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The Role of Virtual Distance in Innovation and Success

Karen Sobel Lojeski
 Stevens Institute of
 Technology
 Howe School of Technology
 Management
 Email: klojeski@stevens.edu

Richard Reilly
 Stevens Institute of
 Technology
 Howe School of Technology
 Management
 Email: reilly@stevens.edu

Peter Dominick
 Stevens Institute of
 Technology
 Howe School of Technology
 Management
 Email: pdominic@stevens.edu

Abstract

Although prior research has tended to dichotomize work teams as virtual or non-virtual, most project teams today involve some mix of face-to-face and virtual interaction. We develop a construct called Virtual Distance® that includes temporal, spatial and relational facets and apply it to 115 project teams. We propose that virtual distance will influence trust, goal clarity and organizational citizenship and will indirectly have an influence on innovativeness and project success. Our results showed that virtual distance had significant influences on trust, goal clarity and OCB and indirectly influenced innovation and success. The results have implications for the selection and management of teams that are geographically dispersed and interact virtually.

Introduction

The rapid acceleration of networked organizations has led to a rise in global and virtual teams (Stough, 2000). An organization's success is highly dependent on the use of such teams in projects focused on new product development (Barczak & McDonnough, 2003), application software development (Powell, Piccoli, & Ives, 2004), supply chain integration (Bal, 1999), and many other activities. In addition, globalizing the innovation process using virtual resources has become an important way to access diverse sets of knowledge and has become an imperative for companies that seek to succeed in a global market (Santos, Doz & Williamson, 2004). Advances in communication technology have reshaped the manner and frequency of daily interactions between coworkers and customers. Telephones, videoconferencing, e-mail, and groupware tools have made it possible for people to collaborate without meeting face-to face (FTF) (Zaccaro & Bader, 2002).

Research on virtual teams has identified three basic characteristics: members are geographically and/or organizationally dispersed,

collaboration and communication occur through the use of information technologies, and interactions are more likely to be temporally displaced or asynchronous (e.g. Townsend, deMarie, & Hendrickson, 1998; Zigers, 2002). Much of the literature assumes that teams are either virtual or FTF. Although some (e.g., Arnison, 2002), contend that it is virtually impossible to distinguish a virtual team from a traditional team due to the pervasive nature of technology and communications. We have taken an expanded perspective in our research. First, "virtualness" is not necessarily a dichotomous phenomenon (Pauleen, 2003). Most teams today, whether they are global, virtual or co-located, can be described by a mix of virtual and FTF interactions. The key characteristics used to define a "virtual team" are best thought of as contributing to a continuum (Zigers, 2002, Watson-Manheim, Chudoba, & Crowston, 2003, Griffith, Sawyer & Neale, 2003) of virtualness. For example, many co-located teams use e-mail or web-based collaboration or design tools. Second, the commonly cited characteristics of virtual teams are not the only factors influencing the attitudes, behavior, and innovativeness of team members. For example, global virtual teams engaged in new product development and other innovative activities are challenged by a number of different issues including building trust and motivating one another, cultural diversity and lack of goal clarity (Barczak & McDonough, 2003). Collaboration, whether it is FTF or computer mediated, occurs within a much broader context or climate, which includes interpersonal, social, organizational and technical factors, all of which have important implications for the attitudes and behavior of team members and their ability to succeed and innovate (O'Leary & Cummings, 2005).

To be effective, leaders must promote a climate that supports innovation and business success (Harborne, 2003). This can only be accomplished when managers understand the issues that virtual team members face in the

globalized workplace. Although there are clearly new sets of issues that present themselves to the 21st century networked workforce, the virtual team research to date has reported relatively few outcome differences between virtual teams and FTF teams (Powell, Piccoli and Ives, 2004). In most cases, these studies have treated virtualness as a dichotomous phenomenon, with FTF or “traditional” teams as a control group or comparator (e.g. Arnison, 2003; Aubert & Kelsey, 2003). Moreover, they have looked at the defining constructs of temporal, technological and geographic displacement in isolation from other potentially important variables (e.g. Montoya-Weiss, Massey & Song, 2001; Jarvenpaa & Leidner, 1998).

We sought to operationalize a broader set of variables that might more fully explain behavior, success, and innovation in workplace teams. We drew from both the recent virtual team research, which stresses computer-mediated interaction along with temporal and geographic displacement as well as more general concepts related to group dynamics and social interaction. We tried to understand how these variables, when considered together, impacted trust, goal clarity and organizational citizenship behavior (OCB); all of which should be predictors of project success and innovation performance.

Most global virtual team research considers geographic distance as a fundamental characteristic. But distance can also be used to describe the emotional or psychological gap between team members who work in the same building and regularly meet FTF. For a team that is working primarily in virtual space the socio-emotional “distance” may be a function of other factors, in addition to the obvious ones of geography and computer mediation.

Factors Influencing Distance

The socio-emotional distance between one team member and another can be influenced by a variety of factors. These include spatial, temporal, technical, organizational and social factors that shape the perceptions of individuals engaged in collaborative work. In the present investigation we explore how these factors collectively impacted work related attitudes, behavior and performance. Based on a review of management, information systems and psychological literature and interviews with senior executives managing virtual work we identified eleven factors that were likely to influence the perception of distance between team members.

Spatial (geographic) Distance – Research suggests that the closer one is physically to another the greater the chance to form social ties (Latane, 1996). Physical distance also impacts the tendency to deceive, ability to influence and the likelihood of cooperation. (Bradner et al., 2002).

Temporal Distance – Differences in time zones amongst virtual team members is often cited as one of the factors that play a role in virtual team interactions (Montoya-Weiss, Massey, & Song, 2002, Jarvenpaa 1998). It has also been suggested that temporal distance be considered when structuring organizations (Orlikowski & Yates, 2002), globalizing an organization (Boudreau, Loch, Robey, & Straud, 1998), and assessing team boundary issues (Espinosa, Cummings, Wilson, & Pearce, 2003).

Relational Distance - Relational distance refers to the difference between team members’ organizational affiliations. For example, an employee of a company is relationally closer to another employee of the same company versus an outsourced employee. Relational distance has been shown to play a key role in social cohesion (Moody & White, 2003), information systems networks, as well as leader effectiveness (Klagg, 1997).

Cultural Distance - Cultural differences have to date, been a focus of some of the research in virtual environments and innovation; virtual teams (Dube & Pare, Jarvenpaa & Leidner, 1999, Massey, Montoya-Weiss, Hung, & Ramesh, 2001, new product teams (Barczak & McDonough, 2003), risk mitigation (Grabowski & Roberts, 1999), virtual societies (Igarria, 1999), consensus building using group support systems (Mejias, Shepherd, Vogel, & Lazaneo, 1997), majority influence (Tan, Wei, Watson, Clapper, & McLean, 1998), software development (Tellioglu & Wagner, 1999) and more. Cultural distance has also been used to study foreign investment expansion, entry mode choice, and the performance of foreign invested affiliates, among others (Shenkar, 2001). Cultural distance is also used to interpret network ties amongst managers (Stevenson, 2001).

Social Distance - Social distance has been studied in a number of contexts including economically defined class or status differences (Akerlof, 1997), feelings of social closeness and distance based on social interactions in social space (Bottero & Prandy, 2003), as a factor in direct and networked exchanges (Buchan, Croson, & Dawes, 2002), as a function of

management (Fox, 1977), a dimension of the Systematic Multiple Level Observation of Groups (SYMLOG) management behavior assessment (Jensen, 1993), as a perceived measure contributing to the concept of leader distance (Antonakis & Atwater, 2002), and as a factor in friendship networks (Krackhardt & Kilduff, 1999).

Relationship History - One indicator of social distance is relationship history. This includes both the extent to which members have had a prior relationship or relationships with some of the same people. Relationship history has been shown to be important in mentoring (Siegel, 2000) and trust building (Rousseau, Sitkin, Burt, & Camerer, 1998). Relationship history has also been found to positively impact openness, trust, and information sharing in computer-mediated teams. (Alge, Wiethoff, & Klein, 2003).

Task Interdependence - Interdependent tasks require more communication (Bishop & Scott, 2000), which should lead to decreased distance between team members. Task interdependence has also been related to both organizational commitment and team commitment and organizational citizenship behavior (Pearce & Gregerson, 1991; Bishop & Scott, 2000)

FTF interaction - The notion of social presence has been used in research on virtual work to describe the extent to which team members feel the presence of other group members and the feeling that the group is jointly involved in communicating (e.g., Venkatesh, Johnson, 2002; Andres, 2002). One end of the continuum of social presence is FTF so frequency of FTF interaction should be related to perceptions of distance.

Team Size - Group or team size has been shown to affect one's sense of belonging (Williams, 1993). A sense of belonging is critical to the development of organizational identity, which has been shown to have a direct influence on organizational citizenship behaviors (Pratt, 1998; Shamir, 1990). Group size in virtual environments has also been shown to effect team decision making (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002) and satisfaction (Dennis & Wixom, 2001).

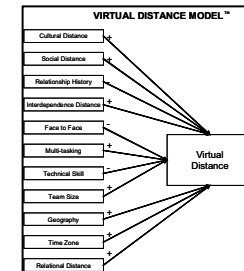
Multi-Tasking - Multi-tasking, a term used to describe a person working on more than one task at a time, can create significant stress and can lead to less efficiency and productivity (Brillhart, 2004). Cognitively distancing oneself from the stress created by multi-tasking and information overload is known as absent presence, "the idea

that we may be physically on a street corner, but our distracted minds are not." (Berman, 2003).

Technical Skill - One's comfort level with technology plays a role in interactions with distant team members (Staples, Hulland, & Higgins, 1999). Less technically competent members may be less inclined or able to communicate and form relationships that would decrease social distance. Major corporations have found that technical and interpersonal skills are key to the selection of virtual team members who are likely to be committed to the project and to each other (Kirkman, Rosen, Gibson, Tesluk, & McPherson, 2002).

The factors described above were taken together to form the multi-dimensional construct, Virtual Distance®.

Virtual Distance enabled us to look more closely



at the combined effect of actual physical and temporal issues (as noted in much of the literature as the primary building blocks upon which virtual teams are formed) as well as the socio-emotional issues

that are often missed. Subsequently, we could then measure Virtual Distance as an independent variable against the key performance drivers of project success and innovation.

In addition to the distance variables we included several other key variables in a tentative model: these were: vision or goal clarity, trust and organizational citizenship behavior (OCB).

Clarity of Vision and Goals

The relationship between group goals and group performance has been well documented (e.g., O'Leary-Kelly, Martocchio & Frink, 1994). As teams become more virtual, however, the absence of experiences gained from FTF interactions may lead to difficulties in creating and maintaining a shared vision and commitment to goals (e.g., Handy, 1995; Seo, Barrett, Bartunek, 2004, Kezsbom, 1999). Among team members who are geographically or temporally distant, individual goals may become less clear if they are not directly attached to some sort of organizational mandate (Manzevski & Chudoba, 2000), potentially leading to less collaborative effort. We expect that virtual distance will influence the extent to which team members understand goals and objectives clearly.

Trust

Trust has received considerable attention, especially in relation to virtual teams and

innovation. Research has found that perceptions of physical distance impacted individuals' willingness to trust counterparts in computer-mediated interaction (e.g. Moon, 1999, Bradner & Mark, 2002). Jarvenpaa & Leidner, (1999) reported that that timely and consistent communication (especially task-oriented) was likely to engender trust within virtual teams. The implications of trust perceptions for team performance are less clear. Lynn & Reilly (2002) found that members of virtual teams reported lower levels of trust and that these lower levels of trust correlated with lower levels of innovation and collaborative behavior. In their investigation of trust on levels of commitment and innovation, Ruppel and Harrington write, "He (Hosmer) suggests that trust and commitment result in enthusiastic cooperative and innovative effort beyond that gained from simple financial incentives or contracts. Only trust can assure people that they will not be overly penalized for new ideas that fail or that they are free to try improvisations leading to competitive innovations in products, markets, methods, and technologies." (Ruppel & Harrington, 2000, p. 319).

A recent survey of top innovators (Milton, 2003) found that trust people was the single most significant factor in differentiating successful innovators. Others have reported that trust perceptions can impact performance when cultural distance is considered (Yadong, 2002).

Organizational Citizenship Behavior

There is strong support for the relationship between trust and OCB (e.g. Yoon & Suh, 2003, Deluga, 1995) and also for relationships between trust and organizational commitment (e.g. Knight & McCabe, 2003). To date however, no studies have attempted to link this relationship to individuals' perceptions of distance. Moreover, discussion of OCB and commitment are conspicuously absent from the growing body of virtual team research.

We proposed that team members' perceptions of distance would collectively impact attitudes and perceptions that have implications for team effectiveness and performance (See Figure 1).

Specifically, we proposed the following:

- a) Individuals' perceptions of distance would be inversely related to the levels of trust they felt toward members of their teams.
- b) Distance perceptions would be inversely related to the clarity of vision and goals for the team.
- c) Lower levels of trust would lead to lower levels of reported commitment to the team and

willingness to engage in organizational citizenship behaviors (OCB).

d) OCB and goal clarity would be positively related to innovation and success within a project.

Innovation

The study of innovation is varied and encompasses many different areas of focus including but not exclusive of diffusion, adoption, "innovating" and "innovativeness" (Damanpour, 1991). We sought to uncover some of the relationships between distance and innovation activities involving project teams that had a virtual component. It has been argued that virtual proximity, connectedness facilitated by the use of ICT, cannot completely substitute for physical proximity when it comes to innovation and learning (Meister, 2004). Quinn argues that services companies (the majority of firms represented in our sample) are particularly dependent on software innovations (Quinn, 2002). For example, the banking industry is becoming more dependent on innovations derived from information and communication technology (Eika & Reistadbakk, 1998). Interestingly, Hedlund (1996) points out that much of the management literature does not generally look closely at innovation activities in these environments.

We sought to understand innovation activities in these environments by analyzing how team members' perceived their ability to express and share innovative and creative ideas with other team members in order to solve problems and achieve project goals. We used this as a proxy for innovation at the project team level. Our approach is supported by other research in which the authors show that companies with the highest levels of innovative performance exhibit certain characteristics; one of them being that people perceive the innovative climate as open and they are free to express new ideas and take creative risks (Milton, 2003). Thus, we expect that virtual distance should have both direct and indirect effects through trust and goal clarity.

Project Success

Project success can be influenced by many different factors. Barczak, et.al. assert that FtF frequency can impact project success, in part because keeping a project on schedule is dependent on a certain focus and discipline that is difficult to maintain with geographically dispersed team members (Barczak, McDonough III, 2003). Smith contends that the perception of project success can also be affected by the

“distance” from ownership of the project (Smith, 2002) which, as we have discussed so far, may be linked to our measure of Virtual Distance and its’ influence on goal clarity, trust, and organizational citizenship behavior. Loo (1996) asserts that physical proximity is also a key variable for project success regarding cooperation, communication, and a clear set of performance standards and goals. We measured project success using team member ratings on three project outcomes: 1) On-time delivery; 2) On-budget delivery; and 3) Customer Satisfaction.

Tentative Research Model

Teams defined primarily by geographic and temporal distance and enabled by information and communication technology (ICT), are likely to be influenced by a number of issues in addition to those that have traditionally been associated with co-located teams. We propose a tentative model that links virtual distance and several key mediating variables to innovation and success. Our tentative model (shown in Figure 1) hypothesizes the following relationships: Virtual distance will negatively influence members’ trust, perceptions of goal clarity, OCB and innovation. Goal clarity will influence innovation and success and will also influence trust which will in turn influence OCB and innovation. Finally, innovation and OCB will influence project success.

Method

The sample included data from 115 projects For 30 projects we used aggregated data from multiple respondents. Most of the respondents worked in technology-related fields in a variety of organizations with headquarters in the Northeastern corridor and held positions ranging from Vice-president to programmer. Seventeen different organizations were represented and included financial services, manufacturing, healthcare, government, software, and outsourcing industries. The two largest functional areas represented include Information Technology (33%) and Engineering (15%). Respondents’ organizations also varied considerably in size with half having less than 5,000 employees and half more than 5,000 employees.

Procedure

All respondents were asked to complete a questionnaire describing their organization, current position and their experiences with a recently completed project. Eleven scales measuring each of the hypothesized distance components were included in the questionnaire.

Our measure of virtual distance, the VDM Index, was a simple linear composite of each of the eleven variables in the Virtual Distance Model. Each of the variables in the model was first converted to a standard score and all scores were averaged with appropriate positive or negative sign so that higher average VDM Index scores indicated greater virtual distance. We also included items to assess five other variables. Trust was assessed with three items taken from Jarvenpaa & Leidner (1999), and OCB was measured with 10 items taken from scales in Podsakoff, Ahearne & Scott (1997). Two-items were used to measure goal clarity, five items were used to assess innovative behavior (White, 2002) and three items measuring project success were taken from Lynn & Reilly (2000).

Internal consistency reliabilities, means and standard deviations and intercorrelations were calculated for all variables. The hypothesized model was tested with LISREL8.

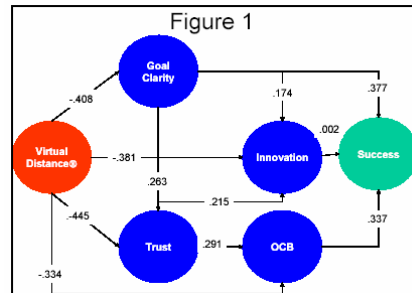
Results

Table 1 shows the means, standard deviations, reliabilities and intercorrelations for the variables in the model.

Table 1: Means, SDs and Correlations¹

	Mean	SD	VDM	Trust	PD	OCB	INNOV	Success
VDM	50.00	10.00	1.00	(.89)				
Trust	3.90	0.81	-0.56	(.94)				
PD	3.57	0.76	-0.42	0.47	(.66)			
OCB	3.70	0.59	-0.49	0.48	0.43	(.82)		
INNOV	3.59	0.64	-0.60	0.49	0.43	0.58	(.65)	
Success	3.50	0.84	-0.37	0.37	0.52	0.47	0.30	(.84)

Figure 1 shows the hypothesized model with standardized path coefficients. All coefficients



¹ Notes: all coefficients were significant at p<.01 Cronbach’s alpha shown for all variables except VDI. VDI reliability was estimated as 1 - ΣVE_i/V_i; where VE is the error variance for each of the eight components and V is the variance for VDI. Reliabilities for all variables are shown in the diagonal.

were significant ($p < .01$) with the exception of a non-significant path between innovation and success. The model had a good fit to the data (RMSEA = .070, CFI = .99, NFI = .973, NNFI = .96). In sum the results showed that the VDM Index has a significant direct effect on Goal Clarity, Trust, Innovation and OCB. Goal Clarity has a significant influence on Trust, Innovation and Success. Trust has a significant direct influence on OCB and Innovation. OCB and Goal Clarity have significant direct effects on overall project success.

Because the path from innovation to success was non-significant we ran a second model without a path from innovation to success. The fit was slightly better (RMSEA = .046, NFI = .97, NNFI = .98, CFI = .99) with no change in the chi-square. All path coefficients in the second model were significant with $p < .01$. Because coefficients for the second model showed only two changes in the third decimal place they are not shown.

Discussion

As globalization and technology continue to evolve it is likely that virtual work will increase. Teams characterized by large cultural, spatial and temporal differences are likely to become the norm rather than the exception. Understanding how perceived distance influences behavior is one of the keys to developing theories and practices that can help select, organize and manage virtual teams effectively. Although our data are preliminary, results suggest that perceived distance is a function of technological, social, geographic and other factors. We proposed the term Virtual Distance to characterize this variable (Reilly, Sobel Lojeski & Dominick, 2005). Our data and other research suggest that Virtual Distance is different than other types of distance and is a multidimensional construct that incorporates a number of distinct factors that create a socio-emotional state. The notion of distance described here differs from other notions of distance (e.g., psychological, cultural, social) in that it includes very real spatial distance and temporal factors that make it difficult for individuals to develop social ties in the same way that co-workers have for centuries.

Eleven factors made up our virtual distance measure in this study. An exploratory factor analysis revealed three factors: Interpersonal congruence (e.g., similar values, status based on contribution, and goal interdependence); Social Relationships (e.g., FtF communication, relationship history); and Technical Expertise

(e.g., technical skill and multitasking). An analysis of factor scores showed Interpersonal Congruence to be the most highly correlated with key endogenous variables. Social Relationships had significant correlations with several endogenous variables. Technical Expertise had no significant relationships. It could be argued that the first two factors will continue to increase in their influence on how teams function in the future. Differences in cultural values and relational distance, for example, are becoming more common as technology evolves, companies increase off-shore contracting and markets become global. Relational distance continues to increase with both on-shore and off-shore outsourcing.

Relationship History may be one way that organizations can decrease distance. Selecting team members with a history of working together would be a simple way to decrease the virtual distance within a team. Lynn & Reilly (2002) found that very high performing teams generally knew one another and had worked on similar projects before. In addition to selecting members with past common experiences organizations can also plan for the future by providing opportunities for dispersed co-workers to build relationships.

Task Interdependence was also found to decrease distance. Consistent with our results other research has shown relationships between task interdependence and commitment (Pearce & Gregerson, 1991; Bishop & Scott, 2000) as well as performance (Saavedra, Early & Van Dyne, 1993). Designing projects to ensure interdependence should increase interactions, communication and mutual goal setting, all of which should lead to decreased perceptions of distance.

Face-to-Face Interaction is one way to decrease distance but may have limited application depending upon the spatial distances involved in the team. The frequency of FTF should continue to be an important variable in team research. A recent study (Kirkman, Rosen, Tesluk, & Gibson, 2004) showed that FTF was a moderator for the relationship of empowerment to success in virtual new product development teams.

Our data suggested that Virtual Distance has a significant influence on trust of project team members. Trust is a widely studied construct with implications for many important organizational outcomes (e.g., Mayer, Davis & Schoorman, 1995; Simons & Peterson, 1995). Thus, evidence that Virtual Distance is related to

trust, if borne out by future studies, is significant for the management of virtual teams. According to a recent model (McKnight, Cummings, Chervany, 1998) social mechanisms play an important role in sustaining and increasing trust. Interaction, they note, tends to increase the trust between people. Likewise, Mayer, et al., (1995) suggest that increased interaction in traditional teams will increase trust. In virtual teams, the more distant a person is, the less frequent the interaction and trust becomes lower over time. One of the outcomes of lower trust is a reduction in OCB. OCBs can be viewed as voluntary behaviors that are part of a social exchange process. Trust characterizes confidence and beliefs about other team members' likelihood of reciprocating OCBs (Soon & Yuh, 2003). Thus, when trust is low team members are less likely to engage in OCBs and less likely to define their role more broadly to include OCBs.

Virtual Distance also has implications for shared understanding of what is expected both in the vision for the project and the goals that are to be achieved. Although empirical studies are lacking, Keszobom (1999) notes that a common vision or sense of purpose is more difficult to achieve with virtual teams. We suggest that it is more important to understand the Virtual Distance amongst team members to know whether a lack of common vision is likely to be a problem. We focused on two outcomes: innovation and success. Although Virtual Distance had direct and indirect influences on innovation and success the latter two variables were not related. One reason may be that the nature of the projects that we studied, most software development in financial organizations, were not directly dependent upon innovative behavior. On the other hand, innovation may have future benefits in other projects or applications.

Many of the implications of Virtual Distance have yet to be studied. Some areas that are potentially interesting and important include affective variables, selecting and organizing virtual teams and managing and leading virtual teams. For example, how does distance influence the emotional and affective side of work? Do distant employees have more or less satisfaction, more or less commitment? Recent research has confirmed the increased difficulty of meeting socio-emotional needs of virtual team members (Chidambaram, 1996; Lurey & Raisinghani, 2001; Maznevski & Chudoba, 2001). Kock (2004) in a recent paper suggests that human evolution has designed both our

brains and bodies for FTF communication. It may be that alternatives to the social interactions of the workplace will have to be found for many virtual workers to meet some of the social and emotional needs required for job and life satisfaction.

Notions of virtual distance may also have applications to selecting and organizing virtual teams. For example, a critical global project may require understanding and perhaps minimizing the distances between team members by selecting individuals with closely aligned work-related values and organizing the tasks to provide clear opportunities for interdependence and frequent communication. A final area for application of virtual distance notions is in team leadership. Understanding how distant team members are from one another and how they differ on key facets of virtual distance can help project managers to better lead and manage.

As virtual work proliferates effective leadership of projects in virtual space will become an essential competitive weapon. We are currently collecting more data to further validate and test our model. The present sample was limited to one respondent per project but future data will include multiple respondents from a variety of multi-national projects. This will allow us to gain a better understanding of the within and across team effects of virtual distance on trust, OCB and other variables. Several theoretical contributions are possible from this research. First, although trust has been extensively explored the notion of distance as a predictor of trust has not. Likewise there is not much research on distance as an antecedent of shared vision. A better understanding of how Virtual Distance affects the formation of shared vision and goal commitment could be an additional contribution. Finally, the data reported here are preliminary and have some methodological limitations such as single response and a relatively small sample. Our future research will address both methodological problems and look at an expanded model of virtual distance and the relationships between virtual distance and organizational outcomes.

Conclusions and Limitations

The results presented provide evidence that a multidimensional index of Virtual Distance has an influence on several important intermediate and outcome variables in project teams. In addition, the results offer some preliminary validation for the notion of Virtual Distance as a meaningful construct. Our study has two major limitations. First, some of our data are limited to

single respondents, which may have produced some mono-method bias. Factor analysis of the VDM Index Variables indicated that 18.7 % of the variance was accounted for by the first factor. A second factor analysis of items measuring the exogenous variables in our model showed slightly 29.2% of the variance accounted for by the first factor. Using the Harman test (e.g., Podsakoff & Organ, 1986) these results suggest that single-source bias may not be a serious problem. For projects for which we had multiple responses we examined intraclass correlations for our key variables. Intraclass correlations ranged from .58 to .77 with a median of .67 suggesting a reasonable level of agreement between independent respondents.

Nevertheless, more multiple response data would allow us to better understand how virtual distance operates within and across teams to influence trust, goal clarity, OCB and other outcome variables. A second limitation has to

do with the nature of our sample. Most of our data come from financial institutions in which the projects tend to be software or service development potentially limiting our generalizations. A final limitation was our relatively small sample size. Opinions as to minimal sample size vary. For example, Stevens (1996) argues that samples should be at least 15 times the number of variables. Bentler and Chou (1987) recommend at least 5 times the number of parameter estimates (including error terms). Loehlin (1992) recommends at least 100 and preferably 200 cases. Our study, while certainly on the low end of these rules of thumb, meets at least the minimal requirements suggested by these authors.

We hope to remedy these limitations in the near future by collecting larger numbers of multiple responses from a variety of different kinds of organizations and projects.

References

- Akerlof, G. A. 1997. Social distance and social decisions. *Econometrica*, 65(5): 1005.
- Alge, B. J., Wiethoff, C., & Klein, H. J. 2003. When does the medium matter? Knowledge-building experiences and opportunities in decision-making teams. *Organizational Behavior and Human Decision Processes*, 91(1): 26.
- Andres, H. (2002). A comparison of face-to-face and virtual software development teams. *Team Performance Management*, 8, 39-48.
- Antonakis, J., & Atwater, L. 2002. Leader distance: A review and a proposed theory. *Leadership Quarterly*, 13(6): 673.
- Arnison, L., & Miller, P. 2002. Virtual teams: A virtue for the conventional team. *Journal of Workplace Learning*, 14(4): 166.
- Aubert, B.A. & Kelsey, B.A. (2003). Further understanding trust and performance in virtual teams, *Small Group Research*, 34(5), 575-618.
- Baltes, B. B., Dickson, M. W., Sherman, M. P., Bauer, C. C., & LaGanke, J. S. 2002. Computer-mediated communication and group decision making: A meta-analysis. *Organizational Behavior and Human Decision Processes*, 87(1): 156.
- Barczak, G., & III, E. F. M. 2003. Leading global product development teams. *Research Technology Management*, 46(6): 14.
- Bentler, P. M. and C. P. Chou (1987). Practical issues in structural modeling. *Sociological Methods and Research*. 16(1): 78-117.
- Berman, D. K. 2003. Technology Has Us So Plugged Into Data, We Have Turned Off, *Wall Street Journal*. New York.
- Bishop, J. & Scott, K. (2000), An Examination of Organizational and Team Commitment in a Self-Directed Team Environment, *Journal of Applied Psychology*, 85, 439-450.
- Bottero, W., & Prandy, K. 2003. Social interaction distance and stratification. *The British Journal of Sociology*, 54(2): 177.
- Boudreau, M.C., Loch, K. D., Robey, D., & Straud, D. 1998. Going global: Using information technology to advance the competitiveness of the virtual transnational organization. *The Academy of Management Executive*, 12(4): 120.
- Bradner, E., & Mark, G. 2002. *Why Distance Matters: Effects on Cooperation, Persuasion and Deception*. Paper presented at the CSCW '02, New Orleans, Louisiana.
- Brillhart, P. E. 2004. Technostress in the Workplace Managing Stress in the Electronic Workplace. *Journal of American Academy of Business, Cambridge*, 5(1/2): 302.
- Buchan, N. R., Croson, R. T. A., & Dawes, R. M. 2002. Swift neighbors and persistent strangers: A cross-cultural investigation of trust and reciprocity in social exchange. *The American Journal of Sociology*, 108(1): 168.
- Chidambaram, L. (1996). Relational development in computer-supported groups. *MIS Quarterly*, 20, 143-165.
- Damanpour, F. 1991. Organizational Innovation: A Meta-Analysis of Effects of Determinants and Moderators. *Academy of Management Journal*, 34(3): 555-590.
- Deluga, R.J. (1995). The relation between trust in the supervisor and subordinate organizational citizenship behavior. *Military Psychology* 7(1), 1-16.

- Dennis, A. R., Wixom, B. H., & Vandenberg, R. J. 2001. Understanding fit and appropriation effects in group support systems via meta-analysis. *MIS Quarterly*, 25(2): 167.
- Dube, L., & Pare, G. 2001. Global virtual teams. *Association for Computing Machinery. Communications of the ACM*, 44(12): 71.
- Eika, K. H., & Reistadbakk, T. 1998. The competitive environment in the banking industry - driving forces and trends. *Economic Bulletin*, 69(4): 368.
- Espinosa, J. A., Cummings, J. N., Wilson, J. M., & Pearce, B. M. 2003. Team boundary issues across multiple global firms. *Journal of Management Information Systems*, 19(4): 157.
- Fox, W. M. 1977. Limits to the Use of Consultative-Participative Management. *California Management Review*, 20(2): 17.
- Grabowski, M., & Roberts, K. H. 1999. Risk mitigation in virtual organizations. *Organization Science*, 10(6): 704.
- Griffith, T.L., Sawyer, J.E., & Neale, M.A. (2003). Virtualness and Knowledge in Teams: Managing the Love Triangle of Organizations, Individuals and Teams. *MIS Quarterly*, 27(3), 265-287).
- Handy, C. (1995). Trust and the virtual organization, *Harvard Business Review* 73(3), 40—50.
- Harborne, P., & John, A. 2003. Creating a project climate for successful product innovation. *European Journal of Innovation Management*, 6(2): 118.
- Hedlund, G., & Ridderstrale, J. 1995. International development projects: Key to competitiveness, impossible, or mismanaged? *International Studies of Management & Organization*, 25(1,2): 158.
- Igbaria, M. (1999). The driving forces in the virtual society. *Association for Computing Machinery. Communications of the ACM*, 42, 64-70.
- Jarvenpaa, S.L., Leidner, D.E. (1999). Communication and trust in global virtual teams *Organization Science*. 10, 791-815.
- Jensen, D. B. 1993. Interpretation of group behavior. *Nursing Management*, 24(3): 49.
- Kezsbom, D.S., (1999). Creating teamwork in virtual teams. *ACE International Transactions*: 1-4.
- Kirkman, B. L., Rosen, B., Gibson, C. B., Tesluk, P. E., & McPherson, S. O. 2002. Five challenges to virtual team success: Lessons from Sabre, Inc. *The Academy of Management Executive*, 16(3): 67.
- Kirkman, B., Rosen, B., Tesluk, P. & Gibson, C. (2004). The impact of team empowerment on virtual team performance: The moderating role of face-to-face interaction. *Academy of Management Journal*, 47, 175-192.
- Klagge, J. 1997. Leadership development needs of today's organizational managers. *Leadership & Organization Development Journal*, 18(7): 355.
- Knight, D. & McCabe, D. (2003). Governing through teamwork: Reconstituting subjectivity in a call centre. *Journal of Management Studies*, 40(7), 1587-1619.
- Kock, N. (2004). The Psychobiological Model: Towards a New Theory of Computer-Mediated Communication Based on Darwinian Evolution, *Organization Science*, 15, 3327–348.
- Krackhardt, D., Kilduff, M. (1999). Whether close or far: Social distance effects of perceived balance in friendship networks. *Journal of Personality and Social Psychology*, 76, 770-772.
- Latane, B. 1996. Dynamic social impact: The creation of culture by communication. *Journal of Communication*, 46(4): 13.
- Loehlin, J. C. (1992). *Latent variable models: An introduction to factor, path, and structural analysis*. Hillsdale, NJ: Lawrence Erlbaum. Second edition.
- Loo, R. 1996. Training in project management: a powerful tool for improving individual and team performance. *Team Performance Management*, 2(3): 6.
- Lurey, J. & Raisinghani, M. (2001). An empirical study of best practices in virtual teams. *Information & Management*, 38, 523-530.
- Lynn, G. & Reilly, Richard, 2002. How to Build a Blockbuster. *Harvard Business Review*, 80(10), 18-19.
- Lynn, G., Reilly, R., Akgun, A. (2000). Knowledge management in new product teams: practices and outcomes (2000). *IEEE Transactions on Engineering Management*, 47, 221-231 (with G. Lynn, A. Akgun).
- Massey, A. P., Montoya-Weiss, M., Hung, C., & Ramesh, V. 2001. Cultural perceptions of task-technology fit. *Association for Computing Machinery. Communications of the ACM*, 44(12): 83.
- Mayer, R., Davis, J., Schoorman, F. (1995). An integrative model of organizational trust. *Academy of Management Review*, 20, 709-734.
- Maznevski, M. L., & Chudoba, K. M. 2000. Bridging space over time: Global virtual team dynamics and effectiveness. *Organization Science*, 11(5): 473.
- McKnight, D., Cummings, L., Chervany, L. (1998). Initial trust formation in new organizational relationships *Academy of Management Review*, 23, 473-490.
- Mejias, R. J., Shepherd, M. M., Vogel, D. R., & Lazaneo, L. 1997. Consensus and perceived satisfaction levels: A cross-cultural comparison of GSS and non-GSS outcomes within and between the United States and Mexico. *Journal of Management Information Systems*, 13(3): 137.
- Milton, F. (2003). *Innovation Survey 52*: London, Price WaterHouse
- Montoya-Weiss, M., Massey, P., Song, M. (2001). "Getting it together: Temporal coordination and conflict management in global virtual teams", *Academy of Management*, 44(6), 1251-1262.

- Moody, J., & White, D. R. 2003. Structural cohesion and embeddedness: A hierarchical concept of social groups. *American Sociological Review*, 68(1): 103.
- O' Leary, M.B. and Cummings, J. (2005). The Spatial, Temporal, and Configurational Characteristics of Geographic Dispersion in Work Teams. Working Paper. *Presented at the 2005 Academy of Management Conference*.
- O Leary-Kelly, A. M., Martocchio, J. J., Frink, D. D. (1994). A review of the influence of group goals on group performance. 37, 1285-1301.
- Orlikowski, W. J., & Yates, J. 2002. It's about time: Temporal structuring in organizations. *Organization Science*, 13(6): 684.
- Pauleen, D. J. 2003. Lessons learned crossing boundaries in an ICT-supported distributed team. *Journal of Global Information Management*, 11(4): 1.
- Pearce, J. L., & Gregersen, H. B. (1991). Task interdependence and extrarole behavior: A test of the mediating effects of felt responsibility. *Journal of Applied Psychology*, 76, 838-844.
- Podsakoff, P.M. and Organ, D. (1986). Self-reporting in organizational research: Problems and prospects, *Journal of Management*, 12, 531-544.
- Podsakoff, Philip M.; Ahearn, Michael; MacKenzie, Scott B. (1997) Organizational citizenship behavior and the quantity and quality of work group performance. ; *Journal of Applied Psychology*, Vol 82(2), 262-270.
- Powell, A., Piccoli, G., & Ives, B. 2004. Virtual Teams: A Review of Current Literature and Directions for Future Research. *The DATA BASE for Advances in Information Systems*, 35(1).
- Pratt, M. G. 1998. *To be or not to be: Central questions in organizational identification*. Thousand Oaks, CA: Sage.
- Rousseau, D. M., Sitkin, S. B., Burt, R. S., & Camerer, C. 1998. Not so different after all: A cross-discipline view of trust. *Academy of Management. The Academy of Management Review*, 23(3): 393.
- Saavedra, R. Early, P. & Van Dyne, L. (1993). Complex interdependence in task-performing groups. *Journal of Applied Psychology*, 78, 61-72.
- Santos, J., Doz, Y., & Williamson, P. 2003. Is Your Innovation Process Global? *MIT Sloan Management Review*, 45(4): 31.
- Seo, M.G., Barrett, L.F., Bartunek, J.M. (2004). Affective experience in work motivation. *Academy of Management Review*, 2004, Vol. 29, No. 3, 423-439.
- Shamir, B. 1990. Calculations, values and identities: The sources of collectivistic work motivation. *Human Relations*, 43: 313-332.
- Shenkar, O. 2001. Cultural Distance Revisited: Towards a More Rigorous Conceptualization and Measurement of Cultural Differences. *Journal of International Business Studies*, 32(3): 519.
- Siegel, P. H. 2000. Using peer mentors during periods of uncertainty. *Leadership & Organization Development Journal*, 21(5): 243.
- Simons, T., Peterson, R. (2000). Task conflict and relationship conflict in top management teams: The pivotal role of intragroup trust. *Journal of Applied Psychology* 85, 102-111.
- Smith, M. E. 2002. What client employees say about consultants. *Leadership & Organization Development Journal*, 23(1/2): 93.
- Staples, D. S., Hulland, J. S., & Higgins, C. A. 1999. A self-efficacy theory explanation for the management of remote workers in virtual organizations. *Organization Science*, 10(6): 758.
- Stevens, J. (1996). *Applied multivariate statistics for the social sciences*. Hillsdale, NJ: Lawrence Erlbaum. 2d edition.
- Stevenson, I. M. M. a. W. B. 2001. Nationality, Cultural Distance, and Expatriate Status: Effects on the Managerial Network in a Multinational Enterprise. *Journal of International Business Studies*, 32(2): 285.
- Stough S., Eom, S. and Buckenmyer, J. (2000), "Virtual teaming: a strategy for moving your organization into the new millennium", *Industrial Management & Data Systems*, Vol. 100 No. 8, pp. 370-8.
- Tan, B. C. Y., Wei, K.-K., Watson, R. T., Clapper, D. L., & McLean, E. R. 1998. Computer-mediated communication and majority influence: Assessing the impact in an individualistic and a collectivistic culture. *Management Science*, 44(9): 1263.
- Tellioglu, H., & Wagner, I. 1999. Software cultures. *Association for Computing Machinery. Communications of the ACM*, 42(12): 71.
- Townsend, A.M.; deMarie, S.M.; and Hendrickson, A.R. (1998) "Virtual teams and the workplace of the future", *Academy of Management Executive*, 12, 3, 17-29.
- Watson-Manheim, M.B., Chudoba, K., Crowston, K. (2002). Discontinuities and Continuities: A New Way to Understand Virtual Work. *Information, Technology, and People*, 15 (3).
- White, S. P., & Wright, P. G. 2002. *New Ideas about New Ideas - Insights on Creativity from the World's Leading Innovators*. Cambridge, MA: Perseus Publishing.
- Williams, M. (1993). In whom we trust: Group membership as an effective context for trust development. *Academy of Management Review*, 26, 377-396.
- Yadong, L. (2002). Contract, cooperation, and performance in international joint ventures. *Strategic Management Journal*, 23, 903-919.
- Zaccaro, S.J., & Bader, P. (2002). E-Leadership and the challenges of leading e-teams: Minimizing the bad and maximizing the good. *Organizational Dynamics* 31(4), 377-387.
- Zigurs, I. (2002). Leadership in virtual teams: Oxymoron or opportunity. *Organizational Dynamics* 31(4), 339-351.