘the glue of the global workspace’ (O’Hara-Devereaux & Johansen, 1994). Development of trust has also been coined as one of the greatest challenges for distributed teams, without the possibility to assess team members’ trustworthiness in face-to-face meetings (Kirkman et al., 2002; Jarvenpaa & Leidner, 1999; MCDonough et al., 2001).

Traditional organizations are arranged by control mechanisms, from the idea that it is unwise to trust people whom you do not know, or can observe in their work (Mintzberg, 1983). In line with this, conventional theory about trust suggests that trust is built over longer time periods in face-to-face contact, with direct observation of behavior as a control mechanism. This kind of trust is hypothesized to be very difficult to develop in teams that rarely meet face-to-face. Since members of distributed teams work in physical isolation and often only for short periods of time, they have been hypothesized to rely on other kinds of trust, such as ‘swift trust’ (Jarvenpaa & Leidner, 1999). Swift trust is a form of trust that is based on an evaluation of an individual’s trustworthiness, due to reputation, position or references from others. It is different from other forms of trust that are based on previous contacts, working relationships and shared experiences. Kirkman and colleagues (2004) found that trust can be built remotely when people honour their work commitments and show a positive work ethic. Trust in distributed teams seems to be developed more on the basis of task performance and perceptions of ability and integrity (Jarvenpaa & Leidner, 1999), which seems to be different from the type of trust that is developed in more conventional face-to-face work modes. An individual’s propensity to trust others has also been found to have an impact on trust development in distributed teams (Aubert & Kelsey, 2003), and using control mechanism, such as having employees file weekly reports and assigning specific tasks were actually found associated with a decline in trust among team members (Piccoli & Ives, 2003).

The nature of team communication, i.e. social, predictable and enthusiastic, has been found to positively impact trust development (Jarvenpaa & Leidner, 1999). Also, initial face-to-face meetings during the start-up phase of distributed teams, have been linked positively to trust development (Suchan & Hayzak, 2001). Although research suggests that trust building is possible via mediated communication, members from different cultural backgrounds may vary in their perception of trust, and how this is developed. What seems to work in low-context cultures such as the ones found in north-west Europe and the US, does not necessarily work for high context cultures, as are found in (southeast) Asia (Connaughton & Daly, 2004c). Overall, the incorporation of team members of different cultures is likely to make trust development more difficult.

Trust emerged as a determining factor of team effectiveness in research and has been studied widely in the domain of group and team research (Dirks & Ferrin, 2001). In distributed teams trust has been found positively associated with job satisfaction (Morris et al., 2002), and improved working relationships (Sharifi & Pawar, 2002). Well performing teams were found better able to maintain adequate levels of trust over time (Kanawattanachai & Yoo, 2002). Trust has a direct positive effect on perceptions of team cohesiveness and can act as a moderator for the relationship between team communication and perceptual outcomes (Jarvenpaa, Shaw, & Staples, 2004). These researchers also suggest that future research on trust in distributed teams should consider situational contingencies.

Cohesion. Group cohesiveness refers to individual team members' attraction to the group and to its task (Kozlowski & Bell, 2003). Early studies found that face-to-face groups reported higher cohesiveness than distributed teams (Warkentin, et al., 1997), and research in distributed teams showed group cohesiveness to be positively associated with information exchange and satisfaction (Chidambaram, 1996). Task cohesion was linked positively to team effectiveness in student groups (Gonzalez, Burke, Santuzzi, & Bradley, 2003), and cohesion was also found to be associated with better performance (Lurey & Raisinghani, 2001).

Feelings of isolation. One of the risks of working in a distributed environment are feelings of isolation from team members. According to Cascio and Shurygailo (2002) workers need a certain level of social interaction with colleagues and supervisors in almost all jobs. This social interaction, which happens more naturally in a face-to-face environment (Connaughton & Daly, 2004b) can involve team members to have lunch together, or to share successes in work or things that happen in their personal lives.

In remote collaboration, random encounters do not happen automatically. Individuals differ in their need for social interaction, which opens up possibilities to select people on personality characteristics that match the requirements of a position in a distributed team (Kirkman, et al, 2002). In general, team building activities may help team members to build relationships, which will help them to find each other when they are working at a distance. Overall, increased communication - mediated as well as face-to-face - can help to counter feelings of isolation (Kirkman et al., 2002).

Conflict. Research has found that conflict is more likely to occur in distributed than in co-located contexts (Mortensen & Hinds, 2001). Several interpersonal factors seem to have an effect on the amount of conflict in distributed teams. For instance, the presence of a group identity within a distributed team will reduce the amount of conflict (Mortensen & Hinds, 2001). Using the right tool for dealing with conflicts was found to determine to a large

extent, whether conflict is managed productively (Poole, Holmes, & DeSanctis, 1991). Finally, studies indicate that collaborative and competitive conflict management styles work best for distributed teams (Montoya-Weiss, Massey, & Song, 2001), and that a collaborative style has a positive impact on satisfaction, decision quality and participation (Paul, Seethamaram, Samarah, & Mykytyn, 2004).

Conflict in distributed teams may be more likely to occur as members tend to be less inhibited in communication via mediated means. For instance, research by Siegel et al. (1986) showed that swearing and other uninhibited behaviors such as insults and name calling are more likely to occur in computer mediated teams, than in face-to-face teams. A gender effect is also noticed here as men-only distributed teams were more prone to use argumentative and coarse language than female-only distributed teams (Savicki, Kelley, & Lingenfelter, 1996). However, conflict also can have benefits. Researchers have suggested that conflict is an important process to allow team members to make better decisions in teams, mostly because more alternatives are generated (Jehn & Mannix, 2001).

Informal communication. Study 1 showed that informal communication and exchange of personal information can help facilitate to develop effective working relationships. In distributed teams the amount of informal, non-task related communication can diminish, due to the use of less rich and synchronous media for communication. A study by Lebie, Rhoades and McGrath (1996) found that the exchange of personal and intimate information was less in computer mediated groups, than in face-to-face groups. This finding might have to do with the lack of contextual cues present about other team members (Cramton, 2001), which forces team members to actively seek this information to interpret a message in its full context. Interestingly, members of highly effective distributed teams were found to communicate more in informal, social ways (Saphiere, 1996).

The expected life cycle of distributed teams seems to have an effect on the amount of informal communication, which was found to develop more after prolonged work relationships (Chidambaram, 1996). Also, expectations of working together in the future might influence individuals willingness to invest in informal communication (Walther, 1994).

3.3.2 Shared understanding

The first study indicated that distributed teams are challenged to develop shared understanding. In line with this, literature suggests that distributed teams are challenged in developing process gains through team synergy, as a result of lack of face-to-face contact, and due to a lack of informal and coincidental hallway conversations (Martins, et al., 2004). Research indicated that even in distributed teams that are culturally homogeneous, it appears quite difficult to develop common ground', i.e. shared ideas, norms and knowledge

(Cramton, 2001). Effective (implicit) coordination between team members can only take place when they use the same conceptual language and share thoughts and beliefs regarding the task. Because development of such a shared conceptual language is more difficult under distributed circumstances, team leaders of distributed teams are expected to play a more important role in this area.

Shared understanding refers to a general state of agreement in perceptions of task and team processes and an understanding that such agreement is present. Shared understanding is conceptually related to mental models, i.e. shared mental models, or team mental models, (Cannon-Bowers et al., 1993; Cannon-Bowers & Salas, 2001) and also to concepts such as transactive memory (Lewis, 2003), and mutual knowledge (Cramton, 2001).

Shared mental models. A shared or team mental model refers to an organized understanding or mental representation of knowledge that is shared by team members (Cannon-Bowers, et al. 1993; Klimoski & Mohammed, 1994). The general idea of shared mental models (SMMS) is that team effectiveness will improve if team members have an adequate shared understanding of the task, team equipment and situation (Duncan, Rouse, Johnston, Cannon-Bowers, Salas, & Burns, 1996; Cannon-Bowers & Salas, 1992; Mohammed, Klimoski, & Rentsch, 2000). This positive effect on team effectiveness is theorized to emerge mostly because SMMs enable teams to have more effective implicit coordination (Espinoza et al., 2002).

Recently, shared mental models were theorized to have similar positive effects in distributed teams by explaining diminishing performance differences between face-to-face and distributed teams over time (Maynard & Gilson, 2004). Moreover, the context of distributed teams (e.g. crossing locational boundaries) was theorized to have a negative impact on the different types of mental models, through an increase in team member diversity, specifically on team interaction mental models, i.e. roles, responsibilities and interaction patterns (Maynard & Gilson, 2004). Researchers also point out that developing an adequate level of shared understanding is more difficult for distributed teams as a result of ICT mediated communication, which leaves room for fewer channels to use for the exchange of information.

Transactive memory. Related to shared mental models is the concept of transactive memory (Wegner, 1986; Wegner, Giuliano, & Hertel, 1985). Contrary to shared understanding, transactive memory leaves room for team mental models to be more complicated, in the sense that not all knowledge is isomorphic, but some knowledge aspects are unique to individual team members. Transactive memory (TM) has been coined as part of shared mental models, as the *team* mental model, by emphasizing how team members develop, share, integrate and leverage distributed expertise (Mohammed & Dumville, 2001). In essence, a transactive memory consists of knowledge and beliefs about

the knowledge possessed by another person and about the accessibility of that knowledge. Transactive memory itself consists of meta-knowledge about what another person knows, combined with the body of knowledge resulting from that understanding (Lewis, 2003; Yoo & Kanawattanachai, 2001). Contrary to shared understanding transactive memory is a distributional model of knowledge, which is especially promising in explaining how distributed groups of knowledge workers (distributed teams) can be effective in terms of team processes and outcomes.

Transactive memory is proposed to consist of two parts (Lewis, 2004). The first part covers the nature of team knowledge and specialization, which we will go into more in detail in Chapter 4. The second part represents the amount of trust team members have in the knowledge of their team colleagues. Theorists have suggested that development of trust is important for distributed teams (Jarvenpaa & Leidner, 1999). Hertel et al. (2005) theorize that transactive memory is more complex to develop in distributed teams than in face-to-face teams, due to the reduced amount of face-to-face communication and the reduced information about individual work contexts. In line with this, Shen (2007) and Shen and Gallivan (2008) theorize that team distribution is negatively related to development of a transactive memory system, as lean media transfer fewer cues about team member characteristics, such as 'who knows what'. Moreover, distributed team members rarely have a prior collaborative history as a basis for knowledge about team colleagues, and diversity in cultural backgrounds and expertise areas further complicate the development of transactive memory.

Team collective mind originates from research on crewmembers of an aircraft carrier (Weick & Roberts, 1993). Team collective mind is manifested through the way that individuals carefully interrelate their actions, based on their notion of a social system of inter-related actions. Team collective mind is different from transactive memory in its active component, that is, individuals do not just have an understanding of interrelated competencies and tasks, but they also act upon these effectively, through coordination.

Research on team collective mind, along with transactive memory in distributed teams shows that the effect of early communication on team performance diminished once distributed teams developed a transactive memory and a team collective mind (Yoo & Kanawattanachai, 2001). This implies that distributed teams, which are able to develop a transactive memory and team collective mind are less vulnerable to the potential negative effects of fewer communication incidences and the use of lean media for communication on team performance.

3.3.3 Summary and Discussion

This section reviewed the literature on two important categories of processes found in the first study: (1) building working relationships and (2) developing shared understanding.

Several processes were discussed as part of these higher level processes (1) trust, cohesion, feelings of isolation informal communication, and conflict and (2) shared mental models, transactive memory and team collective mind. Literature suggests that these processes are more difficult to develop in distributed teams than in co-located teams, due to mediated communication and more diversity in backgrounds of team members. Being able to develop these processes in teams was found in several studies to have a positive effect on team effectiveness. The next section features how leaders can help to develop these team processes and how they may impact team outcomes in the context of distributed teams.

3.4 Leadership, team processes and outcomes

3.4.1 Leadership, team performance and innovation

There is over 50 years of psychological research, which focused on uncovering the processes that underlie team effectiveness under face-to-face conditions (Kozlowski & Ilgen, 2006). Team effectiveness has been studied widely in the past 50 years of team research, mostly by means of the input-process-output approach (IPO), proposed by McGrath (1964). In this model input refers to the composition of the team, in terms of individual characteristics (of both the leader and subordinates) and resources available to the team. Processes refer to activities that members and leaders engage in, while combining their resources to resolve (or fail to resolve) task demands to ultimately reach team goals. Within the IPO framework team processes mediate the translation of inputs to outcomes (Kozlowski & Ilgen, 2006).

Distributed teams are generally assembled to fulfill an organizational task, which they are expected to perform to an acceptable level in terms of product or service quality, which satisfies the client's needs. In addition, distributed teams are expected to deliver those products or services as 'time and resource efficient' as possible, while adhering to deadlines. The degree in which teams are able to do so, reflects their effectiveness in reaching team goals.

To cope with global competition and environmental uncertainty, organizations also increasingly need to develop *innovative* products and services. Innovation is defined as the intentional introduction and application of new ideas, products, processes or procedures in order to benefit the job, team or the organization (West & Farr, 1990; West & Wallace, 1991). Organizations are increasingly relying on (distributed) teams to develop innovative solutions (West, 2002). In order for teams to be innovative, team members need to exceed their standard work behaviors by engaging in innovative behavior (Van der Vegt &

Janssen, 2003). Innovative behavior at the group level is defined as individuals developing, promoting, discussing, modifying, and realizing new ideas (Kanter, 1988; West & Farr, 1989).

Leadership is one of the factors that can influence a team's ability to have effective team processes and to reach desired outcomes (Kozlowski & Ilgen, 2006). Two leadership approaches, of which the effect on team outcomes of distributed teams has been studied are transactional and transformational leadership.

Leaders who display transactional leadership behaviors enable their teams to be effective, by creating clear structures for subordinates, by clarifying what is expected of them and by rewarding them accordingly. When transactional leaders display *contingent reward* behaviors, they clarify roles and tasks, define individual responsibilities for achievements and provide rewards for suitable task behaviors. Transactional leaders also display *management by exception active (MBEA)* behaviors. They monitor team processes and act when problems or irregularities occur to make sure standards are met. Some transactional leaders also display *management by exception passive (MBEP)* behaviors, which reflects an absence of leader intervention until non-compliance of standards occurs. By displaying transactional leader behaviors, leaders reinforce team members to contribute to their team in such a way that the team will perform well and is able to come up with desired innovative solutions. Transactional leadership behaviors are therefore expected to be positively associated with both innovative behavior and team performance, which is formulated in hypotheses 1a and 1b:

Hypothesis 1. Transactional leadership behaviors in distributed teams are positively associated with (a) innovative behavior and (b) team performance.

Because leaders' ability to transform and initiate change has become more important for organizations, leadership researchers have looked for a leadership approach that further strengthen a team's ability to adapt to changes in their environment and to come up with innovative solutions (Bass & Avolio, 1993; Bass, 1985; Conger, Spreitzer, & Lawler, 1999; Den Hartog, Koopman, & Van Muijen, 1997). In their search for such an approach, leadership researchers defined transformational leadership. This approach aims for continuous development of followers and reflection of their ways of working, in order to continuously develop innovative solutions (e.g. Bass, 1985) and it has been coined crucial for organizational innovation (Elkins & Keller, 2003). Results from studies suggest a link between transformational leadership and innovation (Gumusluoglu & Ilven, 2009; Jung, Chow, & Wu, 2003).

Leaders who display transformational leadership behaviors in the form of *idealized influence*, aim at instilling pride, respect, and faith in followers. They do this by displaying a high degree of power, integrity and concern for their team members. They also hold

strong values and beliefs, upon which they act consistently. Transformational leaders help their team members to focus on what lies ahead, by displaying a compelling vision and a clear sense of mission. When transformational leaders display *inspirational motivation* behaviors, they communicate high expectations and display confidence that difficult goals will be achieved. Transformational leaders also show *individualized consideration*, which expresses leader behaviors that demonstrate a high personal concern to followers and willingness to coach them. Such leader behaviors are expected to facilitate teams in reaching a high performance. Transformational leaders also engage in *intellectual stimulation*. This implies that leaders challenge their followers to reflect constantly on their own actions. They re-examine critical assumptions made by their teams and they strive for their team members to look at problems from different angles, to come up with 'new' solutions to problems (Avolio & Bass, 2004). Such behaviors are generally expected to enable distributed teams to display innovative behavior and to perform well, which is reflected in the following hypotheses:

Hypothesis 2. Transformational leadership behaviors in distributed teams are positively associated with (a) innovative behavior and (b) team performance.

Transactional and transformational leadership have been studied extensively in conventional work contexts and were tied to employees' motivation, attitudes and behaviors (Bass, 1985, Conger & Kanungo 1994, House, 1971; Podsakoff, MacKenzie, Moorman, & Fetter, 1990). According to researchers the constructs of transactional and transformational leadership are complementary, rather than opposing, and Avolio and Bass (2004) hold that transformational leadership will be ineffective in the absence of a transactional leader-follower relationship.

Several studies have paid attention to transactional and transformational leadership in distributed teams, by linking the constructs to various measures of team outcomes, and also by considering possible mediator variables (see Chapter 1). Results of these studies have been inconsistent (Zhang, et al., 2005), mostly because the two constructs were examined as opposing constructs, instead of complementary (Zhang et al., 2005). Behavioral complexity theory suggests that in complex situations, such as in most distributed teams, leaders will have to display a set of complex behaviors, which are sometimes contradictory. For example, distributed team leaders who lead culturally diverse teams, will have to display flexibility in their style of communication and leadership, to adhere to the needs of culturally diverse team members (sometimes autocratic and sometimes participative). The notion of the need to display diverse leadership behaviors is largely in line with the view of Avolio and Bass (2004), who see transactional and transformational leadership approaches as complementary, rather than conflicting approaches. Therefore, for the remainder of this dissertation transactional and transformational leadership will be

treated as complementary approaches, that both contribute to team effectiveness and innovative behavior in their own unique way.

Organizations are increasingly shaped in matrix structures, in which work is organized in all kinds of project teams. In multi-national organizations, these teams are increasingly geographically distributed. In such teams face-to-face contact is limited and most communication is handled via mediated means. Study 1 showed that in such teams the role of leaders changes dramatically. For instance, leaders in some cases explicitly fulfill a role in day-to-day coordination of their teams and sometimes they need to provide conditions for team members to be able to do their work (for instance, arranging available technology for a video conference). As we saw from study 1, working in a distributed environment prevents random encounters and informal coordination. As a result, leaders of distributed teams are expected to revert to explicit structuration and coordination of activities (and communication moments).

Study 1 resulted in a large number of leadership activities, especially for leaders of distributed teams. Those leadership behaviors are in some cases also relevant for leadership in a face-to-face context, but the specific actions that leaders undertake and the form in which these actions take place seem to matter, especially for distributed teams. For instance, in co-located teams, leaders provide for structured communication, but in a distributed team this also implies that leaders actively manage the contributions of team members in a virtual meeting. Similarly, in co-located teams, leaders have to motivate and stimulate their team members to fulfill their tasks, however, in distributed teams leaders also face the challenge to overcome geographic boundaries between team members. Motivating team members in such a context implies that leaders facilitating the visibility of remote team members and giving them the feeling of 'being in a team'. The leadership behaviors that emerged from study 1, especially the concrete actions aimed at overcoming distance in teams, are not part of the transactional or transformational leadership approaches. It may therefore be expected that these two approaches are not able to explain fully how leaders enable their distributed teams to be both effective and innovative.

Table 3.3 combines the list of leadership behaviors presented in (normative) theoretical work on distance leadership from the first chapter with leadership behaviors identified in study 1. The result is a comprehensive list of leadership actions and behaviors (nested in five categories), which together constitute a leadership concept, that for the remainder of this dissertation is labeled 'distance leadership'. The five categories of leadership behaviors are the following: (1) facilitating awareness, (2) developing an effective communication climate, (3) motivating team members, (4) formalizing and structuring and (5) focusing on the team as a whole.

Table 3.3: Distance leadership (integration of normative literature and study 1).

Leadership focus	Types of activities and behaviors
Relationship building and facilitating awareness: (1) understand communication and technical issues and pressures people face; (2) understand cultural background (3) understand individual strengths and weaknesses, (4) understand situation at home, (5) keeping the team informed about relevant issues	(1) engage in informal communication with colleagues; (2) actively seek information about cultural backgrounds; (3) distribute information to the team; (4) organize face-to-face (kick-off) meetings when possible; (5) spot important changes in the team's environment and communicate these to the team
Developing an effective communication climate: (1) bring out the opinions of all (culturally diverse) team members, (2) prevent and overcome misunderstandings in communication	(1) develop standards for communication (2) encourage asking questions, (3) ask in-depth questions (repeatedly), (4) stimulate clarification upfront, (5) ask feedback, (6) develop climate in which sharing of problems is accepted (without loss of face), (7) actively ask for opinions, (8) listen and check whether understanding was reached; (9) help team members prevent and solve misunderstandings due to cultural differences
Motivating team members: (1) giving remote members the feeling of being part of the team, (2) increasing their visibility, (3) representing the team to outsiders, and (4) being available	(1) give compliments, (2) showing (remote members) gains from participation, (3) provide (timely) rewards, (4) visit remote colleagues, (5) adapt communication style, (5) choose the right tool for the message, (6) over-communicate, (7) be reachable for remote team members (8) respect cultural differences, (9) make distributed team accomplishments visible
Formalizing and structuring: (1) enabling shared understanding about roles, responsibilities, and agreements, (2) developing clear and correct expectations	(1) have a clear project description, (2) describe processes in documents, (3) clarify importance of goals and members' contribution in these, (4) contracts (range, timing, quality), (5) install knowledge repository, (6) formalize meetings, (7) use minutes and action items (8) select team members capable of distributed work
Focusing on the team as a whole: (1) developing a cohesive team over distance, (2) building relationships and coordinate actively with local and remote leaders and team members	(1) support remote team members and provide backup when mistakes are made (locally), (2) visit remote locations, (3) team building and conflict management activities (e.g. cultural training and role-play), (4) use technology to facilitate empathic feelings, (5) informal, personal communication (6) focus on the distributed team as a whole (7) help team members find each other remotely

The distance leadership actions and behaviors described in Table 3.3 generally enable team leaders to overcome challenges with the development of working relationships and shared understanding in distributed teams. Many of the above described actions and behaviors aim explicitly to overcome problems in these two areas, for instance, to develop effective working relationships, team leaders can engage in informal personal communication, and to develop an effective communication climate leaders can organize face-to-face meetings.

Moreover, team leaders can initiate team building activities to further develop relationships and they can act as role models by showing the importance of the distributed team as a whole. Team leaders can also actively attempt to motivate especially remote team members who have less face-to-face contact and, who do not receive recognition and compliments as frequently as co-located team members. These kinds of behaviors are expected to lead to better developed working relationships, which in turn are expected to

lead to more effective teams, basically because team members are willing to do more for each other and because coordination will be more effective when working relationships are well developed. A similar effect is expected of leadership behaviors that facilitate the development of shared understanding, such as formalizing and structuring and creating an effective communication climate. Leaders, who are able to develop a high degree of shared understanding in their team, are expected to face less problems due to ineffective coordination and resulting problems, such as not making deadlines, having to do rework, or not being able to deliver expected quality.

A second expected positive outcome of distance leadership behaviors is the ability of distributed teams to more effectively leverage diversity in these teams to come up with innovative solutions. Literature suggests that diversity in professional backgrounds can enable teams to reach more alternative ideas, which in turn can lead to more innovative solutions (Van der Vegt & Janssen, 2003). In order to reach optimal innovative solutions, the communication climate of virtual teams has to facilitate to freely share and discuss ideas. Distance leadership behaviors, by aiming to develop such a communication climate, are expected to enable teams to show more innovative solutions.

Hypothesis 3. Distance leadership behaviors in distributed teams are positively associated with (a) innovative behavior and (b) team performance.

Although many of the focus areas mentioned above are also focus areas of transformational and transactional leadership, the degree of concreteness in which leader actions and behaviors are described in normative literature and the first study, is somewhat different from these existing leadership concepts. The distance leadership behaviors in the five categories have a unique focus, but also generally aim to overcome problems with communication and coordination. More attention will be given to the distance leadership concept in Chapter 4.

3.4.2 Mediators in the leadership-performance relationship: shared understanding and knowledge perception

Developing shared understanding is important for all kinds of teams, distributed as well as co-located. Shared understanding about the task, team composition, team processes and goals of the team is often mentioned to be important for distributed teams, particularly when members have to work on interdependent tasks in absence of each other for prolonged periods (Maynard & Gilson, 2004). A review of the shared cognition literature (Cannon-Bowers & Salas, 2001) indicates that shared understanding is expected to be positively associated with team outcomes, such as task performance, better team processes, and higher levels of motivation among team members. For this study we expect shared

understanding, which reflects the degree in which team members have an understanding of what it is that needs to be done in their team, to have an impact on team outcomes.

The degree of shared understanding within a team is also expected to be influenced by the team leader. Transformational leadership by nature is focused on developing a clear direction and compelling vision for followers. Transactional leadership increases understanding about desired goals, how to reach them and how team members are rewarded for their efforts. Distance leadership facilitates shared understanding through more structured communication, active engagement of all team members and by clearing up misunderstandings. Moreover, the degree in which a leader is able to develop shared understanding in the team explains to some extent the team performance. Shared understanding is expected to fulfill an important mediating role for the impact of leadership on team effectiveness. Thus, the following hypotheses are formulated:

Hypothesis 4. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with innovative behavior is mediated by shared understanding.

Hypothesis 5. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with team performance is mediated by shared understanding.

In teams each person has his, or her own specific area of expertise and domain related knowledge. Although shared understanding, or shared mental models have dominated team cognition research, there is recognition that team mental models may be more complex, in the sense that teammates to some extent have the same (e.g. identical) knowledge structures, but also have unique knowledge. Especially in teams where team members are experts in their domain, they can't know, or remember everything their team colleagues know. Transactive memory is stored in the minds of individuals and contains information about the specific areas of expertise of the self and of team colleagues, and the capacity to remember who knows what is the key to transactive memory (Wegner, et al., 1985).

Team members also need to be willing to rely on each other's knowledge to be able to benefit from knowledge distributed in the team. In other words, within distributed teams, members have to trust the input of their remote team members in order to be able to work together effectively (Lewis, 2004). As was mentioned in the section on distance leadership, mediated communication is often more formal, with less opportunity to exchange information and ideas. As team members in distributed teams work over distance, there is also a smaller chance for them to have a shared background or shared work experiences (Yoo & Kanawattanachai, 2001). Team composition in distributed teams is also subject to continuous changes, which forces team members to almost constantly adapt to new people

on the team. All these characteristics render development of trust in the knowledge of team colleagues more problematic for distributed teams, and will render distributed team members less able and comfortable to rely on each others' knowledge in the team.

When team colleagues are aware of each others' knowledge and are also willing to rely on that knowledge this is expected to have a positive effect on innovative behavior and distributed team performance. Trusting each others' knowledge, as part of transactive memory, was found to be positively associated with team effectiveness and overall performance of both co-located (Lewis, 2004; Liang, Moreland, & Argote, 1995; Moreland & Myaskovsky, 2000) and distributed teams (Yoo & Kanawattanachai, 2001).

Team leaders play a pivotal role in helping their team to build trusting relationships (Connaughton & Daly, 2004c). Leaders can help to facilitate trust by structuring communication, by promoting informal conversations, by clearing up misunderstandings and by paying attention to the diverse cultural backgrounds of their team members. Consequently, the ability of leaders to stimulate team members to come up with innovative solutions to problems is partially dependent on their ability to develop trusting relationships that enable team members to rely on each others' knowledge. Thus, the degree of trust in the knowledge of distributed team colleagues is expected to mediate the relationship between leadership, innovative behavior and team performance.

Hypothesis 6. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with innovative behavior is mediated by trust in the knowledge of team colleagues.

Hypothesis 7. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with team performance is mediated by trust in the knowledge of team colleagues.

3.5 A contingency approach to leadership in distributed teams

The relationships between team structure, team processes and team outcomes is central to the work teams' literature (eg. Hackman & Walton, 1986; Sundstrom, DeMuse, & Futrell, 1990). The impact of team structure has been suggested to affect performance through team processes (Hackman & Walton, 1988; Cohen & Bailey, 1997). Results of studies examining the relationship between transformational and transactional leadership, team processes and outcomes have been inconclusive, as noted by Zhang et al., (2005), and as a possible explanation, Zhang and Fjermestad (2006) propose to consider team characteristics in a contingency approach to the study of leadership in distributed teams.

Contingency approaches to leadership (Fiedler, 1971) propose that the effectiveness of leadership styles is dependent on context factors. Such context factors can render leadership behaviors effective in specific circumstances, but not in others. Early work paid attention to contingency factors such as the favorableness of context for the leader in terms of able to provide input on appraisal processes and to control rewards. One of the most popular contingency models, which pays attention to the level of maturity of followers as influencing the effect of different styles of leadership, was the Situational Leadership Theory (SLT) developed by Hersey and Blanchard (1977).

For distributed teams, important situational characteristics may be the amount of geographic dispersion between team members, which renders communication and coordination more tedious, as well as the degree of specialization, in terms of unique knowledge and expertise of team members, which impacts the need for coordination and contact between teammates.

3.5.1 Moderators for the impact of leadership on shared understanding and knowledge perception: geographic distribution and specialization

Research shows that developing shared understanding or common ground is more difficult in distributed teams, due to the reduced amount of face-to-face contact between leaders and followers and the reduced availability of information about individual work contexts (Axtell et al., 2004; Cramton & Orvis, 2003). In line with this, study 1 indicated that in distributed teams, leaders have to focus more explicitly on developing shared understanding in order to make their teams effective. Geographic distribution of team members is associated with both the degree of reliance on ICT for communication in distributed teams and cultural diversity and is therefore expected to have a negative impact on team processes and performance.

In a study among 39 software development teams Cramton and Webber (2005) found that geographic distribution is significantly negatively related with team processes and team effectiveness. Although a direct effect might be expected, an indirect moderating effect of geographic distribution can also be expected. Teams, of which members have to work together across large geographic distance, will likely have more trouble to develop shared understanding and trust in each others' knowledge, due to a high reliance on ICT mediated communication, combined with few opportunities to meet each other in person. In highly geographically dispersed teams, cultural and language differences which complicate coordination and communication, are often bigger than in less geographically dispersed teams, as was found by Bjørn and Ngwenyama, (2009). This implies that leaders may be more actively involved in helping their teams to reach shared understanding in highly geographically distributed teams. Thus, Joshi et al. (2009) propose that geographic distribution can act as a facilitator of transformational leadership. Under co-located (or less geographically dispersed) conditions, shared understanding between team members will

emerge relatively easily, perhaps even without active attempts of the leader to facilitate this. In contrast, in highly geographically dispersed teams shared understanding will not develop by itself. Leaders of such teams are expected to focus part of their leadership activities on helping team members to develop adequate levels of shared understanding. Thus, we expect leadership behaviors to be more strongly associated with shared understanding in highly geographically dispersed teams, than in less dispersed teams, formulated in the following hypothesis:

Hypothesis 8. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with shared understanding is moderated by geographic distribution of team member.

Similarly, it is expected that geographic distribution plays a role in the development of trust in the knowledge of team colleagues. In line with the role of geographic distribution in the relationship between leadership and shared understanding, we expect that member distribution moderates the relationship between leadership and trust in the knowledge of team colleagues. Under condition of high distribution of team members, face-to-face interaction is severely limited. In line with the findings from study 1, literature suggests that for building trusting relationships, face-to-face contact seems important in distributed teams (Alge, Wiethoff, & Klein, 2003); Jarvenpaa & Leidner, 1999; Kirkman et al., 2004). Large geographic distance also reduces the chance of previous shared work experiences and resulting knowledge of team colleagues' credibility. Also, large cultural and language differences, associated with geographic distance, complicate trust development, as team members have different, culturally defined ways of working and interacting. Developing trust in each others' knowledge is therefore expected to be different under conditions of high distribution (in which less face-to-face contact takes place) versus low distribution of team members. In line with our expectations about shared understanding, we expect that leaders will have a more important role in developing trust in the knowledge of team colleagues in highly distributed teams, versus less geographically distributed teams. This is reflected in the following hypothesis:

Hypothesis 9. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with trust in the knowledge of team colleagues is moderated by geographic distribution of team member.

Distributed teams often incorporate team members of several diverse areas of expertise, and coordination of activities across distance is usually more complicated than it is in face-to-face interaction. In line with this, in study 1 it was found that distributed teams often resemble physical structures that facilitate interaction of highly interdependent team

members, by placing them at one location, while placing groups that are less interdependent on a daily basis, further away from each other. For example, the distributed software development teams from study 1 often used a structure in which technical designers and functional test experts were working in close proximity. In such teams, these groups of experts are highly interdependent of each other to deliver a finalized technical and functional design. However, when their design is finalized, the production work can relatively easily be transferred to a remote site without a lot of coordination, provided that these designs are clear.

The structural design method has one important drawback, in the sense that fewer interdependencies across distance will call for fewer interactions across distributed locations. These in turn may hamper the development of shared understanding and trust in the knowledge of team colleagues across distributed locations. Specialization of team members within a team, and the degree of interdependence between specialists influence the degree of necessary contact between team members. In this rational, specialization of knowledge in a distributed team can be considered a moderator for the relationship between leadership and shared understanding and trust in the knowledge of teammates. Especially in cases, in which the degree of team member specialization is high and team member interdependence is also high, interaction between team members will occur more frequently. This is expected to strengthen the positive association between leader behaviors, shared understanding and trust in the knowledge of team colleagues. Thus, hypotheses 10 and 11 a through c are formulated:

Hypothesis 10. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with shared understanding is moderated by team member specialization.

Hypothesis 11. The relationship of (a) transactional, (b) transformational and (c) distance leadership behaviors with trust in the knowledge of team colleagues is moderated by team member specialization.

3.6 Conclusion

Figure 3.1 provides an overview of the relationships between leadership styles, team processes and outcomes that were discussed in this chapter. The different arrows reflect the hypotheses, which were introduced in this chapter. These hypotheses will be tested in an empirical study and this will be reported in chapter 4.

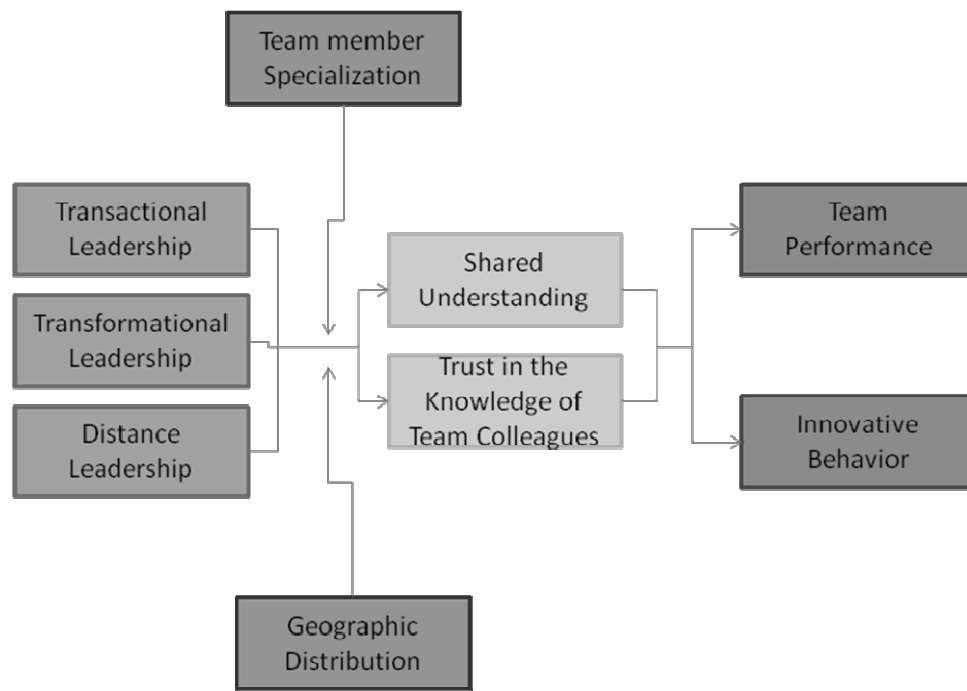


Figure 3.1: A model of leadership, shared understanding, trust, innovative behavior and team performance.

Chapter 4

The impact of leadership on innovative behavior and distributed team performance: an empirical study of mediators and moderators

4.1 Introduction

This chapter presents the findings of a study on the relationship between leadership, innovative behavior and distributed team performance. The hypotheses as presented in Chapter 3 are now tested in a quantitative study among members of 35 teams in a number of organizations. The chapter is structured in the following way. First, the methodology of the study is presented in paragraph 4.2. Then results are presented in paragraph 4.3, starting with team level analyses, followed by individual level analyses. First the relationships between leadership, and team outcomes are tested. Next, the possible mediating role of shared understanding and trust in the knowledge of team colleagues are tested. Finally, the moderating role of geographic distribution and team member specialization on the relationship between leadership, shared understanding and trust in the knowledge of team colleagues are investigated. Paragraph 4.4 presents the discussion and conclusion.

4.2 Methodology

4.2.1 Sample

A field study was conducted to test the hypotheses depicted in the model in Chapter 3. Data were collected from members of 35 distributed teams, who worked for one of eight high technology organizations. The teams under study were involved with diverse activities, such as software development, asset commercialization, product development, off shoring activities, knowledge sharing, business improvement processes, and (high level) management.

The teams were selected with the help of business contacts of the university staff. Contact persons were asked to identify leaders in their organization who were dealing with distributed teams. A total of 61 leaders were contacted, of which 35 were willing to participate in this study with their teams, a response rate of 57%. Background information,

including the main objectives of the teams, size, member distribution, available communication technologies, areas of expertise and the cultural backgrounds of team members was gathered from the team leaders.

The distributed team members under study came from various backgrounds in the area of software development (software architects, programmers, testers), chemistry, electrical engineering, marketing, production, purchasing and management. There was variation in the level of geographic distribution of team members, the amount of team members at each location, and the overall size of teams (which varied from 4 up to 60 team members).

All teams were working geographically distributed. Most communication between geographically dispersed locations took place by mediated communication channels and occasional face-to-face meetings. Most members were working from their office location and in some cases from their home office. The most often used communication means were telephone (100%), e-mail (100%), chat / instant messaging (63%) and audio-conferencing (92%), with or without visual support. Video conferencing was used only in a small number of teams (17%). File sharing and version control software were used in 67% of the teams. For activities in the distributed team, each team member reported to one leader, who was responsible for the overall team performance. However, in many cases team members had several leaders, for instance for managing local issues such as payroll, sick leave and HR activities. For this study they reported only about the leader responsible for the distributed team.

Of a total of 454 team members involved in this study, 173 team members responded by filling out the on-line questions. This constitutes a response rate of 38%. There were variations in the level of participation of members from the different teams. In the case of very large project teams (e.g. teams that designed and developed electronic equipment in a worldwide network), only the management layer of the team was involved in the study. These management teams (often referred to as core teams or platforms teams) were most relevant for this study because these teams included members from the highest number of geographically separated locations, with often large distances between team members. Team leaders invited their team members personally to participate in the study. Participation was voluntary and responses remained anonymous. Individual responses could be linked only to the team leader with whom they had a direct reporting relationship. Eighty-one percent of the respondents were male, and age varied between 21 to 59 years, with a mean of 37.1.

4.2.2 Measures

Leadership. Transformational and transactional leadership behaviors were assessed with the English version of the Multifactor Leadership Questionnaire (MLQ, Avolio & Bass, 2004). The full MLQ contains 45 items. For the purpose of this study we used the

items developed to measure two constructs for transactional leadership (contingent reward and management by exception active), and five constructs for transformational leadership (intellectual stimulation, inspirational motivation, idealized influence attributed, idealized influence behavior and individualized consideration). These measures contained all four original items of the MLQ5X. These items will not be displayed here or in appendices, because of copyright.

To determine the factor structure of transformational leadership, a confirmative factor analysis was performed. The analysis involved the 20 items measuring transformational leadership, in a structure with five unobserved variables and one overall unobserved variable. Based on this analysis the model does not have a good enough fit to distinguish the five underlying constructs (Chi-square was 383.7, with *df* 165, and RSMEA 0.091, with $p=0.000$) Further explorative analyses (correlation analysis and principal components analysis with Varimax rotation) show that the 20 items are strongly correlated. The screeplot resulting from factor analysis suggests a one factor solution. Therefore, in line with an earlier study (Kearney, 2008) we chose to aggregate the 20 items of transformational leadership to one overall measure. Cronbach's alpha for this scale is 0.93 ($n= 161$). This alpha is comparable to what was found in the earlier study by Kearney (2008).

For transactional leadership also a confirmatory factor analysis was performed with four items measuring contingent reward and management by exception active. Analysis with these 8 items predicting two unobserved variables does not result in good fit with the data (Chi-square was 51.2, with *df* 19 and RSMEA 0.103, with $p=0.007$). Further explorative analyses (correlation analysis and principal components analysis with Varimax rotation) indicate that items of the two scales are highly correlated. Factor analysis suggests a two factor solution in which items from the two measures represent two separate factors. Further analysis with items from transformational leadership included (correlation analysis and principal components analysis with Varimax rotation) shows that the items of contingent reward all correlate strongly with transformational leadership items and thus can't be distinguished from transformational leadership in factor analysis. The four items of management by exception active formed a second independent factor. Since contingent reward was not clearly isolated from the transformational leadership subscales it was dropped from further analysis. Management by exception active was selected as a single measure of transactional leadership. Cronbach's alpha of the four item measurement scale is 0.71 ($n=162$). This alpha's is acceptable (Nunnally, 1978).

Based on the overview of the concept of distance leadership (see Chapter 3, Table 3.3), a number of items was developed to measure different aspects of this type of leadership. These distance leadership behaviors are divided in five categories and relate to a more 'hands on' level of leadership and mostly deal with overcoming distance and preventing

communication problems. A total of 18 items were developed to measure these specific leadership behaviors (see Table 4.1).

Table 4.1: Measurement of distance leadership.

Leadership focus	Items: <i>The person I am rating.....</i>
Relationship building and facilitating awareness:	<i>Item 1:</i> organizes face-to-face meetings between distant members when necessary <i>Item 2:</i> Engages in small talk with team members also during “electronically mediated” meetings <i>Item 3:</i> Shares personal experiences of everyday life with all team members
Developing an effective communication climate:	<i>Item 4:</i> Sets an example by bringing important news to remote team members first <i>Item 5:</i> Asks remote team members for their opinions during meetings <i>Item 6:</i> Shares “lessons learned” with team members <i>Item 7:</i> Establishes ground rules for communication
Motivating team members:	<i>Item 8:</i> Sets an example for team members by adapting his style of communication to members from different cultures <i>Item 9:</i> Takes local (National) holidays into account when planning meetings <i>Item 10:</i> Helps team members clear up misunderstandings as a result of cultural differences <i>Item 11:</i> Makes fun of team members from different cultures (reverse coded item)
Formalizing and structuring:	<i>Item 12:</i> Identifies meetings as “mandatory” and “non-mandatory” meetings <i>Item 13:</i> Makes sure that each meeting has a clear agenda
Focusing on the team as a whole:	<i>Item 14:</i> Makes sure that remote team members feel they are part of the team <i>Item 15:</i> Stresses the importance of the virtual team as a whole <i>Item 16:</i> Regularly complains of incompetence of remote members (reverse coded item) <i>Item 17:</i> Creates a clear picture of dependencies between geographically dispersed locations of the team <i>Item 18:</i> Helps me to find specific knowledge and expertise of members in the virtual team

An explorative factor analysis (principal components analysis with Varimax rotation) was done in order to explore the factor structure for these leadership constructs. Five factors with an Eigenvalue above 1 emerged from the data, but these did not reflect the five focus areas. Furthermore, on the basis of the screeplot, a solution with one factor was found most suitable (see appendix V for inter-item correlations). This factor incorporates 14 of the original 18 items. Because the remaining four items could not be interpreted as a measurement scale these items (items number 3, 9, 11 and 16) were discarded from further analyses. Cronbach’s alpha of this 14 item scale is 0.87 ($n=141$). See appendix V also for the component matrix of these items. It seems strange that the items that belong to the five different focus areas, are so highly inter-correlated. This point will be addressed further in the discussion.

Shared understanding. The construct of shared understanding was measured as perceived shared understanding within the team. It reflects a person’s perception of a

situation in which team members understand each other, where it is clear how they accomplish the task and in which little clarification is needed to get a message through. This measure consists of 8 items. One item was taken from Lurey and Raisinghani, (2001) *'Team members have a shared understanding of what the team is supposed to do'*, five items from a scale developed by Lewis (2003), sample item, *"our team has very few misunderstandings about what to do"* and two self developed items, of which an example is *'within this team we need little information to get a message through'*. Confirmatory factor analysis for this 8 item scale with one unobserved variable results in acceptable fit on the data (Chi-square was 41.3, with *df* 20, and RSMEA 0.084, with $p=0.062$). Cronbach's alpha for this scale was an acceptable 0.81 ($n=151$). See appendix VI for inter-item correlations.

Trust in the knowledge of team colleagues. This variable was measured by a five item measure, developed by Lewis (2003). This particular trust measure is part of an overall measure of transactive memory. It measures the amount of trust team members have in each others' knowledge. A sample item of this scale is *'I trust that other members' knowledge about the project is credible'*. Cronbach's alpha for this measure is .71 ($n=173$). See appendix VII for inter-item correlations.

Innovative behavior. Innovative behavior was measured with three items taken from Van der Vegt and Janssen (2003). The items were rephrased from the individual level to the team level. A sample item of this scale is *'Our team creates new ideas for improvements'*. Cronbach's alpha for this scale was .74 ($n=151$). Inter-item correlations for this scale can be found in appendix VIII.

Team performance. Team performance was measured with a four item scale developed by Lewis (2003). A sample item of this scale is *'the team's deliverables are of excellent quality'*. Cronbach's alpha was .83 ($n=151$), see appendix IX for inter-item correlations.

Specialization of knowledge. Specialization was measured by a five item measure developed by Lewis (2003). This construct captures the nature and specialization of knowledge in a team, knowledge about who possesses specific knowledge and the interdependence of experts for team accomplishments. A sample item is *'I have knowledge about an aspect of the project that no other team member has'*. Cronbach's alpha for this measure is .67 ($n=173$). The inter-item correlations for this scale are included in appendix X.

Geographic distribution of team members. For geographic distribution a variable was calculated, which reflects the amount of geographic distribution of team members in miles, and also takes the number of team members per location into consideration while controlling for the overall team size. The variable we used for calculation was developed by O'Leary and Cummings (2007). The index is based on a matrix of all non-redundant member-to-member connections in the team. In the example of a team with team members

geographically distributed over three locations K, L and M the index is calculated as follows:

$$(TKL * n_K * n_L) + (TKM * n_K * n_M) + (TLM * n_L * n_M) / [(n^2 - n) / 2].$$

For computation of the variable two types of information are needed: (1) the cities where team members are located and the amount of team members per location, and (2) the distances (T) between all combinations of locations. The symbol T represents the geographic distance between two locations, for instance locations K and L. The information about geographic locations and number of members working at each location was gathered via the team leaders. For computation of the distribution index the information from the team leaders was used in each case (leaders provided a picture of the distributed team in a short questionnaire and interview).

Necessary geographic coordinates were found by means of Google Earth, and the distances between coordinates were calculated by means of the ‘great circle distance’. The great circle distance is the distance between two locations on the earth’s surface. The following formula, which is based on a spherical model of the earth, calculates the great circle distance by means of latitude and longitude coordinates of two locations. Several websites offer to calculate the great circle distance on the basis of the geographic coordinates of two locations, for an example see: “<http://www.gb3pi.org.uk/great.html>”.

$$\Delta\hat{\sigma} = \arctan \left(\frac{\sqrt{(\cos \phi_f \sin \Delta\lambda)^2 + (\cos \phi_s \sin \phi_f - \sin \phi_s \cos \phi_f \cos \Delta\lambda)^2}}{\sin \phi_s \sin \phi_f + \cos \phi_s \cos \phi_f \cos \Delta\lambda} \right) . *$$

* If r is the great-circle radius of the sphere, then the great-circle distance is $r \Delta\hat{\sigma}$.

As an example, members of team 5 in the sample were involved with software development from three locations. Three team members were located in Delft (K), The Netherlands, one was located in Enschede (L), The Netherlands and ten team members were working from an office location in Kuala Lumpur (M), Malaysia. The calculation of the separation index for this team is as follows: The distance (T) between Delft and Enschede was determined at 108 miles, the distance (T) between Delft and Kuala Lumpur was found to be 6335 miles, and the distance (T) between Enschede and Kuala Lumpur was 6246 miles. The separation index is calculated as follows: $[(108 * 3 * 1) + (6335 * 3 * 10) + (6246 * 1 * 10)] / [(14^2 - 14) / 2] = 2778$. This value is a representation of the average distance between any two team members in the distributed team. This value was entered in SPSS for all the members coming from this team. The separation index was calculated for all teams. The mean value of the separation index in our sample was 2363, with a range

between 20 and 6221. This range and variance is considerable and reflects the diversity in team structures.

4.3 Results

As participants in this study were all members of a distributed team, the individual level observations can be grouped on the basis of team membership. Therefore characteristics of the data on the team level were explored first. For this purpose intra-class correlations for each variable in this sample were computed (ICC1 and ICC2). The ICC statistics provide information about the balance of within and between group variability for each variable. The statistics are computed from Mean Squares Between (MSB) , which is defined as the partition of the Sum of Squares (SS) that represents differences between groups and Mean Squares Within (MSW), which is defined as the partition of Sum of Squares (SS) within groups. Mean Squares Within is an unbiased estimate of the error variance within groups (Hays, 1994).

Table 4.2 presents the ICC's for the variables in the research sample. ICC's were computed on the basis of the responses in the sample, with k representing the average number of respondents per team. Given the fact that the ICC2 is dependent on the size of teams in a sample (Bliese, 2000) and given that the variability in team sizes in our sample is considerable, ICC1 scores (which incorporate an average of team size on sample level) were used to determine the appropriateness for aggregating data to the team level.

Table 4.2: Intra-class correlations of variables in sample.

Variable	MSB	MSW	F value	ICC 1 ^a	ICC 2 ^a
1. Transactional MBEA leadership	0.785	0.535	($F(34,132) = 1.468, p < 0,065$)	0.09	0.32
2. Transformational leadership	0.810	0.318	($F(34,132) = 2,552, p < 0,000$)**	0.24	0.61
3. Distance leadership	0.576	0.326	($F(32,119) = 1,764, p < 0,015$)*	0.13	0.43
4. Shared understanding	0.363	0.289	($F(34,136) = 1,254, p < 0,183$)	0.05	0.20
5. Trust in knowl. of coll.	0.186	0.213	($F(34,138) = 0,874, p < 0,668$)	-0.03	-0.15
6. Innovative behavior	0.276	0.285	($F(32,118) = 0,968, p < 0,525$)	-0.01	-0.03
7. Team performance	0.606	0.243	($F(32,118) = 2,493, p < 0,000$)**	0.23	0.60
8. Team knowl. specialization	0.567	0.210	($F(34,138) = 2,703, p < 0,000$)**	0.26	0.63
9. Geographic distribution	-	-	-	-	-

^a ICCs were calculated using the following formulae (see Bliese, 2000)

MSB = SS between/(J-1)*

MSW = SS within/(N-J)*

ICC1 = [MSB - MSW] / [MSB + (k-1) x MSW]

ICC2 = [MSB - MSW]/ MSB

Average team size $k = 4.9$ (k was computed as the average number of responses per team)

*With the number of groups J and the number of respondents in the sample N .

As a criterion for ICC1, James (1982) reported a median ICC1 of 0.12 as acceptable for the organizational literature. This value, which reflects the value most often found in organizational research is accepted and widely used as a minimum criterion for ICC1. Table 4.2 shows that three of the measures in this study are lower than the value found by James, two of these even have a negative score. These measures, transactional MBEA leadership, credibility of knowledge, innovative behavior and shared understanding should therefore not be aggregated to the team level. For credibility of knowledge this is not that surprising, given that this variable assesses an individual perspective of knowledge of team colleagues and its credibility. For transactional leadership this is also not surprising, it justifies analyses on the individual level of analysis.

For the measure of innovative behavior the low ICC1 score is surprising as this measure assesses the degree of innovative behavior on the team level and would therefore be expected to show less within-team variability. Also for shared understanding this finding is contrary to what the current literature suggests (Klimoski & Mohammed, 1994). Within-team variability of a perception of a team level phenomenon, such as shared understanding is generally reported to be smaller than between team variability. In other words, team colleagues are expected to share a perception about the degree of shared understanding in their team. The measure of distance leadership has an ICC1 value of 0.13, just above James' criterion and should therefore be treated with caution in analyses on the team level.

On the basis of these results data analysis on the team level is not viable for a number of important measures in this study. Due to the overall amount of within-team variance, individual analyses are more suitable for this data than group level analyses. Few empirical studies have been performed on leadership in distributed teams. To our knowledge, the few studies found did not suggest any cross level effects. We therefore analyze the data only on the team level and the individual level. In the next section the results of several team level analyses are presented (only variables with ICC1 above 0.12 are included).

4.3.1 Team level analyses

Analyses included transformational and distance leadership, team performance output and specialization of team knowledge. All team level variables are computed from the individual scores, by taking the aggregated mean score from the members of each team. The separation index (see paragraph 4.2.2) was calculated on the team level and will be used as such for these analyses. There were few missing values. To include also the teams in which missing values occurred, these values were replaced by the group mean for that

variable. In case of 4 teams in the sample there was only one respondent. These teams were all removed from the team level analysis as the single response was not regarded as representative for the respective teams. The resulting dataset contained 31 teams. The descriptive statistics for this dataset are reported in Table 4.3.

Table 4.3: Descriptive statistics and correlations on team level^a.

Variable	Mean	s.d.	1	2	3	4
1. Transformational leadership	3.57	0.40				
2. Distance leadership	3.42	0.30	.53**			
3. Team performance	3.63	0.38	.48**	.14		
4. Team knowl. specialization	4.01	0.30	.22	.11	.01	
5. Geographic distribution	2386.1	1786.1	.04	-.11	-.10	.03

^an = 31. * p < .05; ** p < .01

As can be seen from Table 4.3, transformational and distance leadership are significantly inter-correlated. Transformational leadership is also significantly correlated with team performance. Hypothesis 2b, which states that transformational leadership behaviors in distributed teams will be positively associated with team performance is therefore not rejected. Distance leadership shows only a very low positive association with team performance even though it is highly correlated with transformational leadership. Therefore, on the team level of analyses no evidence is found to support hypothesis 3b, which states that distance leadership is positively associated with team performance. Hypothesis 3b is therefore rejected. For team effectiveness on the team level of analysis, transformational leadership seems to be most important. Geographic distribution and specialization do not show any significant correlations with the other variables.

Because shared understanding and trust in the knowledge in team colleagues cannot be aggregated to the team level, correlation and mediation analyses were not performed. Analyses to test moderation of the association between leadership and mediators were therefore also not performed. The moderation of the direct association between transformational leadership and team performance by specialization and geographic dispersion was analyzed instead. For this purpose two moderated regression analyses were performed. The first, in which team member specialization was used as a moderator for the relationship between transformational leadership and team performance found that specialization the interaction term were both non significant in the equation. The second analysis showed that geographic dispersion and the interaction term were also both non significant in the equation. Team member specialization and geographic distribution could not be detected as moderators for the leadership performance association on the team level of analysis.

Overall the data show much within team variance, relative to between team variance. As a result only few individual level measures could be aggregated for team level analyses. For analyses of the data the individual level therefore seems to be better suited to test the hypotheses on the relationships hypothesized in Chapter 3. In the next section, the individual level of analyses are presented. First the individual level data are described. Then hypotheses are tested in the following sequence: (1) direct associations between leadership and team outcomes, (2) mediation analyses and (3) moderation analyses.

4.3.2 Individual level analyses

For hypothesis testing several techniques were used. For the first set of hypotheses a correlation analysis was used. The hypotheses concerning mediation were tested by means of a three step procedure proposed by Baron and Kenny (1986), after which significance was determined by means of the Sobel test (Sobel, 1982). For testing of the moderation hypotheses, a series of stepwise moderated regression analyses were performed.

Leadership and team outcomes

First a correlation analysis was performed including all variables that were introduced in this study. Table 4.4 shows the means, standard deviations and correlations between variables. The main diagonal shows the cronbach's alpha's for each scale.

The results show that transformational leadership is significantly positively associated with team performance (.37**) and innovative behavior (.42**). Hypotheses 1c and 1d are therefore not rejected. Transactional (MBEA) leadership was not found to be positively associated with team performance or innovative behavior, therefore hypothesis 1a 1b are rejected. Hypotheses 2a and 2b stated that distance leadership is positively associated with innovative behavior and team performance. Correlations between distance leadership, innovative behavior (.32**) and team performance (.23**) are significant and therefore these hypotheses are not rejected.

Table 4.4: Descriptive statistics and Correlations^a

Variable	Mean	s.d.	1	2	3	4	5	6	7	8
1. Transactional MBEA LS	3.45	0.70	.71							
2. Transformational LS	3.55	0.65	.29**	.93						
3. Distance LS	3.38	0.62	.36**	.69**	.87					
4. Shared understanding	3.68	0.63	.14	.35**	.32**	.81				
5. Trust in knowl of colleagues	3.80	0.46	.13	.27**	.15	.48**	.71			
6. Innovative behavior	3.78	0.53	.03	.42**	.32**	.44**	.27**	.74		
7. Team performance	3.64	0.57	.01	.37**	.23**	.64**	.50**	.40**	.83	
8. Specialization	3.40	0.53	.07	.33**	.17*	.18*	.30**	.21**	.26**	.67
9. Geographic distribution	2363	1512	-.05	.06	-.01	.13	.02	.00	-.04	.06

^a $n = 170$. * $p < .05$ ** $p < .01$

Table 4.4 shows that transformational and distance leadership are strongly and significantly inter-correlated.

Transformational leadership is significantly correlated with both innovative behavior ($R=0.42^{**}$) and team performance ($R=0.37^{**}$). Hypotheses 2a and b are therefore not rejected. Hypotheses 3a and b are also not rejected as distance leadership is also significantly correlated with innovative behavior ($R=0.32^{**}$) and team performance (0.23^{**}).

The correlation analysis shows that transactional (MBEA) leadership was not found positively associated with shared understanding or trust in the knowledge of team colleagues. Contrary, transformational leadership is significantly positively associated with shared understanding ($R=0.35^{**}$) and trust in the knowledge of team colleagues ($R=0.27^{**}$). A significant correlation is found also between distanced leadership and shared understanding ($R=0.32^{**}$). Surprisingly, distance leadership was not associated significantly with trust in the knowledge of team colleagues.

Next, to determine which of the leadership styles explains most of the variance in team outcomes a hierarchical regression analysis was performed with transformational leadership (step 1), transactional leadership (step 2) and distance leadership (step 3) as independent variables and innovative behavior and team performance as dependent variables (see Table 4.5). Hierarchical regression enables the researcher to control for the effect of an independent variable x_1 in analysis of the effect of another independent variable x_2 on one or more dependent variables y . This type of analysis was chosen because transformational leadership was found a strong predictor of team outcomes, such as innovation and performance in previous studies. Transactional leadership was found a strong predictor of such team outcomes in numerous studies as well. By means of hierarchical regression analysis we have investigated the effect of distance leadership, a

new leadership concept, while controlling for the effect of other leadership concepts, of which an effect on the dependent variables is to be expected.

Transformational leadership turned out to be a significant predictor for both innovative behavior ($\beta=0.373$, $p<0.01$) and team performance ($\beta=0.407$, $p<0.01$), thus again hypothesis 2a and b are not rejected. As could be expected on the basis of the correlation analysis, transactional leadership did not significantly predict variance in outcomes in the presence of transformational leadership. In the presence of transformational leadership, distance leadership also did not significantly predict variance in team outcomes.

Table 4.5: Results of Hierarchical Regression Analysis.

	Innovative Behavior			Team Performance		
	R ²	ΔR^2	β	R ²	ΔR^2	B
Step 1	0.168	0.174		0.131	0.137	
Transformational Leadership			0.373**			0.407**
Step 2	0.168	0.005 ^a		0.133	0.007 ^a	
Transactional MBEA Leadership			-0.095			-0.084
Step 3	0.167	0.005 ^b		0.127	0.000 ^b	
Distance Leadership			0.098			-0.023

Note: $n=150$. Standardized regression coefficients are shown based on the last step in regression procedure.

^a Step 1 to step 2

^b Step 2 to step 3

* $p < .05$; ** $p < .01$

To investigate the effect of transactional (MBEA) and distance leadership in the absence of transformational leadership a second regression analysis was performed (see Table 4.6). Results show that transactional (MBEA) leadership is not significant as a predictor of innovative behavior or team performance. In the absence of transformational leadership, distance leadership does significantly predict variance in innovative behavior ($\beta = 0.354$, $p < 0.01$) and team performance ($\beta = 0.256$, $p < 0.01$). For further analyses on mediation and moderation of associations between leadership and outcomes transactional MBEA leadership will not be considered further, as this leadership approach does not seem to play any role in predicting team outcomes.

Table 4.6: Results of Hierarchical Regression Analysis without transformational leadership.

	Innovative Behavior			Team Performance		
	R ²	ΔR^2	β	R ²	ΔR^2	β
Step 1	-0.006	0.001		-0.007	0.000	
Transactional MBEA Leadership			-0.094			-0.083
Step 2	0.099	0.110** ^a		0.045	0.057** ^a	
Distance Leadership			0.354**			0.256**

Note: $n=151$. Standardized regression coefficients are shown based on the last step in regression procedure.

^a Step 1 to step 2

* $p < .05$; ** $p < .01$

The predictive value of distance leadership is strongly dependent on the presence of transformational leadership. Because hypotheses about leadership are tested each by means of analyses that incorporate one leadership style and because distance leadership is positively associated with shared understanding, innovative behavior and team performance (see Table 4.4) hypotheses concerning this leadership approach will be tested even though distance leadership does not explain variance in the presence of transformational leadership.

For testing of the mediation hypotheses, associations between mediators and team outcomes are of vital importance. Correlation analysis (Table 4.1) shows that shared understanding is significantly positively related with innovative behavior ($R=0.44^{**}$) and team performance ($R=0.64^{**}$). Trust in the knowledge of team colleagues is also significantly positively related with innovative behavior ($R=0.27^{**}$) and team performance ($R=0.50^{**}$). This implies that distributed teams that have a high degree of shared understanding and which develop high degrees of trust in team colleagues' knowledge are likely to perform better and show more innovative behavior.

Mediation effects

In order to assess the mediating roles of shared understanding and trust in the knowledge of team colleagues on the relationship between leadership behaviors, innovative behavior and team performance, Baron and Kenny's (1986) three step procedure was followed.

In this study, the requirements for at least partial mediation are as follows. First the independent variable (leadership style) should be significantly related to the mediator variables (shared understanding and trust in knowledge of team colleagues). Second, the independent variable should be significantly related to the dependent variables (innovative behavior and team performance). Third, the mediating variable should be significantly related to the dependent variable with the independent variable in the equation. Full mediation is found if the independent variable (IV) has a non-significant beta weight in the third equation, partial mediation is found when the beta weight of the IV becomes smaller, but is still significant in the equation.

The results of these regression analyses indicate the proportion of the effect that is mediated and significance is tested by means of the Sobel test (Sobel, 1982), which is calculated with the following formula:

$$(z\text{-value} = a*b/\text{SQRT}(b^2*s_a^2 + a^2*s_b^2)).$$

In this formula the following parameters are needed: a = raw (unstandardized) regression coefficient for the association between IV and mediators; s_a = standard error of a ; b = raw coefficient for the association between the mediator and the DV (when the IV is also a predictor of the DV) and; s_b = standard error of b .

Hypotheses 4 a through c are about the mediating role of shared understanding in the relationships between the leadership variables and innovative behavior. In order to test these mediations, two independent mediation analyses were performed. In both analyses the results for step 1 and step 2 were significant; the independent variable was significantly related to both the mediator and the dependent variable (β for transformational leadership (IV) on innovative behavior (DV) was 0.42*** and β for distanced leadership (IV) on innovative behavior (DV) was 0.32***).

In hypothesis 5 (a through c) we suggested that shared understanding mediates the relationships of leadership behaviors with team performance. The results of step 1 and step 2 were significant also for these analyses, the β for transformational leadership (IV) on team performance (DV) was 0.27*** and β for distance leadership (IV) on team performance (DV) was 0.23**. These results allow us to pursue to step 3 of the mediation analyses: entering the independent variables in the equation. Table 4.7 displays the results of the analyses performed to test hypotheses 4 b and 4c.

Table 4.7: Dependent Variables Regressed on Mediators (With Independent Variable Included).

	Variable	F	df	Adjusted R2	β
1.	DV: Innovative behavior Transformational leadership Shared understanding	28.72	2, 148	.27	.31*** .34***
2.	DV: Innovative behavior Distance leadership Shared understanding	21.78	2, 148	.22	.20* .37***
3.	DV: Team performance Transformational leadership Shared understanding	57.25	2, 148	.43	.19** .58***
4.	DV: Team performance Distance leadership Shared understanding	50.14	2, 148	.40	.02 .63***

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 4.8 displays results of the Sobel test in step 3 for these analyses. In all cases the beta weights of the mediator were found significant when the independent variable was entered in the equation. Also, the beta weights of the independent variable became smaller with the mediator included in the analysis, but remained significant in most cases (see Table 4.7). Results therefore show evidence of partial mediation of the relationship between transformational leadership and innovative behavior. Therefore hypothesis 4b is not rejected. Partial mediation of shared understanding is found also for the relationship of distance leadership with innovative behavior and therefore hypothesis 4c, is also not rejected.

Shared understanding was found to partially mediate the relationship of transformational leadership with team performance, which leads us to not reject hypothesis 5b either. As full mediation of shared understanding is found for the relationship of distance leadership with team performance hypothesis 5c, is also not rejected (see Table 4.7).

Table 4.8: Significance Tests of Mediation Analyses for shared understanding.

Independent Variable	Dependent Variable							
	Innovative Behavior				Team Performance Output			
	Mediator	% Mediated	Sobel	Sign.	Mediator	% Mediated	Sobel	Sign.
Transformational	Shared Underst.	30.23	2.86*	0.042	Shared Underst.	57.21	3.62**	0.002
Distance Leadership	Shared Underst.	37.72	3.28*	0.001	Shared Underst.	89.72	3.94***	0.000
N=150								

* p < .05 ** p < .01 ***p < .001

Hypotheses 6 (b and c) stated that trust in the knowledge of team colleagues mediates the relationship between leadership styles and innovative behavior. To test these hypotheses, again two independent mediation analyses were performed. The results of analyses can be found in Table 4.9 and 4.10. The results for step 1 and 2 of these analyses were significant in both cases. Although the beta coefficients for the mediator variable were significant in both analyses, the Sobel test was not significant for mediation of the relationships between leadership styles and innovative behavior. Therefore hypotheses 6 b and c are rejected.

Hypotheses 7 (b and c) stated that trust in the knowledge of team colleagues mediates the relationship between leadership styles and team performance. Two independent mediation analyses were performed to test these hypotheses. The results for step 1 and 2 of these analyses were significant in both cases. The beta coefficients for the mediator variable were significant in both analyses. The Sobel test was significant in both analyses and evidence for partial mediation was found. Therefore hypotheses 7 b and c are not rejected.

Table 4.9: Dependent Variables regressed on Mediators (with Independent Variable included).

	Variable	F	df	Adjusted R2	β
1.	DV: Innovative behavior Transformational leadership Trust in knowl. of team coll.	18.00	2, 148	.19	.37*** .18*
2.	DV: Innovative behavior Distance leadership Trust in knowl. of team coll.	13.40	2, 148	.14	.29*** .23**
3.	DV: Team performance Transformational leadership Trust in knowl. of team coll.	34.00	2, 148	.31	.27*** .43***
4.	DV: Team performance Distance leadership Trust in knowl. of team coll.	27.66	2, 148	.26	.16* .48***

* p < .05 ** p < .01 ***p < .001

Table 4.10: Significance tests of mediation analyses for trust in the knowledge of team colleagues.

Independent Variable	Dependent Variable							
	Innovative Behavior				Team Performance Output			
	Mediator	% Mediated	Sobel	Sign.	Mediator	% Mediated	Sobel	Sign.
Transformational	Trust in knowl	11.52	1.77	0.076	Trust in knowl	31.32	2.76**	0.006
Distance Leadership	Trust in knowl	10.38	1.57	0.12	Trust in knowl	30.71	1.78**	0.076
N=150								

* p < .05 ** p < .01

Moderation effects

Hypotheses 8 through 11 are about the moderating role of geographic distribution and specialization of knowledge on the effect of leadership styles on team processes. To test these hypotheses a total of 8 stepwise moderated regression analyses were performed. Analyses were not performed for transactional MBEA leadership, as this leadership style was not associated with team processes and outcomes. In each case Step 1 involved regression analysis in which leadership style predicts the team process. In Step 2, the moderator variable is entered in the equation. To test whether moderation occurs in Step 3 the interaction term (leadership style x moderator) is entered also in the equation. Evidence for moderation is found when the interaction term is significant in the third step of analysis. The first four analyses pay attention to the moderating role of geographic distribution for the association of leadership with shared understanding.

Hypothesis 8 stated that the association between transformational leadership and shared understanding (8b) is moderated by geographic distribution of team members. Results of a stepwise moderated regression analysis did not provide support for this hypothesis. In hypothesis 8c we claimed that geographic distribution moderates also the relationship between distance leadership and shared understanding. Results for this analysis were also not significant. In other words, the degree of geographic distribution does not moderate associations of leadership with shared understanding. Hypotheses 8b and 8c are therefore rejected.

In hypothesis 9 we predicted that geographic distribution moderates the relationship of transformational (9b) and distance leadership (9c) with trust in the knowledge of team colleagues. Leadership styles were found positively associated with trust in the knowledge of team colleague, however, contrary to our expectations the relationships between leadership behaviors and trust in the knowledge of team colleagues were not significantly moderated by geographic distribution. Therefore hypotheses 9b and 9c are rejected.

Hypotheses 10 b and c predicted that specialization of knowledge of team members fulfills a moderating role in the relationships for transformational (10b) and distance (10c) leadership with shared understanding. Table 4.11 displays the results of stepwise moderated regression analysis of specialization for transformational leadership with shared understanding. The results show that team members' specialization significantly moderates the relationship between transformational leadership and shared understanding. Figure 4.1 shows that transformational leadership is more strongly associated with shared understanding under condition of high team member specialization, than under condition of low team member specialization. Hypothesis 10b is therefore not rejected, however, the same effect was not found for the relationship between distance leadership and shared understanding, therefore hypothesis 10c is rejected.

Table 4.11: Moderated regression analysis for transformational leadership, team member specialization and shared understanding.

Variable	95 Percent Confidence Interval			
	Shared Understanding	Lower Bound	Upper Bound	Tol.
<i>Step 1</i>				
Transformational (β)	0.35**	0.167	0.396	1.00
<i>F</i> (df)	23.54 (1, 165)			
R^2	0.125			
Adjusted R^2	0.120			
<i>Step 2</i>				
Specialization (β)	0.09	-0.058	0.232	0.876
Transformational $\times$ Specialization (β)	0.34**	0.064	0.47	0.019
<i>F</i> (df)	10.6 (3, 162)			
R^2	0.163			
Adjusted R^2	0.148			
ΔR^{2b}	0.038*			

* $p < .05$ ** $p < .01$ *** $p < .001$

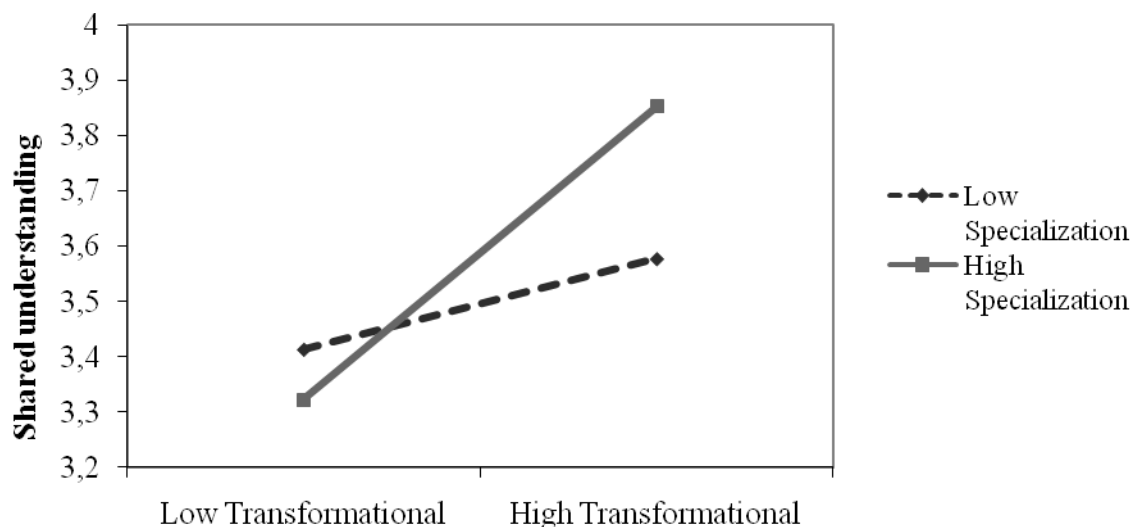


Figure 4.1: Moderation of transformational leadership, specialization and shared understanding.

Finally, hypotheses 11b and c predicted that specialization of knowledge fulfils a moderating role in the relationship between transformational (11b) and distance (11c) leader behaviors and trust in the knowledge of team colleagues. Results showed no evidence to support these hypotheses. Again, significant direct relationships between specialization and trust in the knowledge of team colleagues were found, however, the interaction terms did not turn up significant in analyses. Therefore hypotheses 11b and c are both rejected.

4.4 Discussion

In this chapter hypotheses were tested on leadership, team processes and outcomes, from the research model presented in Chapter 3.

Table 4.12: overview of testing mediation hypotheses

Outcome (DV)	Innovative behavior		Team performance	
Mediator	Shared understanding	Trust	Shared understanding	Trust
Leadership approach (IV)				
Transactional leadership	Not tested	Not tested	Not tested	Not tested
Transformational leadership	Not rejected (partial mediation)	No support	Not rejected (partial mediation)	Not rejected (partial mediation)
Distance leadership	Not rejected (partial mediation)	No support	Not rejected (full mediation)	Not rejected (partial mediation)
Findings support hypothesis	2 out of 4 that could be tested		4 out of 4 that could be tested	

Table 4.12 shows that of 12 mediation hypotheses formulated, only 8 were tested in analyses. Of these 8 hypotheses, 6 were confirmed in analyses. Shared understanding mediated the relationship of transformational and distance leadership with both team performance and innovative behavior. Trust on the other hand only mediated the relationship of transformational and distance leadership with team performance, not with innovative behavior.

Table 4.13: overview of testing moderation hypotheses

Outcome (DV)	Shared understanding		Trust	
Moderator	Geographic distribution	Specialization	Geographic distribution	Specialization
Leadership approach (IV)				
Transactional leadership	Not tested	Not tested	Not tested	Not tested

Transformational leadership	Rejected	Not rejected	Rejected	Rejected
Distance leadership	Rejected	Rejected	Rejected	Rejected
Findings support hypothesis	1 out of 4 that could be tested		0 out of 4 that could be tested	

Table 4.13 sums the results for our moderation hypotheses. Of 12 hypotheses formulated, only 8 were tested. Of these 8 only one hypothesis was not rejected in analysis. Specialization moderated the relationship of transformational leadership with shared understanding. We will discuss these findings in light of previous research in the next paragraph. Limitations and theoretical and managerial implications are discussed also.

4.4.1 Main findings

Leadership and team outputs

Researchers have demonstrated the importance of the role of team leaders in reaching desired team outcomes such as satisfaction, creativity and performance within distributed teams (Hoyt & Blascovich, 2003; Sosik, et al., 1998a; Sosik et al., 1998b). The findings of the present study are in line with these earlier findings and show that transformational leadership is a significant positive predictor of innovative behavior and team performance on an individual level of analysis. The study also provides initial support for the role of transformational leadership in performance at the team level of analysis, by showing that transformational leadership is significantly related to team performance.

With this study a new leadership style has been introduced, which was labeled distance leadership. The overall approach incorporates a number of leadership activities that were found important for distributed teams in earlier work (see Chapter 1) and also contains leadership aspects found in the first study. Items were developed (Table 4.1.) on the basis of the list of leadership activities reported in Table 3.3 of Chapter 3. The five focus areas that formed the basis for this newly developed measure, could not be distinguished on the basis of explorative factor analysis. We chose to collapse 14 of the original items in a single measurement scale. Although the cronbach's alpha was acceptable, the one factor solution accounted for only 30% of the variance.

Because the dataset used for this study was not very large, the items should be used in other studies to determine the factor structure on the basis also of other, possibly larger samples. The fact that the factor structure did not emerge from the data is something that is not unique to this specific measurement scale. Quite some debate has taken place on other leadership scales, such as transformational leadership in the MLQ, as the underlying structure of this leadership approach is sometimes not found in studies (Rafferty & Griffin, 2004), yet the model and the instrument are still dominant in leadership research.

The reported findings indicate that distance leadership is positively related to transformational leadership ($R=.69$), shared understanding ($R=.32$), innovative behavior ($R=.32$), and team performance ($R=.23$) on the individual level of analysis. However, contrary to our expectations the construct does not significantly predict unique variance in outcome variables in the presence of transformational leadership. This may imply that transformational leaders in distributed teams also in most cases engage in distance leadership activities. The distance leadership activities measured with the newly developed scale may represent actions that could be expected of transformational leaders when they are placed in a distributed environment. The leadership styles are as such complementary, not opposing ($R=.69$). This might explain why transformational leadership explains also the variance that was accounted for by distance leadership in the absence of transformational leadership

Shared understanding and trust in the knowledge of team colleagues

The second objective of this study was to explore whether shared understanding and trust in the knowledge of team colleagues fulfill a mediating role in the relationship between leadership, innovative behavior and team performance. Researchers have demonstrated the role of concepts closely related to shared understanding, such as shared mental models, and shared cognition in the performance of teams and work groups (Cannon-Bowers, et al., 1993; Klimoski & Mohammed, 1994). This study shows that shared understanding acts as a significant mediator for the relationships between leadership behaviors, innovative behavior, and performance of distributed teams. These findings extend the previously established link between shared understanding and team performance in co-located teams.

Transformational leadership behaviors seem to be best suited for development of both shared understanding and trust. Findings of this study suggest that leaders of distributed teams should aim for shared understanding in their teams as this can contribute to teams' performance and innovative capacity. Trust also fulfils an important role for teams' performance, but not necessarily for innovative behavior. Possibly, a certain level of trust is optimal for distributed teams. The results suggest that, beyond a certain point, it is not necessarily beneficial for teams to develop higher levels of trust in order to be innovative. Perhaps an optimal level of trust can be reached, after which higher levels of trust may lead to less innovative solutions. Beyond a certain degree of trust, this might lead to a state of 'groupthink', in which team members explore and discuss fewer alternative ideas or solutions to problems, which may ultimately lead to less innovative behavior.

Geographic distribution and specialization of knowledge

The third objective was to investigate whether the degree of geographic distribution and specialization of knowledge influence the relationship between leadership, shared understanding and trust in the knowledge of team colleagues. In other words, is the

relationship between leadership, shared understanding and trust different in teams with a low degree of geographic dispersion, than in teams with a high degree of dispersion. Earlier research, in which face-to-face and distributed teams were contrasted, indicated that geographic distribution has a direct influence on team performance, which was found to be mediated by team processes (Cramton & Webber, 2005).

We did not find a difference between teams with a high and low degree of geographic dispersion regarding the relationship between leadership and shared understanding. Neither was a difference found for the relationship between leadership and trust in the knowledge of team colleagues. Although there is a growing understanding that distributed team structure has an important impact on distributed teams and leadership of such teams, this second study does not provide empirical evidence for this role. This might have to do with the nature and size of the research sample. Future research could further focus on the role of geographic dispersion by using larger samples of distributed teams.

In line with the hypotheses we did find a difference between teams with a high and low degree of specialization regarding the relationship of transformational leadership with shared understanding. This information can be useful for team leaders who lead highly distributed teams. Team members who are highly specialized and collaborate at a distance are more dependent of each other to fulfill their tasks. Team members who are highly dependent of each other will communicate and coordinate more than team members who are less dependent of each other. In teams in which innovative solutions are aimed for especially, leaders may develop a certain degree of interdependence between geographically separated specialists, for instance by assigning them specific tasks that require cooperation. Creating dependencies on a task level will to some degree facilitate interaction, shared understanding and trust in the knowledge of team colleagues. On the other hand, interdependencies that require for continuous (synchronous) interaction are generally not very suitable for coordination across distance.

4.4.2 Conclusions

This field study is one of the first to examine the role of shared understanding and trust in knowledge of team colleagues, in the association between leadership and team outputs of distributed teams. The study also proposed and explored the roles of team member specialization and team distribution (Bell & Kozlowski, 2002; O'Leary & Cummings, 2007) as context factors that impact the relationship between leadership, shared understanding and trust.

The results show that transformational and distance leadership are significantly positively related to team performance and innovative behavior. Evidence was found for the importance of shared understanding in distributed teams. Via an indirect path, shared understanding (partially) explains the association of leadership with team performance and innovative behavior. Therefore hypotheses 4b and c and 5b and c were not rejected. Trust

in the knowledge of team colleagues (partially) explains the relationship between leadership and team performance. Therefore hypotheses 7b and c were also not rejected. However, it does not explain the relationship between leadership and innovative behavior and therefore hypotheses 6b and c were rejected. Moreover, in teams of which team members were highly specialized, the association of transformational leadership with shared understanding was stronger than in teams of which members were less specialized. Therefore hypothesis 10b was not rejected.

Chapter 5

Leadership for distributed teams: an integrated discussion

5.1 Introduction

The increased availability of ICT that is capable of transferring rich information combined with societal developments will likely lead to a further increase in international collaboration. With increased international collaboration, distributed teams that work predominantly with ICT to communicate and coordinate across distance will become ever more prominent in organizations. In other words, distributed teams are probably here to stay. Such teams have numerous advantages for organizations, such as tapping into scarce resources, providing a flexible means to integrate experts on an ad hoc basis, cost reduction and reducing time to market.

Yet to gain these advantages, organizations face challenges with effectively leading such teams. Due to geographic separation, communication with lean media and the considerable diversity in the backgrounds of team members, it can be difficult for such teams to communicate and coordinate effectively. Research indicates that such teams find it difficult to develop into cohesive teams with adequate levels of trust. Insight into team processes and how to manage these in a distributed context is therefore important, however, there is a paucity of research into and theory on the development of distributed team leadership, and therefore relatively little is known about how to deal with such teams from a leader perspective. Therefore this dissertation was aimed at answering the question: *What is effective leadership for distributed teams?*

To answer the main question I divided the work into several steps. I started out with a literature search aimed at drivers and enablers of such teams. From this search it became clear that the research field is multidisciplinary in nature and involves research streams such as: Work and Organizational Psychology, Industrial and Organizational Psychology, Cognitive Psychology, Organizational Behavior, Organizational Communication and Information Systems (OCIS), Organization and Management, Group Dynamics and Communication Research. Getting an overview of this field and the different approaches to research was quite a challenge. Researchers in these fields use different frames of reference and theories and sometimes use different research approaches, i.e. experimental laboratory studies vs. field studies. I believe that to get a better understanding of work in distributed teams, combining insights from the different fields is important.

In this multidisciplinary field, some debate is taking place about the nature of distributed teams. For this dissertation the term distributed team was chosen to provide clarity about the research focus, but in the literature, and most of our literature sources, such teams are referred to as virtual teams. Researchers from information systems and other IT related fields generally take the use of technology as the focal point of their research and of their definition of virtual teams. Other researchers, such as those in OB take geographic dispersion as the core characteristic of virtual teams. This complicates the comparison of research findings and prevents the development of theory. With this dissertation an attempt was made to provide an overview of research from these different fields aimed at leadership.

The second step in the research project was a qualitative explorative study, described in Chapter 2. In this study I found that team characteristics, e.g. distance, time, mediated communication, cultural differences, often co-exist or co-vary in teams. In the research sample, teams working on overall tasks in one domain, e.g. software offshoring, generally showed some resemblance in team structure. Several types of distributed teams can be distinguished on the basis of the overall reason of why they were installed, combined with their geographic and management structure and their overall task. From the 50 teams that were discussed in interviews three dominant types emerged: (1) the software offshoring team, (2) the management platform team and (3) the ICT support team. Although these different types of teams share some distributed team characteristics (e.g. cultural diversity) they have notable differences, e.g. task, team composition, life-cycle and team size. In line with this Espinoza et al. (2003) indicate that distributed team characteristics, such as geographic distance are often not exogenous variables. These characteristics depend largely on the deliberate choice of organizations to locate a specific piece of work in a specific region, because of cost reduction, a global orientation, or a lack of qualified employees, see Chapter 1. Organizations adopting the same strategy to, for instance, organize ICT support, can therefore install teams that bear a lot of resemblance to each other.

The third step in the research project was to review the literature on characteristics of distributed teams. The literature was also analyzed for concepts related to team processes, developing shared understanding and working relationships, and a research model with hypotheses was developed. This model, which integrates transformational leadership theory, insights about distance leadership and theory on shared mental models is presented in Chapter 3 and the hypotheses were tested by using a quantitative study which is reported in Chapter 4.

With this dissertation I show that distributed teams face problems due to the geographic dispersion of team members, mediated communication, time differences and cultural diversity. As a result, distributed teams seem to have difficulty, especially to develop working relationships and to develop shared understanding especially. Results of

the two studies presented in this dissertation suggest that certain leadership behaviors have a positive effect on the development of trusting intra-team relationships, on shared understanding within the team and on team outcomes. From the studies it appeared that, in attempts to perform well, and to increase innovation, leaders of such teams should focus on developing shared understanding. Trusting relationships were also found to be important for team performance. Transformational leadership was found to be the strongest predictor of shared understanding, trust and team outcomes. This dissertation also shows that specialization of team members can act as a situational enhancer of transformational leadership. Overall, the dissertation provides a critical step towards a better understanding of the challenges leaders of distributed teams face and leader actions and behaviors that can be effective in overcoming these challenges.

This chapter is structured as follows. Section 5.2 discusses transformational leadership in the distributed context. In section 5.3 I go into the importance of shared understanding and trust for team effectiveness. In section 5.4 the nature of distributed teams is discussed, followed by section 5.5, which presents a reflection on the studies. It is followed by a discussion of practical implications of the results in section 5.6. Finally, suggestions for further research are presented in section 5.7.

5.2 Transformational leadership at a distance

A rich stream of research has examined the influence of transformational leadership on employees' motivation, attitude and behaviors. However, this research is based on the premise that leaders are able to influence followers when they are in close, sustained and personalized contact with them (Joshi et al., 2009). Not much is known about these relationships in distributed teams when leaders are at a distance from their followers.

The first study revealed that the combination of a culturally diverse team composition and a high reliance on mediated communication with few face-to-face meetings may have a strong negative impact on the development of shared understanding and the development of trust in distributed teams. Leaders in study 1 indicated that to overcome these problems they targeted their leadership activities on facilitating an effective communication climate and on making clear written agreements. Leaders also indicated that they needed to be available for their team members to answer questions. Furthermore, leaders mentioned a need to invest in building effective working relationships and a need to focus on the distributed team as a whole. These activities were captured in a newly developed measure of distance leadership, presented in Chapter 4. Recent research has shown that the perception of behaviors critical to distributed team functioning, is dependent on culture (Dekker, Rutte, & Van den Berg, 2009). This may imply that leaders of distributed teams have to be aware of the differences in perception of critical leadership and team members

behaviors, so they can adapt their style accordingly and also understand behaviors of team colleagues of the diverse cultural backgrounds.

Study 2 was aimed at testing hypotheses about the relationships between transactional, transformational and distance leadership, team processes and outcomes. Of the three leadership styles included in the second study, transformational leadership was identified as the strongest predictor of shared understanding, trust and team outcomes. Surprisingly, transactional leadership and the newly developed measure of distance leadership did not predict variance in team processes and outcomes in the presence of transformational leadership. This result suggests that leaders of distributed teams should engage in transformational leadership behaviors. In other words, they should focus most strongly on providing a clear vision and engaging direction and on fulfilling their role in ways that make team members identify with the leader. Respecting and acknowledging individual differences and attending to the needs of culturally diverse team members can help motivate them to perform well. In order to facilitate innovative behavior, this type of leadership should aim to encourage team members to be self-critical and to constantly challenge the status quo.

It was hypothesized that the relationship between leadership, shared understanding and trust is different in teams with a high degree of geographic distribution, than in teams with a low degree of geographic distribution. Surprisingly, this effect was not found. Interestingly, Joshi et al. (2009) found geographic dispersion moderated the relationship between transformational leadership and trust in team members. Although these researchers used a somewhat different measurement approach to geographic dispersion, than used in this research, the contradiction in findings is striking and clearly more research should be aimed at the role of geographic dispersion in the relationship of leadership with team processes and outcomes.

5.3 The importance of shared understanding and trust for team effectiveness

An analysis of the interview results in study 1 revealed that (a lack of) shared understanding is an important theme for distributed teams. Misunderstandings involved a lack of understanding about technical issues, or a more general lack of understanding. These misunderstandings often result from language problems, a lack of verbal repertoire in the team language, a lack of awareness of cultural differences and an absence of non-verbal cues. Leaders suggested that a lack of shared understanding is problematic especially when team members think they have reached an agreement, which is then interpreted differently by geographically separated team members. In the context of a

conventional team in which daily contact takes place, such differences in interpretation are usually spotted quickly. In contrast, in distributed teams such misinterpretations may exist below the surface for longer periods of time and they manifest too late when a piece of work has gone in different directions than expected, resulting in all kinds of problems, such as delays and increased costs due to necessary rework.

Interestingly, shared understanding was not found in a study in a similar vein by Kirkman et al. (2002), in which five other major challenges to distributed team success were found on the basis of interviews with leaders and members of 65 distributed teams. When taking a closer look at this study, it becomes clear that the teams involved were all distributed within the United States and in some cases Canada. Large cultural and language differences were therefore not very likely in these teams and this could explain this difference in findings. This further strengthens our finding that cultural and language diversity increase the likelihood of problems with shared understanding.

Apart from some theoretical work by Maynard and Gilson (2004) shared understanding has yet to receive much attention in distributed team research. In contrast, shared understanding has received considerable research attention in conventional face-to-face teams. Studies in conventional teams have revealed the importance of team and task mental models, by showing that these are related positively to team processes and performance (Cannon-Bowers et al., 1993). Study 2 in this dissertation adds to the literature showing that shared understanding is also an important mechanism in reaching team performance and innovative behavior in distributed teams, indicating that leaders of such teams should look for possibilities to increase shared understanding.

Interestingly, shared understanding was found to be important for team performance in study 2, even when team members did not agree on the amount of shared understanding within their team. An important aspect of shared understanding therefore seems to be the individual feeling of team members that a certain degree of understanding is present.

To measure shared understanding I chose a subjective measurement scale to tap the individual perception of shared understanding in the team. Research on team and task mental models has used different approaches, mostly experimental, which enable the researcher to assess both the sharedness and accuracy of objective task- and team information. However, this approach can be used only when teams' tasks are controlled for and are equal for multiple teams, for instance in the case of the teams of fighter pilots, studied by Mathieu et al. (2000).

Research on team mental models in organizations is different because any two teams are unlikely to do exactly the same tasks. Assessing task information accuracy is more difficult because the tasks are not designed for this purpose and therefore 'objective' knowledge of the task may not be present. In addition, team members seldom fulfill one task in complete interdependence. Rather, distributed teams work on multiple tasks, some of which require interdependence, while others require specialized knowledge and can be

performed individually. If this was not the case, the need for constant coordination would render work difficult across distance, especially in teams that develop technological solutions, team members are often specialists in their own (technical) domain and cooperation among members involves combining the unique expertise of individuals to come to an innovative solution. In other words, technical expertise or domain knowledge itself is not shared. Rather, what is shared is knowledge about the overall goal of the team, the critical steps towards that goal, who possesses what knowledge and when and how individuals' knowledge should interlock to complete the overall task at hand.

On the basis of study 1, it was suggested that for distributed team work to be effective, apart from shared understanding, well developed working relationships are important. Working relationships, which include knowledge about co-workers and a willingness to work with them, render work more pleasant. As team members get to know each other on a 'deeper' level they become able to make correct predictions about their team colleagues' views and ways of working. This knowledge of co-workers and their way of communicating and their strong and weaker points helps team members to communicate effectively during mediated communication sessions, thereby, over time, reducing the need for costly face-to-face meetings.

Mediated communication in distributed teams is prone to technical problems, as well as problems with awareness of others. Non response or silence on behalf of (a) team member(s) during mediated meetings can be interpreted in multiple ways, yet is surprisingly often attributed to dispositional factors such as a bad work ethic, rather than to situational or technical conditions (Cramton & Orvis, 2003). Having good and trusting working relationships between team members may prevent such faulty attributions, thereby enhancing the team climate and effective collaboration. In line with this notion, trust in distributed teams was found to be positively associated with job satisfaction (Morris et al., 2002). Study 2 in this dissertation adds to existing research that trust is also important for the performance of distributed teams.

For teams to show innovative behaviour, trust seems to be less important than shared understanding as it does not explain the relationship of leadership with innovative behaviour. This finding might suggest that an increased level of trust does not necessarily lead to more innovative behaviour. The relationship between trust and innovative behaviour may not be linear in nature, instead an optimal level of trust might exist for teams. At this level, team members may trust each other enough to rely on each other's knowledge and expertise, while remaining critical of the ideas of team colleagues. Earlier work by Jehn and Mannix, (2001) suggested that productive conflict is an important process that allows teams to make better decisions because more alternatives are generated and considered prior to a decision being made. Moreover, high levels of trust may lead to a psychological state of 'groupthink', which reduces the amount of productive conflict. This

essentially blocks critical evaluation of the suggestions of fellow team members, possibly leading to less innovative ideas.

The results from study 1 suggest that leaders may prevent problems in their teams by investing in the development of shared understanding and working relationships at the time when teams begin to work under their leadership. As many researchers have already mentioned, this is done best in a face-to-face kick-off meeting during the initial “courtship” period of a distributed team (Martins et al., 2004). Team leaders in study 1 indicated that they used face-to-face meetings mostly for strategic issues, status updates and for the planning of activities in the future. These kinds of subjects were considered ‘worth’ investing time and money to bring team members together. Few leaders in the first study actively used team building sessions at the start up of a team. The findings from study 1 suggest that these face-to-face meetings should include time for team members to interact informally to facilitate the development of working relationships. Examples of active attempts to make team members aware of cultural differences, customs and way of communicating, or team building initiatives may prove useful for team leaders to consider when composing new distributed teams.

5.4 Are distributed teams like any other kind of team?

In study 1, one of the leaders stated the following about distributed teams: *“Virtual teams in general involve more complexity. There is geographic distance, cultural differences, different professional backgrounds, and different time zones. The organizations surrounding teams are also complex, unclear matrix structures. Teams also increasingly work with partner organizations, i.e. customers and suppliers, and all of this happens in increasing invisibility. Shared understanding is therefore less and you have to work on it harder”* This quote implies that distributed teams are not like any other kind of team. Although distributed teams share many common aspects with conventional teams, there are also many differences in characteristics.

The effect of these characteristics was indicated in study 2, in which perceptions of shared understanding and other team aspects were found to be shared between team members only to some extent, following from the low ICC’s in this study. This may have to do with the distributed nature of the teams in which shared experiences are limited, which reduces commonality of individual perception of team level aspects. The sheer diversity of team members’ backgrounds, cultural, language, organizations etc, is another possible explanation. Results from study 2 therefore raise questions about the degree of ‘teamness’ present in the distributed teams in the sample. An interesting question is what characteristics of distributed teams might lead such teams to be more or less ‘teamy’.

Several aspects were discussed in Chapter 3, these are now discussed more in light of 'teamness'.

Study 2 measured geographic distance using a continuous measure which collapsed team structure aspects into an overall index of team member distribution. The use of such an index enables the researcher to make more subtle distinctions in the degree of geographic distribution within a sample of distributed teams. Although not quantified, geographic distance was strongly related to cultural and language diversity in our study and study 1 suggested that these aspects potentially cause problems with shared understanding. Surprisingly, I could not detect a difference between teams with a high or low degree of geographic dispersion in the relationships between leadership, shared understanding and trust. The measure of geographic dispersion as a variable may not be precise enough to capture cultural and language differences in distributed teams, as these are not linearly connected to geographic distance. The presence of expatriates in distributed teams, which is quite common in global organizations is also problematic when using only a measure of geographic distribution. Although difficult to measure on an individual level or team level, future researchers should continue to complicate their perceptions of, and look for nuances in cultural and geographical distribution to reflect the complexities of processes of distributed teams that contain members from different cultures (Connaughton & Shuffler, 2007).

Geographic dispersion is but one of several indicators of distributed team structure. O'Leary and Cummings (2007) have suggested other measures for this purpose. An example of such a measure is the window of synchronicity across locations, which represents the overlap of working hours across all geographically separated locations. Structural characteristics such as these could in future research be systematically measured and where possible, combined with coordination aspects such as the amount of face-to-face contact and the richness of communication media used during mediated communication sessions.

Time is an important aspect for distributed teams. Time covers aspects such as the life cycle of teams, discrete or continuous; the time team members have been working on their tasks and possible prior working relationships. More important than the objective measurement of time may be the developmental stages teams undergo during their life cycle. Future research could therefore investigate the impact of time, by following different teams progress through their developmental stages (Hertel et al., 2005; Tuckman, 1965). Major events in distributed teams, such as absence or leave of team members and new members entering a team, may also interfere greatly with processes such as shared understanding and relationship building. Future research could take a longitudinal approach by observing and measuring, as well as discussing, these changes and their impact with team members. Such an approach, which has already been used successfully by Majchrzak et al. (2000) will add greatly to the knowledge in this research domain.

In a discussion of teamness, or groupness, Andriessen (2002) included distance and time, and other team characteristics, of which some have been mentioned in the third chapter. Of central importance is the degree and type of task and goal interdependence. Related to task interdependence, the second study showed that teams with high and low specialization of team members differ with regard to the relationship between transformational leadership and shared understanding. Intensity of interaction is another aspect mentioned by Andriessen (2002) as affecting the degree of teamness. Team leaders in study 1 reported various degrees of intensity of interaction between team members. Teams also varied from relatively loosely coupled knowledge sharing teams, in which members participated several hours per week, to highly interdependent project teams, in which members worked full time. The degree of intensity of interaction may be tightly linked to the amount of time per week a team member devotes to a team. Perhaps some distributed teams have more resemblance to virtual communities of practice, than with conventional face-to-face teams. Finally, Andriessen (2002) mentions team size to be of major importance in distributed team research. Although size may affect distributed teams differently than face-to-face teams, as electronic brainstorming tools may facilitate discussion with much larger teams, team size potentially affects the degree of teamness experienced in such teams. Large project teams, as discussed in the first chapter, may actually be whole organizations that work together, but in which only few organizational members, i.e. those fulfilling a role in the core team, are responsible for coordination at a distance. This implies little contact between the majority of team members who work geographically separated.

Variation of any of these characteristics can have a major impact on interaction and individuals' perception of their team. Researchers should therefore carefully consider whether the teams they are studying can be considered to be a team. After deciding how teamy the teams under study are, an appropriate level of analyses of data should be applied. In the case of our second study, individual level analyses were found to be most appropriate.

Research in distributed teams in organizations might benefit from looking for dominant types of teams, of which several possible types are mentioned in the first and second chapter. Comparing types of distributed teams in research is a potentially fruitful direction, as it forms a means to reduce the great potential of disturbing factors in the research context, however, differentiating types clearly and finding enough teams that share characteristics to fill several different categories may prove to be quite a challenge. Using types of teams is one way to refine further the incorporation of team structure in research. Looking for and measuring simultaneous occurrence of variation of team characteristics in general might be a fruitful avenue to pursue in future research.

5.5 Practical implications

5.5.1 Transformational leadership

Transformational leadership seems to work best for distributed teams as it is the strongest predictor of shared understanding, trust, innovative behavior and team performance. When selecting leaders for distributed teams, organizations could look for transformational leadership potential, by evaluating potential leaders for this potential using assessment centers, or by gathering information from subordinates about the leadership style of candidates in previous leader roles. Some evidence was found for a relationship between personality traits and transformational leadership. This for instance suggests that leaders high in ‘openness to experience’, one of the Big V personality dimensions, engage in transformational leadership, especially in dynamic environments (De Hoogh, Den Hartog, & Koopman, 2005). Leaders scoring high on openness to experience are characterized by traits such as imagination, creativity, autonomy and divergent thinking. Such traits may be of extra relevance in the context of distributed teams, in which diverse team members work on tasks that require innovation.

Most leaders of distributed teams face the challenging task of leading a diverse distributed collective, without having much previous experience with such teams. A relevant question therefore is: *“What should be the focus in leadership development initiatives aimed at leaders of distributed teams?”*. The context of distributed teams proved to be a complicating factor for leaders, particularly for relationship building and developing shared understanding. I believe that individuals who start leading distributed teams should be made aware of the potential pitfalls of distributed teamwork. This context demands leaders who facilitate awareness, who are able to create an effective communication climate, who can motivate team members at a distance, who can provide enough structure for the team to work and who focus attention on building a cohesive team. Therefore teaching team leaders about these leadership aspects and their importance in distributed teams is crucial.

I believe on the basis of study 1, that organizations are reaching a point where a lot of knowledge about managing distributed teams exists, yet this remains mainly in the heads of experienced leaders. A model in which relatively inexperienced leaders are coached by experts may be fruitful to distribute knowledge about distance leadership. In large organizations especially, in which many experienced leaders are scattered worldwide, a knowledge sharing community targeted at leadership development may be of great added value, also, given the effects of diversity in teams, I believe training in cultural awareness is crucial for all leaders of distributed teams.

5.5.2 Shared understanding and trust

Shared understanding has been found to be important for team performance and is therefore something that team leaders should try to develop. This is often heard advice, and a common suggestion is for leaders to organize face-to-face meetings, especially in the startup phase of a distributed team. Leaders in study 1 often underlined the importance of knowing colleagues on the team, which they almost unanimously linked to face-to-face contact. However, it was also found that face-to-face contact is expensive and rare, and that much of the time spent in face-to-face interaction is used for strategic and content related issues and less for learning about each others' way of working and cultural backgrounds. I believe that more attention should be given to these high cost meetings, because these are rare in most teams I believe that as much should be gained from them as possible. Therefore we suggest that especially in the beginning these meetings should involve a program in which team members are made aware of each others' cultures and traditions. Training, aimed at working together effectively with technology should also be given to reduce the likelihood of misunderstandings within a team.

Another aspect that may be helpful, in particular to increase awareness of the larger context in which a team operates, is to perform a stakeholder analyses, in which the complete picture of the team is sketched, including all external parties the team depends on and those that are dependent on the team. Such an analysis can be performed as part of the strategic plan for a team. When such an exercise also includes the individual team members' roles and responsibilities, more understanding about tasks, obligations and the limitations of team members is reached. This will increase team members' understanding of the complex structure of the team and will provide for team members to understand their colleagues' personal situations and why things sometimes do not go as planned.

5.5.3 The nature of distributed teams

Following from the studies in this dissertation, distributed teams are not like any other kind of team. Although team structure in terms of geographic dispersion is often 'given', some team characteristics may be manipulated. One such characteristic, which was found to be a situational enhancer of transformational leadership is specialization of team members. Although specialization may increase interdependence and the need for coordination between team members, it also increases contact and helps to develop shared understanding and working relationships within the team.

Distributed teams work across distances and depend on email, telephone and audio conferencing equipment for their communication. Even though most teams involved in this research had access to video conferencing applications, such tools were only used in a small number of teams. Team leaders responded that using high quality video applications was mostly limited to a specific room, which they had to book in advance and its use was

therefore perceived to be inflexible. More ‘richer’ interaction can be facilitated by the use of the advanced tools, such as desktop video conferencing, that are available now. Although I certainly do not suggest technology should be leading the forms of interaction in distributed teams, an experimental attitude towards new technologies and the willingness to use these in the context of distributed teams may help improve teamwork. Therefore a positive and experimental attitude towards (new) technologies is something that may be looked for in both team leaders and team members of distributed teams.

5.6 Reflection

This research started out with the general question: *What is effective leadership for distributed teams?* This question was my focus of choice from a broader domain of possibilities, captured in the overall project description “coordination mechanisms for virtual work forms”. I chose to study leadership with the above question leading my efforts. At this point I would like to reflect critically on this research question, the approach taken in the studies and the results of this research.

Looking back at the general research question I believe that this question was the right one to pose at that time. Although the first study commenced more than 4 years ago, the question is today still not answered fully and therefore remains relevant. Leadership of course is not the only coordination mechanism applied in distributed teams. When I take a broader perspective, the distributed team environment, which complicates teamwork in ways described, actually also facilitates some management processes. Especially in the software development domain, coordination of work is taking place via workflow management systems in which tasks and responsibilities are defined and work finds its way to team members through systems relying on protocols that, once installed, take place without the actions of a leader.

The leadership role still remains quite important in such an environment, first of all because someone has to be responsible for the development and maintenance of the technical environment, which has to suit the needs of a team performing a specific task. Secondly, as was found in study 1, the systems often do not require team members to interact and communicate, which was found necessary for effective teamwork in study 1. In such work environments especially, in which work flows from one team member to another without active efforts of team members, a leader needs to undertake action to facilitate communication and knowledge sharing between team members, in order to increase the exchange of information and to forge a distributed team.

With hindsight, I believe that the explorative qualitative research approach that was taken in study 1, was defensible given the research findings present at the time. The study systematically paid attention to the perceptions of leaders regarding their role, the impact

of context and leader actions and behaviors they considered fruitful. However, the study was oriented strongly on challenges for distributed teams and less on opportunities. Some of the results, such as the problems with videoconferencing, were not new. Interviews in the study were held mostly with leaders of large multinational organizations. These leaders were highly experienced, but were also part of the generation that started working in a face-to-face context and had already experienced a lot of changes during their careers. A different approach that I could have taken was to look for smaller recently started organizations, for instance by young entrepreneurs, who are more used to the digital world and communication via mediated means. Perhaps such an approach would have lead to more opportunities and positive aspects of distributed work.

In study I used a cross-sectional approach with a web survey to study teams in organizations. The hypotheses formulated in the third chapter are about processes such as leadership and development of shared understanding. The cross sectional research design did not enable me to actually determine causality of relationships. A longitudinal research approach would have been more suitable to answer the research questions. However, getting access to the teams to gather data proved quite difficult and therefore a repeated measures approach was considered to have too much impact on the teams.

I found that locating distributed teams in organizations is not a simple task, as these teams are, in many organizations, not part of any formal organization structure. The teams in our second study were often combinations of parts of regional organizations, which also collaborated with supplier and customer organizations. Key persons with an overview of such teams in an organization were difficult to find. This is more of a problem for distributed project teams, who emerge and dissolve more frequently, than it is for ongoing distributed management teams, which generally have a continuous life cycle. It proved especially difficult to find a large sample of teams within one organization which share organizational and task characteristics. Most organizations do not have 50 *comparable* teams ready for research.

Due to the difficulties in gathering data, the number of teams involved in study 2 was not impressive. Of the 61 team leaders initially contacted only 56% was able to involve their teams for further study. Even for the groups that showed commitment to the research, gathering data still proved difficult. The response rate also varied to some extent between teams. In some cases only one team member responded, in such cases data can hardly be interpreted as representative for the total team. A brief analysis of non-response indicated that people who are involved in geographically distributed teams, are usually very busy and often overburdened with all kinds of requests from colleagues, head quarters and researchers. To make matters worse, leaders of many of the teams involved did not have the formal position to 'tell' team members to participate. The relative extensive questionnaires that are needed for this kind of study, do not help to generate responses. The relatively small sample size that was acquired in study 2 increases the chance of random

effects, or effects that are related to the specific sample in the study. The results of this study therefore have to be interpreted with caution.

The diverse nature of teams in the sample has its advantages and its disadvantages. Teams were diverse in overall task or objective, size, life cycle, i.e. discrete or continuous and phase within the team life cycle, as well as types of expertise on the team. The sheer diversity of teams limited my ability to find strong effects in the data, as much variance can be expected due to the diversity in contexts and team size and life cycle; because the sample covers different types of teams from different organizations, in different life cycles, the effects found can be generalized to quite a broad domain of distributed teams in organizations.

Given the research context, targeted studies, which use smaller instruments will probably face higher success levels than studies with larger, more time-consuming instruments. Another approach to increase sample size in studies is to look for collaboration with organizations that deliver products, i.e. IT collaboration systems, and/or services, i.e. leadership development and management consultancy or training, aimed at distributed teams. Such organizations can be found both as external parties and as internal departments within multinational organizations. These organizations typically have intensive contact with higher level management and teams, which can increase access to teams, especially when studies have a practical value for the involved partners.

If I was to start this research again tomorrow, in order to increase sample sizes I would invest more energy in targeting organizations that can supply enough comparable teams to study distributed team processes systematically, however this type of research has a considerable impact on organizations and their teams. In distributed teams especially, in which team members have multiple reporting relationships and in which the leader of the distributed team has no formal position to tell team members to participate in research, the commitment of higher level management is needed to attain reasonable sample sizes, both in number of teams and response rate for every team. My aim would therefore be to acquire such commitment. The use of some kind of reward for individuals filling out questionnaires might also help to generate a higher response rate.

5.7 Future research

The results from the studies reported in this dissertation provided answers to the research questions, but also lead to other questions, which could be fruitful directions for future research. In this section four such directions are discussed: (1) further exploring the effect of distributed team context, (2) analysing leadership behaviours, (3) exploring the domains of shared understanding and (4) investigating the development of shared understanding

over time. These directions will be discussed around several questions that need to be investigated.

Question 1: What are the implications of face-to-face contact and cultural diversity on leadership actions needed to reach desired team processes and outcomes?

In the second study the role of geographic distance in distributed teams, as a single indicator of the complexity of distributed teams was investigated. The degree of geographic dispersion present in teams was not found to influence the association between leadership and team processes. Geographic dispersion by itself does not represent the full range of aspects presented in Chapter 3.

Another aspect related to geographic dispersion and also to the degree of mediated communication is the amount of face-to-face meetings organized with a distributed team. Depending on the amount of face-to-face contact, problems with coordination of distributed teams, resulting from geographic dispersion, mediated communication and/or cultural differences may be mitigated, as relationship building is facilitated by face-to-face meetings. As Kirkman and colleagues (2004) have shown, the amount of face-to-face contact affects the relationship between empowerment and team performance. The amount of face-to-face contact may fulfill a similar role in the relationship between leadership and team processes.

Respondents in study 1 mentioned cultural diversity as an important distributed team characteristic which leads to problems with shared understanding. Although the measure of geographic dispersion is related to cultural diversity in distributed teams, this relationship is not always straight forward. Given the nature of the sample, with many teams working across the European and Asian continent, the highly distributed teams were also the teams with members from different cultural backgrounds. However, some of the teams in our sample were working from sites that are far away from each other, but did not span large differences in culture, for instance a team that works from distributed locations across the US and a single location in the Netherlands. Had I included more of such teams, our findings might have been different, as cultural and language differences would then not be linked as logically to geographic distribution.

Future research should try to find ways to more directly capture cultural diversity in the study of leadership in distributed teams. Existing measures, such as the entropy measures of Blau, (1977) and Teachman, (1980), that reflect the number of different cultures within a team, are examples that can be used for this purpose. However, the nature of differences between cultures cannot really be captured simply with an entropy index, as certain pairs of cultures differ more and in other ways, than other pairs. Dimensional approaches, which have been applied in studies of the effects of national cultures have been available for some time, however, these conceptualizations have roots in research on population level.

This means that differences between cultures apply only when the average scores of large numbers of individuals from two cultures are compared; because individual differences between members of one culture can be quite large, the use of dimensional approach in small groups is not without problems. Our first study provided practical examples of exactly how cultural differences manifest in intercultural distributed teams, but more research is needed in this area. Specifically, research that somehow captures the degree and type of diversity that exists between team members on an individual level could prove useful.

Question 2: Does distance leadership offer anything else on top of transformational leadership?

Some researchers suggest that leadership issues in distributed teams remain largely the same and leaders therefore must be competent in the same leadership areas as leaders of conventional teams. In line with this, Kayworth and Leidner (2002) found that the core leadership attributes in distributed teams did not vary significantly from face-to-face teams. What did vary was the emphasis of certain roles. For example, taking care of team members and their individual needs became more important in distributed teams. To some extent our research is in line with this suggestion, as transformational leadership, an approach that has been around for some time and has been investigated numerous times in co-located teams, has also been proven to be successful in distributed teams. Future research could therefore aim at studying the relative importance of individual elements (subscales) of transformational leadership.

However, our first study suggested leadership actions and behaviors that are potentially promising in leading distributed teams and that are not part of transformational leadership. These behaviors aim at dealing specifically with geographic dispersion, mediated communication and cultural differences. Some of these behaviors were transformed into the measurement scale of distance leadership. Although evidence was found for the relevance of the concept through its positive relationship with shared understanding, trust and team outcomes, the concept did not significantly explain variance in team processes and outcomes in the presence of transformational leadership. A possible explanation could be that strong transformational leaders will engage in distance leadership behaviors when placed in a distributed team. This might explain why the two leadership concepts are highly inter-correlated ($R=.69$), but more research is clearly needed on the construct of distance leadership.

First, the measurement scale developed for this study should be used also in other studies, possible with different samples of teams. In such studies, preferably other leadership styles, team processes, i.e. empowerment, and outcomes, i.e. commitment and satisfaction, will be included to determine its relationships with distance leadership. The

leadership measure could be refined in several ways. First of all, the items that did not correlate significantly with other items in the scale could be reformulated. As most of these items were 'reversed items', these could be reformulated in a positive manner. In study 2 I chose to include distance leadership as a single measurement scale, on the basis of the screeplot, however the one factor solution explained only 30% of variance. Therefore secondly, the characteristics of the measurement scale could be further investigated, by means of factor analysis, on the basis of larger samples, to see whether the different focus areas of distance leadership can be distinguished in several sub-scales. Finally, insights from other studies aimed at leadership for distributed teams could be used as input for development of new items.

Question 3: Which domains of shared understanding are most important for distributed teams?

The studies reported in this dissertation indicate that shared understanding is important for distributed teams, specifically knowledge about team colleagues, as persons, and about their knowledge, content knowledge. The quantitative study investigated shared understanding on quite a general level and only in terms of a perception of such understanding, however, the literature on shared mental models differentiates four domains of shared understanding. These are (1) the team (2) team interaction (3) the task and (4) the technology. Study 2 focused on knowledge about team colleagues, e.g. part of transactive memory, as well as shared understanding about the team's task on a general level. This choice was made because the teams in this study probably would benefit the most from meta knowledge about team colleagues knowledge and expertise and how this relates to one's personal knowledge.

In study 2, I did not pay explicit attention to the specific task at hand, nor have I assessed objectively whether the actual knowledge individuals held was shared and/or accurate. One of the reasons for this choice was that objective measurement of shared understanding of the tasks is practically impossible in field studies in which correctness of task knowledge cannot be objectively assessed, however, a shared and correct perception of the tasks in a distributed team are crucial for effective team interactions. Future research could investigate more specifically which parts of (shared) knowledge, i.e. the team, team interaction, the task or the technology, are most important for distributed teams, so teams can invest most energy in these domains. Conceptual and empirical work aimed at measurement of team mental models is not without its problems. In field research especially, objective assessment of shared understanding and accuracy in these four domains is complicated. For an overview of conceptual work and promising measurement approaches I refer to Mohammed et al. (2000).

Question 4: Does the level of shared understanding develop over time, for instance when distributed teams have been working together for longer periods of time?

Study 2 in this dissertation provides evidence for the importance of shared understanding in distributed teams and the role of leaders in reaching shared understanding. A distributed team may start out with individuals with a lot of individual knowledge, of which nothing is shared. Over time, due to interaction, the part of the individual knowledge that is shared by team members increases. So, although the degree of shared understanding present in a team can be measured at a single point in time, by taking a snapshot, this degree is something that develops gradually over time (Maynard & Gilson, 2004).

Through interaction with team colleagues and occasional face-to-face meetings shared understanding may increase over time. Therefore, future research should investigate how shared understanding develops as a process over time, using a longitudinal research approach. Longitudinal studies on shared understanding in distributed teams have been scarce. Although difficult to perform, field studies which take a longitudinal approach could add to our existing knowledge. To study the development of shared understanding in its full context, a combination of qualitative, quantitative and possibly experimental or action research methods will be expected to be very fruitful.

Given the developments discussed in Chapter 1, among which the enormous technological advances of the last two decades, distributed teams will be increasingly used in organizations worldwide. In other words, they are probably here to stay. Such teams have difficulty to manage team processes and to reach favorable outcomes, because of geographic dispersion, mediated communication and cultural differences. There has been a paucity of research aimed at leadership in distributed teams and currently there is a significant need to examine how to best develop leadership for the distributed team context (Kahai et al., 2007). The studies presented in this dissertation have led to several important insights for leaders of such teams and have also led to several research areas for scientists to pursue.

Concluding remarks

As technological developments continue, tools become increasingly sophisticated and powerful. With wireless networks with large bandwidth in place, these tools are now capable of transferring video images live on mobile telephones. Children are raised in a world that is, and will be increasingly supported by all kinds of communication and coordination tools. Future generations of leaders will be increasingly adept to work and communicate in a virtual world; they currently already perform complex missions with large virtual groups in online games such as World of Warcraft and they grow accustomed

to meeting perfect strangers in virtual surroundings such as Second Life (Kock, 2008). Perhaps, as a result, future generations will experience fewer problems with distributed team work? These are interesting times and I am really wondering what the next great invention will be that facilitates work at a distance.

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Appendix I: Project proposal

Research Project: Leadership and Coordination Mechanisms for Virtual Teams

Delft University of Technology is currently doing research into leadership and coordination mechanisms for virtual teams.

Background

Much of today's theory on coordination and leadership is based on research in conventional organizations, in which people are working in co-location and in which leaders can observe their subordinates directly in their work.

Increasingly however, people work in complex matrix structured organizations, in which they perform their work in all kinds of projects and teams. With the enormous developments in communication and collaboration technology of the last two decades, much of the work in these projects now spans boundaries of space and time. Increasingly people are working in virtual work forms, in which face-to-face contact is limited and most communication is being performed via mediated means. In this context much of the information typically transferred in face-to-face conversations is lost. Although different ICT are developed to substitute for this lack of face-to-face contact, many workers indicate that they are struggling with the limitations in communication they increasingly encounter.

The role of leaders has changed dramatically due to the development towards virtual work. Leaders can no longer directly observe their subordinates and have to rely on information that subordinates supply them, which is often delayed or incomplete. Leaders can no longer use face-to-face communication to a large degree for clearing up misunderstanding or for conflict management. Literature indicates that leaders, because of their limitations in communication focus more on getting the job done and less on keeping people motivated and enthusiastic.

Leaders also have to increasingly coordinate their tasks with other leaders (functional leaders, department heads, HR managers) and also increasingly work with team members who are only working for them on a part-time basis. To make matters even more difficult, virtual leaders sometimes have no explicit role in performance evaluation of members, or control over incentives.

From a researcher point of view these new work constellations are extremely interesting to study. Work in the virtual team research area is expanding at a rapid rate and new theory in the area of virtual work is being developed.

Research Project

In the current project we are focusing on leadership and other coordination mechanisms for virtual teams. We are very interested in hearing about your personal experiences as a professional virtual leader. Therefore we would like to ask you for a moment of your time, in which you can share your experiences with us. For this purpose we would like to set up a structured interview in which we will discuss leadership and coordination (use of tools, appraisal and rewards) in the context of your virtual project team. This interview will not take more than an hour of your time. Before the interview we will kindly ask you to fill in a short checklist, which will help us in understanding the specific structure and context of the virtual team you are working in. Filling in this checklist will take you 5 minutes at most.

The next phase in the project will focus on gathering of data on a larger scale, also on the level of virtual team *members*. This part of the study will be performed by means of a large survey, in which virtual team leadership is central. Apart from leadership measures the survey will also incorporate measures related to the

use of tools for communication and coordination, and about the use of face-to-face meetings. Data on team processes will also be gathered, including measures of shared mental models of teamwork and measures of task interdependence. Team effectiveness measures will also be incorporated in the survey, as well as measures of innovative behaviour within the team. The survey will not take more than 20 minutes of time from your team members.

Research results

Analyses of data in this research project will shed light on:

- (1) the relationship between team structure (members dispersion, diversity and ICT mediated communication and coordination) and team effectiveness;
- (2) differences between virtual project teams and implications of these differences for team effectiveness;
- (3) the role of the team leader, in specific the use of different leadership styles and activities, in relation to team effectiveness and other output measures;
- (4) the impact of the presence of shared mental models on team effectiveness;
- (5) the role of ICT for team coordination;
- (6) the role of performance appraisal and reward practices in virtual team coordination

In general, this research project will formulate answers to the question “what are effective mechanisms for the coordination of virtual project teams?”

If you are interested in hearing more about the project and possibilities to participate, please contact:

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Appendix II: Online checklist for interviews

1. Your name

[open answer]

2. What is the name of your team? (if you are a leader of multiple teams, please specify which team you have in mind when filling in this checklist)

[open answer]

3. Are you the formal leader of this team?

1. yes

2. no

4. What would be the best description of your role in your team?

1. you are leader of your team

2. you are leader of your team and you fulfill a specialist role within your team

3. you are supervisor of your team, but do not lead your team in day to day activities

4. you are supervisor of multiple teams, which you do not lead in day to day activities

5. other

5. How many years experience do you have as a leader/supervisor of virtual/distributed teams?

1. 1-2 years

2. 3-4 years

3. more than 4 years

6. Are other formal team leaders from different locations, apart from you, leading (parts of) this team?

1. yes

2. no

7. What kind of task or goal is central to your team's existence?

[open answer]

8. Please indicate from which locations your team's members are working and how members are divided over locations. If multiple sites per country are present, please differentiate per site.

Example:

Paris: 2 members

Amsterdam: 10 members

[open answer]

9. Which different National cultures do members of this team originate from?

[open answer]

10. Were you involved in selecting the members of your team?

1. yes

2. no

11. How many different organizations are involved in your team?

1. 1
2. 2
3. 3
4. 4
5. more than 4

12. Are external linkages (suppliers or customers) part of your team?

1. yes
2. no

13. Please indicate what kind of different professional expertise's members bring to this team?

Example:

(1) Software engineering

(2) Marketing

[open answer]

14. Are some of your team's members also working in other (virtual) teams during work in this team?

1. yes
2. no

15. Do members regularly flow in and out of this team?

1. yes
2. no

16. How much experience do your team members have with work in virtual teams (on average)?

1. 1-2 years
2. 3-4 years
3. more than 4 years

17. How much of their time do members typically invest in activities within your team?

1. 10-30%
2. 30-50%
3. 50-70%
4. 70-90%
5. full time

18. What is the expected lifecycle of your team?

1. 1-4 months
2. 5-8 months
3. 9-12 months
4. more than a year
5. other

19. How long have most team members been working on your team so far?

1. 1-4 months
2. 5-8 months
3. 9-12 months
4. more than a year
5. other

20. In which phase of its life would you categorize this team?

1 (at the absolute beginning) - 10 (very near to completion of its task)

21. How often does your team organize face-to-face meetings with all team members attending?

1. Never
2. Once a year
3. Several times a year
4. Once a month
5. Several times a month
6. Once a week

22. What kinds of communication and coordination tools does your team have at its disposal? (more than one answer is possible)

1. Telephone
2. E-mail
3. Chat software (MS messenger)
4. Audio-conferencing tools
5. Videoconferencing tools
6. File sharing applications / version control software
7. Workflow / Project management tools
8. Other applications not in this list

23. Was a special communication/collaboration tool developed or purchased to fit the specific needs of your team?

1. yes
2. no

24. Are you as a team leader responsible for the evaluation of performance of your team members?

1. yes
2. no

25. Do you have control over your team members' rewards?

1. yes
2. no

26. What kind of appraisal system is being used in this team?

1. Individual-based performance appraisal by team leader
2. Individual-based performance appraisal by multiple individuals (peer evaluation)
3. Team based performance appraisal without individual differentiation

4. Team-based performance appraisal with individual differentiation

5. Other

27. This is the end of the survey, if you have any remarks or questions, please write these down in this field.

[open answer]

Appendix III: Interview script for study 1

This script contains the total list of questions. Depending on the answers given in the checklist, questions were in some cases discarded in interviews. The interviews were semi-structured. Leaders were given room to focus on specific subjects that they found important for their teams.

Task

1. You have stated that the goal of this team is: Can you tell me a little bit more about this task and the goal of this (project) team?

Role

2. Can you tell me about your specific role in this project? (more questions about this in leadership section)

Team management structure

3. Maybe you can show graphically what the structure of this (project) team looks like?

4. Can you tell me about the effect of geographic dispersion on (communication and coordination in) this team?

Team Members

5. You have indicated that this team spans a number of different cultures (for example: French, Dutch, Chinese, Polish and German team members are involved). Can you tell me about the effect of cultural diversity on this team?

6. What about the impact of diversity of expertise in this team?

Face-to-face meetings

7. Can you tell me about face-to-face meetings that are organized within this (project) team? [if applicable]

8. What issues are discussed in this team during these meetings? Did this team start off with a face-to-face meeting?

9. Are these meetings always planned ahead, or do meetings sometimes occur spontaneously; for instance when problems arise?

Tools

10. Can you tell me about the use of tools within this team? (for example: you have highlighted telephone, e-mail, teleconferences, chat and videoconferencing tools).

11. Do you use specific tools for specific purposes? (decision making, idea generation,)

12. Does your team encounter problems with the use of tools?

Team processes

13. Do you experience any difficulties with communication and coordination in a dispersed team such as this?
14. In which areas do you experience (most) problems?

Leadership

15. Can you tell me more about your role as leader of this team?
16. What are your main activities and how much time and energy do you invest in different tasks?
17. Do you have the feeling that leadership in a virtual/distributed team (leading at a distance) is very different from leadership in conventional face-to-face teams? (In what way?)
18. When do you feel you are doing a good job as a virtual team leader?
19. Do you experience limitations of your possibilities to exert leadership in the virtual context?
20. In what way does the presence of multiple leaders affect work in this (project) team? [if applicable]
21. Given the problems with communication and coordination you mentioned, what do you consider to be highly effective leadership approaches, actions or behaviors in the context of this distributed teams?

Formalization and appraisal and rewards

22. How is progress of your team monitored?

Team progress

23. Are you satisfied with the way work in this team is progressing?
24. Do you think improvements are possible?

End

25. Thank you very much for this interview. Do you have any questions or remarks concerning our conversation or this research?

Appendix IV: Coding scheme for qualitative analysis

Table IV.1 presents the codes generated and used for the qualitative analysis. In Table IV.2 the definitions of codes are given.

Table IV.1 Coding scheme

I. Window of synchronicity	WoS	1.1
WoS: Planning Meetings	WoS-PM	1.1.1
WoS: Long Working Days	WoS-LWD	1.1.2
WoS: Advantages of time differences	WoS-Adv	1.1.3
II. Physical distribution		1.2
PD: General	PD-GEN	1.2.1
PD: No Contact with Client	PD-NCC	1.2.2
PD: Travel Time	PD-TT	1.2.3
III. Multi-cultural Teams	MCT	1.3
MCT: General	MCT-GEN	1.3.1
MCT: Pro-activeness	MCT-P	1.3.2
MCT: Information Seeking and Providing	MCT-ISP	1.3.3
MCT: Communication Styles	MCT-CS	1.3.4
MCT: Need for Physical Contact	MCT-NPC	1.3.5
MCT: Need for Procedures	MCT-NP	1.3.6
MCT: Language Problems	MCT-LP	1.3.7
MCT: Cultural Awareness	MCT-CA	1.3.8
MCT: Functional Differences	MCT-FD	1.3.9
IV. Reduction of face-to-face contact	RFC	1.4
RFC: General	RFC-GEN	1.4.1
RFC: Lack of Informal Encounters	RFC-LIE	1.4.2
RFC: Organizing Face-to-face Meetings	RFC-OFM	1.4.3
RFC: Lack of Visual Cues	RFC-LVC	1.4.4
RFC: Lack of Context Cues	RFC-LCC	1.4.5
RFC: Lack of Control	RFC-LOC	1.4.6
RFC: Lack of Awareness	RFC-LOA	1.4.7
RFC: Level of Interaction	RFC-LOI	1.4.8
RFC: Lack of Physical Appreciation	RFC-LPA	1.4.9
V. Technology factors	TP	1.5
TF: Information Overload	TF-IO	1.5.1
TF: Unstructured Information	TF-UI	1.5.2
TF: Technology Problems	TF-TP	1.5.3
TF: Member contribution	TF-MC	1.5.4
TF: Tools as enablers	TF-TAE	1.5.5

TF: Ineffective Communication	TF-IC	1.5.6
VI. Rest Category	RC	1.6
RC: Developing Trust	RC-DT	1.6.1
RC: Developing Shared Understanding	RC-DSU	1.6.2
RC: Selection of Team Members	RC-STM	1.6.3
RC: Complex Team Structure	RC-CTS	1.6.4
RC: Competencies for virtual work	RC-Comp	1.6.5
RC: Transactive memory system	RC-TMS	1.6.6
RC: Previous Working Relationships	RC-PWR	1.6.7
RC: Problems due to high turnover	RC-Turn	1.6.8
RC: Higher Expectations	RC-HE	1.6.9
RC: Becoming Detached	RC-BD	
VII. Implications for Leadership	IL	1.7
IL: Strategies for language problems	IL-Lang	1.7.1
IL: Awareness of members	IL-AM	1.7.2
IL: Allowing Travel	IL-AT	1.7.3
IL: Motivating people	IL-Mo	1.7.4
IL: Building relationships	IL-BR	1.7.5
IL: Focusing meetings	IL-FM	1.7.6
IL: Facilitate Team Communication	IL-FTC	1.7.7
IL: Open Communication	IL:OC	1.7.8
IL: Being Problem Oriented	IL:BPO	1.7.9
IL: Involve team members	IL:ITM	1.7.10
IL: Stimulating Work Upfront	IL: SWU	1.7.11
IL: Convincing Team Members	IL:CTM	1.7.12
IL: Communicating team structure	IL:CTS	1.7.13
IL: Project Description	IL:PD	1.7.14
IL: Controlling Output	IL:CO	1.7.15
IL: Climate of Asking Questions	IL:CAQ	1.7.16
IL: Politics	IL:Pol	1.7.17
IL: Overcommunicating in the Virtual Team	IL:Overcom	1.7.18
IL: Being on top of things	IL:BoT	1.7.19
IL: Inform Team	IL:IT	1.7.20
IL: Being Available	IL:BA	1.7.21

Table IV.2: definitions of codes

<i>Window of Synchronicity</i>	
WoS-PM	Difficulties with planning meetings due to time differences across locations
WoS-LWD	Problems associated with long working days, as a result of collaboration across locations with different time zones
WoS-Adv	Advantages of working over different time zones such as, business continuity and effective use of asynchronous tools to coordinate work
<i>Physical Distribution</i>	
PD-GEN	Problems with managing virtual teams due to physical Distribution of team

	members
PD-NCC	Problems with managing virtual teams due to a lack of client contact as a result of the distributed nature of the team.
PD-TT	Need for travel is high which results in many hours of travel time
<i>Multi-cultural Teams</i>	
MCT-GEN	General barriers or enablers associated with multi-cultural teams
MCT-P	Problems with managing virtual team due to differences in the degree of proactive behavior of individual team members, related to their cultural background
MCT-ISP	Problems with managing virtual teams due to differences in the degree of information seeking and information providing across cultures
MCT-CS	Problems with managing virtual teams and/or virtual meetings, due to differences in communication style between culturally diverse members
MCT-NPC	Difficulties with managing virtual team meetings (e.g. teleconference) due to differences in the need for physical contact, and/or direct feedback across cultures
MCT-NP	Difficulties with managing virtual teams as a result of differences in the need for procedures, hierarchy, and confirmation in formal documents
MCT-LP	Difficulties with managing virtual teams as a result of language problems
MCT-CA	Difficulties with managing virtual teams due to a lack of cultural awareness
MCT-FD	Difficulties with managing virtual teams due to differences in functional backgrounds between team members
<i>Reduction of face-to-face contact</i>	
RFC-GEN	Difficulties with managing virtual teams associated with reduction of face-to-face contact in general
RFC-LIE	Difficulties with managing virtual teams, as a result of an absence of informal encounters
RFC-OFM	Organizing face-to-face meetings as an enabler for managing virtual teams, by means of building relationships and getting to know people on the team
RFC-LVC	Difficulties with managing virtual teams and virtual meetings, due to an absence of visual communication cues (non-verbal, body language)
RFC-LCC	Lack of context cues in communication, for instance with the use of text based media such as e-mail
RFC-LOC	Problems with managing virtual teams due to a lack of control
RFC-LA	Problems with management of virtual teams due to lack of awareness of context at other locations and invisibility of what is happening
RFC-LoI	Problems with managing virtual teams, because virtual meetings cannot facilitate the same level of interaction, as face-to-face sessions can, receiving fragments of people's attention
RFC-LPA	Difficulties with management of virtual teams due to a lack of opportunities to celebrate team accomplishments in a face-to-face setting
<i>Technology factors</i>	
TF-IO	Problems with virtual team work due to information overload, as a result of misuse of tools (e.g. e-mail, voice mail and chat)
TF-UI	Problems with virtual teamwork due to unstructured or badly structured information and the need to use many different applications in the search for

	information
TF-TP	Problems with the use of technology, as a result of complexity to arrange, malfunction, unavailability at any locations, or inexperienced users
TF-MC	Member contribution to meetings is harder or more easy as a result of the use of ICT applications
TF-En	Tools as enablers for managing virtual teams
TF-IC	Problems with managing virtual teams due to ineffective communication with ICT (e.g. e-mail ping pong sessions and flaming)
<i>Rest Category</i>	
RC-DT	Problems with managing virtual teams due to problems with development of trust
RC-DSU	Problems with managing virtual teams due to a lack of shared understanding between team members
RC-STM	Problems with management of virtual teams as a result of not being able to select team members in the team
RC-CTS	Problems with management of virtual teams due to complex team structures, with multiple managers and part-time team members
RC-Comp	Difficulties with managing virtual teams as a consequence of members not having competencies for virtual work (professionalism, willingness to communicate via ICT, openness to other cultures and curiosity about ICT)
RC-TMS	Problems with managing virtual teams, due to people not being aware of who does what, or where to find specific expertise
RC-PWR	Having had previous working relationships as an enabler of virtual team work
RC-Turn	Problems with managing virtual teams due to high turnover
RC-HE	Virtual teams are associated with higher expectations, better quality at lower cost
RC-BD	Becoming detached from reality as a result of working for a long time in a virtual team with unclear goals
<i>Implications for leadership</i>	
IL-Lang	Strategies to work around language problems (shifting tools etc)
IL-AM	Having an awareness of team members and their strengths and weaknesses and challenges
IL-AT	Allowing people to travel to other locations when needed and be an example by doing this yourself
IL-Mo	Motivating people in a virtual team, treating them as individuals and adapting communication style and approach
IL-BR	Building relationships with remote team members and leaders
IL-FM	Focusing meetings to get the most out of them, involve only the people you need, keep it small, keep it structured, assign a chairman
IL-FTC	Facilitate communication between team members and suggest strategies for effective communication
IL-OC	Communicating in an open fashion; being open to other cultures
IL-BPO	Having a problem oriented attitude, trying to solve problems instead of being strongly procedural
IL-ITM	Involve team members actively in meetings, by taking them by the hand, by asking questions and by stimulating communication

IL-SWU	Stimulating team members to do work upfront, to prepare for virtual meetings
IL-CTM	Convincing team members to do certain things, without the ability to tell them to do them
IL-CTS	Communicating about team structure, multiple inclusion, dotted lines and make these visible to team members
IL-PD	Having a good project description that contains information about who does what and ways of working on a detailed level
IL-CO	Managing virtual teams by controlling output, that forces a certain procedure to get there
IL-CAQ	Facilitating a climate in which clarification is standard and asking questions is stimulated. Giving the example by asking in-depth questions, until you have the answer
IL-Pol	Being able to deal with politics in a complex international environment
IL-Overcom	Overcommunicate: communicate more and via multiple channels and work harder to pull the virtual team together
IL-BoT	Being on top of things, send minutes and follow up, remember people etc.
IL-IT	Inform the team about things that happen in (the environment of) the team, which remote team members are not aware of
IL-BA	Being available to team members in virtual teams

Appendix V: Scale characteristics for distance leadership

Table V.1: cronbach's alpha of distance leadership items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.87	.87	14

Table V.2: correlations of distance leadership items (omitted are items 3, 9, 11 and 16)

Item (the person I am rating)	M	1	2	4	5	6	7	8	10	12	13	14	15	17
1. Organizes face-to-face meetings between distant members when necessary	3,42													
2. Engages in small talk with team members also during "electronically mediated" meetings	3,39	.29**												
4. Sets an example by bringing important news to remote team members first	2,92	.39**	.30**											
5. Asks remote team members for their opinions during meetings	3,67	.30**	.46**	.36**										
6. Shares "lessons learned" with team members	3,56	.35**	.51**	.43**	.41**									
7. Establishes ground rules for communication	3,31	.26**	.43**	.32**	.38**	.49**								
8. Sets an example for team members by adapting his style of communication to members from different cultures	3,37	.19*	.25**	.21*	.34**	.29**	.35**							
10. Helps team members clear up misunderstandings as a result of cultural differences	3,29	.20*	.25**	.22**	.35**	.27**	.38**	.37**						
12. Identifies meetings as "mandatory" and "non-mandatory" meetings	2,83	.22**	.12	.30**	.13	.31**	.42**	.16	.12					
13. Makes sure that each meeting has a clear agenda	3,61	.22**	.14	.19*	.37**	.25**	.31**	.21*	.33**	.27**				

14. Makes sure that remote team members feel they are part of the team	3,85	.30**	.40**	.15	.51**	.39**	.44**	.28**	.31**	.19*	.45**			
15. Stresses the importance of the virtual team as a whole	3,64	.26**	.37**	.28**	.41**	.45**	.46**	.19*	.19*	.34**	.24**	.41**		
17. Creates a clear picture of dependencies between geographically dispersed locations of the team	3,23	.34**	.24**	.31**	.35**	.35**	.51**	.25**	.38**	.33**	.30**	.29**	.32**	
18. Helps me to find specific knowledge and expertise of members in the virtual team	3,26	.27**	.49**	.38**	.43**	.61**	.48**	.37**	.38**	.25**	.25**	.37**	.39**	.41**

n=141

* correlation is significant at the 0.05 level (2-tailed)

** correlation is significant at the 0.01 level (2-tailed)

Table V.3: component matrix of distance leadership items (omitted are items 3, 9, 11 and 16)

Component Matrix		
Item number		Component
		1
Item 7	Establishes ground rules for communication	0,719
Item 6	Shares “lessons learned” with team members	0,715
Item 18	Helps me to find specific knowledge and expertise of members in the virtual team	0,708
Item 5	Asks remote team members for their opinions during meetings	0,695
Item 14	Makes sure that remote team members feel they are part of the team	0,621
Item 17	Creates a clear picture of dependencies between geographically dispersed locations of the team	0,62
Item 2	Engages in small talk with team members even during “electronically mediated”	0,613
Item 15	Stresses the importance of the virtual team as a whole	0,607
Item 4	Sets an example by bringing important news to remote team members first	0,578
Item 10	Helps team members clear up misunderstandings as a result of cultural differences	0,556
Item 8	Sets an example for team members by adapting his style of communication to members from different cultures	0,532
Item 1	Organizes face-to-face meetings between distant members when necessary	0,505
Item 13	Makes sure that each meeting has a clear agenda	0,505
Item 12	Identifies meetings as “mandatory” and “non-mandatory” meetings	0,462
Item 3	Shares personal experiences of everyday life with all team members	-
Item 9	Takes local (National) holidays into account when planning meetings	-
Item 11	Makes fun of team members from different cultures (R)	-
Item 16	Regularly complains of incompetence of remote members (R)	-
Extraction Method: Principal Component Analysis.		
a. 1 components extracted.		

Appendix VI: Scale characteristics for shared understanding

Table VI.1: cronbach's alpha of distance leadership items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.81	.82	8

Table VI.2: correlations of shared understanding items

Item	Mean	1	2	3	4	5	6	7
1. Within this team members are able to take a hint from each other	3.75							
2. Within this team we need little explanation to get a message through	3.39	.43**						
3. Team members have a shared understanding of what the team is supposed to do	3.91	.40**	.44**					
4. Our team works together in a well-coordinated fashion	3.66	.30**	.25**	.38**				
5. Our team has very few misunderstandings about what to do	3.47	.24**	.22**	.27**	.44**			
6. Most of the time we do things right the first time	3.36	.30**	.26**	.29**	.52**	.51**		
7. We accomplish the task smoothly and efficiently	3.40	.30**	.36**	.30**	.53**	.44**	.64**	
8. It is clear how we will accomplish the task	3.60	.23**	.22**	.27**	.46**	.33**	.45**	.55**

n=163

** correlation is significant at the 0.01 level (2-tailed)

Appendix VII: Scale characteristics for trust in the knowledge of team colleagues

Table VII.1: cronbach's alpha of trust in the knowledge of team colleagues items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.72	.72	5

Table VII.2: correlations of trust in the knowledge of team colleagues items

Item	Mean	1	2	3	4
1. I am comfortable accepting procedural suggestions from other team members	4,06				
2. I trust that other members' knowledge about the project is credible	4,03	.21**			
3. I am confident relying on the information that other team members bring to the discussion	3,91	.32**	.45**		
4. I accept the information provided by other team members without a doubt	3,17	.24**	.22**	.47**	
5. I have a lot of faith in other members' expertise	3,82	.31**	.32**	.47**	.36**

n=173

** correlation is significant at the 0.01 level (2-tailed)

Appendix VIII: Scale characteristics for innovative behavior

Table VIII.1: cronbach's alpha of innovative behavior items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.74	.74	3

Table VIII.2: correlations of innovative behavior items

Item	Mean	1	2
1. Our team creates new ideas for improvements	3.85		
2. Our team searches out new working methods, techniques or instruments	3.72	.50**	
3. Our team generates original solutions to problems	3.77	.43**	.55**

n=151

** correlation is significant at the 0.01 level (2-tailed)

Appendix IX: Scale characteristics for team performance

Table IX.1: cronbach's alpha of team performance items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.83	.83	4

Table IX.2: correlations of team performance items

Item	Mean	1	2	3
1. The team's deliverables are of excellent quality	3,61			
2. The team manages time effectively	3,42	.53**		
3. The team meets important deadlines on time	3,65	.51**	.59**	
4. The team does a good job of meeting [the client's] needs	3,86	.54**	.49**	.59**

n=151

** correlation is significant at the 0.01 level (2-tailed)

Appendix X: Scale characteristics for team member specialization

Table X.1: cronbach's alpha of team member specialization items

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.67	.69	5

Table X.2: correlations of team member specialization items

Item	Mean	1	2	3	4
1. Each team member has specialized knowledge of some aspect of our project	4,13				
2. I have knowledge about an aspect of the project that no other team member has	3,65	.16*			
3. Different team members are responsible for expertise in different areas	4,00	.36**	.19*		
4. The specialized knowledge of several different team members is needed to complete the project deliverables	4,12	.43**	.24**	.40**	
5. I know which team members have expertise in specific areas	4,10	.30**	.15*	.42**	.41**

n=173

* correlation is significant at the 0.05 level (2-tailed)

** correlation is significant at the 0.01 level (2-tailed)

Summary (in English)

Leadership for Distributed Teams, Joris de Rooij, 2009

The aim of this dissertation was to study the little examined, yet important issue of leadership for distributed teams. Distributed teams are defined as: *“teams of which members are geographically distributed and are therefore working predominantly via mediated communication means on an interdependent task and in realizing a joint goal”* (adapted from Bell & Kozlowski, 2002 and Dubé & Paré, 2004).

Chapter 1 first presents the outline of the dissertation. Next, several characteristics of distributed teams are discussed. These characteristics render team processes more difficult. Because theory on management and leadership is based mostly on research in conventional (co-located) organizations there is a need to address leadership in distributed teams. The dissertation aims do this by answering the question: *“What is effective leadership for distributed teams?”* In chapter 1, several developments, which have lead to the increased use of distributed teams in organizations are discussed. One of these developments is considered an enabler (ICT developments), while others are considered drivers (e.g. globalisation, cost reduction, business continuity, flexibility and using networks of expertise). In the discussion of these developments, some examples of distributed teams that have emerged in organizations are presented.

In the second part of Chapter 1, a body of literature on leadership for distributed teams is reviewed. First, based on practitioner oriented sources, some tasks, roles and responsibilities of leaders of distributed teams are discussed. This is followed by a review of findings of empirical studies aimed at leadership in distributed teams. The chapter concludes that empirical research aimed at leadership in distributed teams has been scarce, particularly when it comes to field studies. It also concludes that transformational leadership seems promising for distributed teams, as it is associated with favourable team outcomes. Findings from the normative literature and explorative studies have not been integrated in quantitative field studies. For field studies of leadership in distributed teams a hybrid approach, which combines existing leadership theory with new leadership concepts, while incorporating team context systematically, is proposed.

In Chapter 2, findings of an explorative study (study 1) are reported. The main purpose of study 1 was to investigate the challenges associated with characteristics of distributed teams, as well as leadership actions and behaviours to overcome these challenges. Four questions were posed at the beginning of this study:

1. “How do leaders from distributed teams in organizations perceive the impact of geographic distribution, mediated communication, time dispersion and cultural differences on distributed team work?”
2. “What are the most important challenges with distributed team work, as perceived by distributed team leaders?”
3. “What, according to leaders, are effective leader behaviors to overcome these challenges?”
4. “What can we learn from this first study in terms of promising areas for research?”

For this study a series of semi-structured interviews ($n=50$) with team leaders of distributed teams from nine different multinational organizations was held. Before the interviews, information about the team’s tasks and management structures was gathered by means of a short on-line questionnaire (see Appendix II). For the purpose of these interviews a general interview script was designed (see Appendix III). Leaders were asked how they experienced characteristics of their distributed teams as influencing their team and their role as leaders. All interviews were recorded, transcribed and then analyzed with a program that supports analysis of unstructured data (Atlasti). In this process a codebook was generated (see appendix IV).

The second part of Chapter 2 presents several types of distributed teams, as well as the results of the study in the following order: geographic distribution, mediated communication, time differences and cultural diversity. Respondents indicated that geographic distance lead to complex team structures and the emergence of sub-teams. Mediated communication lead to a lack of visual cues, a lack of awareness and a lack of informal encounters. Few problems were reported as a result of time differences, although the planning of meetings was sometimes difficult. Cultural diversity was mentioned to lead to differences in communication styles, to language problems and to differences in hierarchy perception. From the results of study 1, two major challenges emerged (1) development of effective working relationships and (2) development of shared understanding.

The third part of Chapter 2, presents a list of leadership actions and behaviours that were mentioned as useful for leaders of distributed teams, particularly to overcome the two challenges. Leadership in distributed teams was found typical in its active component. Five general focus areas for distributed team leadership were identified: (1) facilitating awareness, (2) developing an effective communication climate (3) motivating members, (4) formalizing and structuring and (5) focusing on the team as a whole.

Chapter 3 presents the development of a research model. First, literature is discussed on the specific elements of the context of distributed teams and the extensive debate that has taken place. Research findings of the impact of team characteristics on team processes and outcomes are presented, followed by a presentation of theoretical concepts related to

the two challenges derived from Study 1, i.e. the development of effective working relationships, and the development of shared understanding.

In the third part of the chapter a research model is presented. It contains a number of hypotheses about the relationships between leadership approaches, i.e. transactional, transformational leadership and distance leadership, team processes, i.e. shared understanding and trust in the knowledge of team colleagues, and outcomes, i.e. team performance and innovative behaviour. The model displays associations between leadership and team outcomes, which are mediated by team processes. Two team characteristics, i.e. geographic dispersion and team members specialization, are expected to moderate the relationships of leadership with team processes.

Chapter 4 reports study 2. This is a quantitative field study aimed to test the hypotheses presented in Chapter 3 in three steps: (1) the relationship between leadership behaviors, innovative behavior and team performance, (2) the mediating roles of shared understanding and trust in the knowledge of team colleagues in these associations and (3) the moderating roles of geographic distance and specialization in the association between leadership, shared understanding and trust in the knowledge of team colleagues. The study took place in 35 distributed teams which were working in innovative and technological disciplines. The teams originated from 8 different organizations involved in the (management of) development of technology. The study used mostly existing measurement scales for the variables under study. Aggregation of the individual level data to the team level was problematic for some variables and therefore most analyses were performed at the individual level. To test hypotheses, mediated and moderated regression analyses were performed, supported by SPSS.

Results of this study provide support for transformational and distance leadership to influence team processes and outcomes in distributed teams. Shared understanding mediated the association of transformational and distance leadership with innovative behaviour and team performance. Partial mediation was found in most cases and full mediation occurred for the association between distance leadership and team performance. Trust in the knowledge of team colleagues was found to partially mediate the relationship between leadership styles and team performance, however, trust did not mediate the relationship of the leadership styles with innovative behaviour. Contrary to expectations, in study 2 no support was found for the moderating role of geographic distribution in associations of leadership with team processes, i.e. shared understanding, and trust in the knowledge of team colleagues. Specialization of knowledge was found to moderate the association of transformational leadership with shared understanding.

In Chapter 5 theoretical and empirical findings are discussed and integrated. After an introduction, first the role of transformational leadership at a distance is discussed. Transformational leadership was found the strongest predictor of shared understanding, trust and team outcomes. Surprisingly, the degree of geographic dispersion did not

moderate the impact of leadership on team processes, whereas a recent study by Joshi and colleagues (2009) did find this effect. Next, the importance of shared understanding and trust for team effectiveness is discussed. Shared understanding was found to be a challenge for distributed teams and to be an important mechanism to reach team performance. Surprisingly it received relatively little research attention in distributed teams. Some measurement issues are discussed, particularly in the case of field studies. The role of trust is important for team performance, but less important for innovative behaviour. Suggestions to develop shared understanding and trust in distributed teams are discussed.

Next, the attention is focused to how distributed teams are (un)like conventional co-located teams. It is concluded that distributed teams are in many respects different from conventional teams, which renders these teams to be less 'teamy'. Several team characteristics are discussed with regard to their effects on the 'teamness' of distributed teams, as well as several approaches to study the effects of these characteristics. Next, the practical implications of the studies reported in this dissertation are discussed in three areas, i.e. selection and development of team leaders, the role of face-to-face meetings and the use of 'richer' technology for development of shared understanding, and the characteristics to look for in members of distributed teams.

Finally, a reflection on the results is presented followed by suggestions for further research in four domains, i.e. further exploring the effects of the distributed team context, further exploring and analysing the value of distance leadership behaviours, exploring the different domains of shared understanding, and investigating the development of shared understanding over time.

Samenvatting (in het Nederlands)

Leiderschap voor Gedistribueerde Teams, Joris de Rooij, 2009

Het doel van deze dissertatie was het uitvoeren van een onderzoek naar een weinig onderzocht, maar belangrijk thema: leiderschap voor gedistribueerde teams. Gedistribueerde teams zijn gedefinieerd als: *teams waarvan de leden werken vanuit geografisch verspreide locaties, daarbij gebruik makend van Informatie en Communicatie Technologie (ICT), bij het samenwerken aan een gemeenschappelijke taak of een gemeenschappelijk doel, waarvoor zij afhankelijk zijn van elkaar (afgeleid van Bell & Kozlowski, 2002 en Dubé & Paré, 2004).*

In Hoofdstuk 1 wordt de structuur van de dissertatie gepresenteerd. Daarna volgt een discussie over enkele eigenschappen van gedistribueerde teams. Deze eigenschappen zorgen ervoor dat deze teams meer moeite hebben met team processen. Omdat theorieën op het vlak van management en leiderschap hoofdzakelijk zijn gebaseerd op onderzoek in conventionele (niet verspreide) organisaties, bestaat er een behoefte om aandacht te besteden aan leiderschap in gedistribueerde teams. Met deze dissertatie wordt daartoe een poging gedaan, door een antwoord te formuleren op de vraag: Wat is effectief leiderschap voor gedistribueerde teams? In hoofdstuk 1 worden enkele ontwikkelingen beschreven die hebben bijgedragen aan de toename van het gebruik van gedistribueerde teams. Eén van deze ontwikkelingen wordt gezien als een in staat stellende ontwikkeling (ICT ontwikkelingen), terwijl anderen worden gezien als voortdrijvende ontwikkelingen (globalisatie, kosten reduceren, de 24-uurs economie, behoefte aan flexibiliteit en het gebruik van expertisenetwerken). In de beschrijving van deze ontwikkelingen worden enkele voorbeelden van teams beschreven die zijn verschenen in organisaties.

In het tweede deel van Hoofdstuk 1 wordt een overzicht gegeven van literatuur over leiderschap in gedistribueerde teams. Allereerst wordt een aantal taken, rollen en verantwoordelijkheden van teamleiders van gedistribueerde teams beschreven, op basis van enkele praktijkgerichte literatuurbronnen. Hierna volgt een overzicht van resultaten van empirische studies naar leiderschap in gedistribueerde teams. In het hoofdstuk wordt geconcludeerd dat er weinig empirisch onderzoek heeft plaatsgevonden naar leiderschap in gedistribueerde teams, in het bijzonder wat betreft veldonderzoek. In het hoofdstuk wordt ook geconcludeerd dat transformationeel leiderschap een veelbelovende leiderschapsbenadering is voor gedistribueerde teams, omdat deze benadering samenhangt met verschillende gewenste teamuitkomsten. De bevindingen uit de praktijkgerichte, normatieve literatuur, en uit de kwalitatieve veldstudies zijn nog niet opgenomen in kwantitatief veldonderzoek. Daarom wordt gepleit voor een hybride aanpak van onderzoek

in het domein, waarin inzichten uit de gevestigde leiderschapsliteratuur worden gecombineerd met nieuwe leiderschapsconcepten in onderzoek, waarbij de context van teams systematisch wordt meegenomen.

In Hoofdstuk 2 worden resultaten van een kwalitatieve studie (Studie 1) gepresenteerd. Het hoofddoel van Studie 1 was het onderzoeken van de uitdagingen die gepaard gaan met het leiding geven aan gedistribueerde teams. Ook stond centraal het achterhalen van leiderschapgedragingen en acties om deze uitdagingen te lijf te gaan. Voor dit onderzoek zijn vier vragen gesteld:

1. “Hoe beleven leiders van gedistribueerde teams in organisaties de invloed van team eigenschappen zoals geografische afstand tussen teamleden, communicatie via ICT, tijdsverschillen tussen locaties en culturele verschillen tussen teamleden?”
2. “Wat zijn, in de ogen van teamleiders, de belangrijkste uitdagingen die gepaard gaan met werken in gedistribueerde teams?”
3. “Wat zijn, in de ogen van teamleiders, effectieve leiderschapsgedragingen om deze uitdagingen te lijf te gaan?”
4. “Wat kunnen we leren van deze eerste studie in termen van veelbelovende richtingen voor toekomstig onderzoek?”

Voor Studie 1 is een serie semi-gestructureerde interviews ($n=50$) gehouden met teamleiders van gedistribueerde teams, afkomstig uit negen verschillende multinationals. Voorafgaand aan de interviews zijn, door middel van een korte online vragenlijst, gegevens verzameld over de taak van het team en de management structuur (zie Appendix II). Om de interviews te houden is een algemeen interviewsript ontwikkeld (zie Appendix III). Leiders werd gevraagd hoe zij de eigenschappen van hun gedistribueerde team(s) ervoeren en hoe deze invloed hadden op het team en op hun rol als leider. Alle interviews zijn opgenomen en later uitgewerkt in transcripten. Daarna werden ze geanalyseerd met behulp van een programma wat de analyse van ongestructureerde data ondersteunt (Atlasti). Gedurende dit proces werd een codeboek gegenereerd (zie Appendix IV).

Het tweede deel van Hoofdstuk 2 presenteert enkele typen gedistribueerde teams, gevolgd door de resultaten van het onderzoek in de volgende volgorde: geografische afstand, ICT gemedieerde communicatie, tijdsverschillen en culturele diversiteit. Respondenten in het onderzoek gaven aan dat geografische afstand leidde tot complexe teams structuren en het ontstaan van subteams. Gemedieerde communicatie leidde tot een gebrek aan visuele hints, een gebrek aan bewustzijn van het team (awareness) en een gebrek aan informele ontmoetingen. Weinig problemen werden genoemd als gevolg van tijdsverschillen, hoewel het plannen van afspraken soms moeilijk was. Culturele diversiteit werd genoemd als oorzaak van het hebben van verschillende communicatiestijlen, taalproblemen en verschillen in de perceptie van hiërarchie. Uit de resultaten van Studie 1

verschenen twee belangrijke uitdagingen (1) het ontwikkelen van effectieve werkrelaties en (2) het ontwikkelen van gedeeld begrip.

In het derde deel van Hoofdstuk 2 wordt een lijst met acties en gedragingen van leiders gepresenteerd die gericht zijn op het omgaan met de twee belangrijke uitdagingen. Leaderschap in gedistribueerde teams was opvallend in de actieve component. Vijf generieke aandachtsgebieden voor leidinggevendenden werden geïdentificeerd: (1) het tot stand brengen van een team bewustzijn, (2) het ontwikkelen van een effectief communicatieklimaat, (3) het motiveren van teamleden, (4) formaliseren, vastleggen en structureren en (5) de nadruk leggen op het gedistribueerde team als een geheel.

In hoofdstuk 3 wordt de ontwikkeling van een onderzoeksmodel beschreven. Allereerst wordt literatuur beschreven over de kenmerken van gedistribueerde teams. Hierin wordt aangegeven wat voor debat er heeft plaatsgevonden rond de definiëring van deze teams. Vervolgens worden onderzoeksresultaten gepresenteerd, gericht op de kenmerken van gedistribueerde teams en de invloed hiervan op team processen en uitkomsten. Daarna volgt een presentatie van theoretische concepten die gerelateerd zijn aan de twee uitdagingen die naar voren kwamen uit Studie 1: (1) het ontwikkelen van effectieve werkrelaties en (2) het ontwikkelen van gedeeld begrip.

In het derde deel van het hoofdstuk wordt een onderzoeksmodel gepresenteerd, met een aantal hypothesen over de relaties tussen leiderschapsbenaderingen, zoals transactioneel, transformationeel en 'afstands' leiderschap, team processen, zoals gedeeld begrip en vertrouwen in de kennis van teamleden en uitkomsten, zoals team prestaties en innovatief gedrag. Het model toont de relaties tussen leiderschap en team uitkomsten, welke gemedieerd worden door team processen. Twee teamkenmerken, geografische afstand en specialisatie van teamleden, worden verondersteld de relaties tussen leiderschap en team processen te modereren.

In Hoofdstuk 4 wordt Studie 2 gepresenteerd. Studie 2 is een kwantitatieve veldstudie gericht op het toetsen van de hypothesen uit Hoofdstuk 3, in drie stappen: (1) de relaties tussen leiderschapsbenaderingen, innovatief gedrag en team prestaties, (2) de medierende rol van gedeeld begrip en vertrouwen in de kennis van teamleden in deze relaties en (3) de modererende rol van geografische afstand en specialisatie van teamleden in de relaties tussen leiderschapsbenaderingen, gedeeld begrip en vertrouwen in de kennis van teamleden. Het onderzoek vond plaats in 35 gedistribueerde teams die werkzaam waren in innovatieve en technische disciplines. De teams waren afkomstig uit acht verschillende organisaties, die actief waren in het ontwikkelen van technologie. In dit onderzoek is hoofdzakelijk gebruik gemaakt van bestaande meetschalen. Aggregatie van individuele gegevens naar het teamniveau van analyse was problematisch voor sommige variabelen, daarom zijn bijna alle analyses uitgevoerd op het individuele meetniveau. Voor het toetsen van hypothesen zijn gemedieerde en gemodereerde regressieanalyses gebruikt, met behulp van SPSS.

De resultaten van het onderzoek laten zien dat transformationeel en afstands leiderschap invloed hebben op team processen en uitkomsten in gedistribueerde teams. Gedeeld begrip medieerde de relatie tussen transformationeel en afstands leiderschap, innovatief gedrag en team prestaties. In de meeste gevallen was sprake van gedeeltelijke mediatie, maar volledige mediatie werd gevonden in de relatie tussen afstands leiderschap en team prestaties. Vertrouwen in de kennis van teamleden medieerde de relatie tussen leiderschapsbenaderingen en team uitkomsten gedeeltelijk, maar medieerde niet de relatie tussen leiderschapsbenaderingen en innovatief gedrag. In tegenstelling tot de verwachtingen, werd er geen ondersteuning gevonden voor de modererende rol van geografische afstand in de associaties tussen leiderschap en team processen, zoals gedeeld begrip en vertrouwen in de kennis van teamleden. Specialisatie van teamleden daarentegen, werd wel gevonden als moderator van de relatie tussen transformationeel leiderschap en gedeeld begrip.

In Hoofdstuk 5 worden theoretische en empirische bevindingen bediscussieerd en geïntegreerd. Na een introductie wordt eerst aandacht geschonken aan de rol van transformationeel leiderschap. Dit type leiderschap was de sterkste voorspeller van gedeeld begrip, vertrouwen en team uitkomsten. Enigszins verrassend bleek geografische afstand geen moderator te zijn voor de relatie tussen leiderschap en team processen, terwijl dit in een recent onderzoek van Joshi en collega's (2009) wel werd gevonden. Vervolgens wordt het belang van gedeeld begrip en vertrouwen in kennis van teamleden, voor team prestaties besproken. Gedeeld begrip kwam uit Studie 1 naar voren als een uitdaging voor gedistribueerde teams en in Studie 2 kwam het naar voren als een belangrijk mechanisme voor het behalen van team prestaties. Het is daarom verrassend dat het begrip nog weinig aandacht heeft gekregen in onderzoek in gedistribueerde teams. Vervolgens worden enkele problemen besproken rond het meten van gedeeld begrip, gericht op het veldstudies. Vertrouwen in de kennis van teamleden is belangrijk voor team prestaties, maar in mindere mate voor innovatief gedrag. Enkele suggesties worden gedaan voor het ontwikkelen van gedeeld begrip en vertrouwen in gedistribueerde teams.

Vervolgens wordt de aandacht verschoven naar hoe gedistribueerde teams lijken, of juist niet lijken, op conventionele teams. We concluderen dat gedistribueerde teams op veel vlakken verschillen van conventionele teams, wat er de oorzaak van is dat deze teams minder 'teamy' zijn. Enkele eigenschappen van deze teams worden besproken in hun relatie met de 'teamness' van gedistribueerde teams. Ook wordt aandacht geschonken aan enkele benaderingen om deze karakteristieken te onderzoeken. Vervolgens worden enkele praktische implicaties van de studies in deze dissertatie besproken, zoals selectie en ontwikkeling van teamleiders, de rol van fysieke (face-to-face) ontmoetingen en het gebruik van 'rijkere' communicatiemediën voor het ontwikkelen van gedeeld begrip, en tenslotte de eigenschappen waarnaar gekeken kan worden voor teamleden in gedistribueerde teams.

Tenslotte wordt een reflectie gepresenteerd op de resultaten van de studies, gevolgd door suggesties voor toekomstig onderzoek in vier domeinen, het verder onderzoeken van de rol van de context van gedistribueerde teams, het verder onderzoeken van de waarde van de afstands leiderschapsgedragingen, het verkennen van de verschillende domeinen van gedeeld begrip en tenslotte het onderzoeken van de ontwikkeling van gedeeld begrip over tijd.

About the Author

Joris de Rooij (Waalwijk, 1976) attended the Atheneum in Waalwijk. After that he studied Economics for one year, followed by Work and Organizational Psychology at Tilburg University. He graduated on a study of learning style and preference for style of leadership in service organizations. After his graduation he accepted a position as Phd candidate at Delft University of Technology, where he performed the research reported in this dissertation. In 2007 Joris moved to LTP, a consultancy organization, where he worked as an assessment consultant in selection and career development. Since 2008 Joris is employed as a researcher at the Institute for Policy Research and Consultancy (IVA) at Tilburg University. His main areas of interest are labor relations, distributed work, leadership and competency management.