

Leading Virtual Teams: Hierarchical Leadership, Structural Supports, and Shared Team Leadership

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Using a field sample of 101 virtual teams, this research empirically evaluates the impact of traditional hierarchical leadership, structural supports, and shared team leadership on team performance. Building on Bell and Kozlowski's (2002) work, we expected structural supports and shared team leadership to be more, and hierarchical leadership to be less, strongly related to team performance when teams were more virtual in nature. As predicted, results from moderation analyses indicated that the extent to which teams were more virtual attenuated relations between hierarchical leadership and team performance but strengthened relations for structural supports and team performance. However, shared team leadership was significantly related to team performance regardless of the degree of virtuality. Results are discussed in terms of needed research extensions for understanding leadership processes in virtual teams and practical implications for leading virtual teams.

Keywords: team virtuality, virtual team leadership, structural supports, shared team leadership, team performance

Virtual teams work together over time and distance via electronic media to combine effort and achieve common goals (Bell & Kozlowski, 2002). Although surveys indicate that fewer than 50% of companies used virtual teams in 2000, by 2008 over 65% stated that their reliance on virtual teams would “mushroom” in the future. Moreover, among companies with over 10,000 employees, the use of virtual teams was projected to be 80% (I4cp, 2006, 2008). Concurrent with this growth in the use of virtual teams, the literature on virtual teams has been increasing (Cheshin, Rafaeli, & Bos, 2011; Hill, Bartol, Tesluk, & Langa, 2009; Majchrzak, Malhotra, Stamps, & Lipnack, 2004; Martins & Shalley, 2011; Mesmer-Magnus, DeChurch, Jimenez-Rodriguez, Wildman, & Shuffler, 2011; Peters & Karren, 2009; Sarker, Anjuja, Sarker, & Kirkeby, 2011; Shin, 2004).

Most research has focused on the advantages and disadvantages of virtual teams. Relative to face-to-face teams, benefits attributed to the use of virtual teams include the ability to compose a team of experts flung across space and time, increases in staffing flexibility to meet market demands, and cost savings from reduced travel (Kirkman, Gibson, & Kim, 2012; Kirkman & Malthieu, 2005; Stanko & Gibson, 2009). Disadvantages include lower levels of team cohesion, work satisfaction, trust, cooperative behavior, social control, and commitment to team goals; all factors that can negatively impact team performance.

In light of these concerns, it is surprising that relatively limited research attention has been directed toward virtual team leadership (Gibson & Gibbs, 2006; Kirkman et al., 2012; Martins, Gilson, & Maynard, 2004; O'Leary & Mortensen, 2010; Siebdrath, Hoegl, & Ernst, 2009). Team leadership is regarded as a key mechanism for minimizing motivation and coordination losses and maintaining team effectiveness when they are virtual (Bell & Kozlowski, 2002; Malhotra, Majchrzak, & Rosen, 2007; Martins et al., 2004; Zigurs, 2003). However, one particular concern is that traditional hierarchical leadership processes are expected to be disadvantaged in virtual teams because of the lack of face-to-face contact. Thus, some scholars have suggested that hierarchical leadership processes may need to be supplemented in virtual teams as a way to augment team effectiveness (Avolio, Kahai, & Dodge, 2000; Bell & Kozlowski, 2002). The purpose of this research is to investigate the impact of team leadership on team performance in teams that span degrees of virtuality. Although this perspective has been proposed in the theoretical literature, it has not been examined empirically. In particular, we examine the extent to which structural supports and shared team leadership supplement hierarchical leadership and the extent to which these relationships are moderated by the degree of virtuality.

Editor's Note. Eduardo Salas served as the action editor for this article.—S.W.J.K.

This article was published Online First December 3, 2012.

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The first author would like to acknowledge the German Research Foundation (Grant No. 1412/6-1, U. Konradt, PI) for funding that, in part, provided support during her doctoral dissertation research and Dr. Konradt for serving as Chair of her doctoral thesis committee. Nonetheless, any opinions, findings, and conclusions or recommendations expressed are those of the authors and do not necessarily reflect the views of the DFG.

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Theoretical Development

Leadership in Virtual Teams

There is consensus among scholars that virtual teams are more difficult to lead than face-to-face teams (Bell & Kozlowski, 2002; Duarte & Snyder, 2001; Gibson & Cohen, 2003; Hinds & Kiesler, 2002; Lipnack & Stamps, 2000). As a consequence of the lack of face-to-face contact and geographical dispersion, as well as the (often) asynchronous nature of communication, it is more difficult for team leaders to perform traditional hierarchical leadership behaviors such as motivating members and managing team dynamics (Avolio et al., 2000; Bell & Kozlowski, 2002; Purvanova & Bono, 2009). It has been argued that leader influence can be extended by having leadership augmented by new media (Avolio & Kahai, 2003; Avolio et al., 2000) and that team leaders simply have to learn how to use and apply those media properly. Findings from empirical research show that getting virtual teams to function equivalently to face-to-face teams requires virtual team leaders to invest much more time and effort (Purvanova & Bono, 2009), although showing more initiative, trying harder, and investing more time and energy might not always be feasible.

Some scholars suggest that leadership functions should be supplemented by providing structural supports (Bell & Kozlowski, 2002; Hinds & Kiesler, 2002; Kahai, Sosik, & Avolio, 2003). For example, structuring rewards to provide incentives for performance should result in higher motivation. Another suggested approach is to supplement leadership by distributing leadership to team members (Bell & Kozlowski, 2002). Sharing leadership with team members is based on the premise that leadership should not be the sole responsibility of a hierarchical leader, but should be collectively exercised by empowering and developing individual team members (Kirkman, Rosen, Tesluk, & Gibson, 2004).

Although this view of leadership challenges in virtual teams has consensus in the literature, it has not been subjected to empirical verification. With respect to improving team performance, it is important to understand the extent to which the influence of hierarchical leadership is attenuated (or not) as team virtuality increases. Moreover, if the influence of hierarchical leadership is diminished as is suspected, then the extent to which it can be supplemented by structural supports and shared team leadership (and, potentially, other supplements) becomes a critical target for theory and research extensions.

To examine these issues, our conceptual model treats hierarchical leadership, structural supports, and shared team leadership as inputs to team performance. The model is illustrated in Figure 1. The basic premise of our approach is that supplementing hierarchical leadership with shared leadership and structural supports will be more relevant when teams are more virtual in nature. Thus, the degree of team virtuality is predicted to moderate the relationships between hierarchical leadership, structural supports, and shared team leadership with team performance.

There are two notable aspects of the model. First, it is focused on the contribution of these input factors to team performance. The model does not focus on mediating processes at this stage of the research. The primary reason for this focused approach is to enable a clear evaluation of the moderating effects of virtuality on the contributions of hierarchical leadership, structural supports, and shared leadership to team performance. Second, the inputs are conceptual-

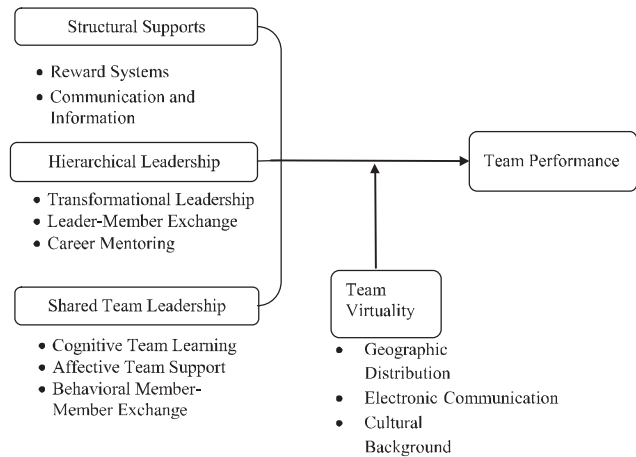


Figure 1. Effects of structural supports, hierarchical leadership, and shared team leadership in predicting team performance, moderated by team virtuality.

ized as distinct higher-order factors or construct composites, rather than unitary constructs. This allows each of the inputs to be conceptualized as a composite of established constructs. For example, hierarchical leadership is represented by transformational leadership, leader-member exchange, and supervisory mentoring. Each of these constructs, as core aspects of hierarchical leadership, is supported by a body of theory and empirical research with established measures. Using established constructs and measures of hierarchical leadership as input factors allows us to clearly assess the potential supplementary influence provided by structural supports and shared leadership. The same conceptual and measurement approach using established constructs and measures is applied to structural supports and shared leadership.

Team Virtuality

With the growth and evolution of virtual teams during the past decade, researchers have focused on the conceptualization and measurement of team virtuality (e.g., Bell & Kozlowski, 2002; Hinds, Liu, & Lyon, 2011; Kirkman & Malhotra, 2005). In early research, virtuality was treated as distinctly categorical; researchers applied a simple dichotomous characterization of virtual and face-to-face teams. More recently, however, scholars have asserted that this simple characterization glosses over a variety of nuanced dimensions that underlie a range of differences in the degree of *virtuality* (Gibson & Gibbs, 2006; Irwin & McClelland, 2003; Kirkman et al., 2012; MacCallum, Zhang, Preacher, & Rucker, 2002; Mesmer-Magnus et al., 2011). Whereas early conceptualizations focused exclusively on geographic distribution, subsequent conceptualizations added electronic communication and noted differences between the use of asynchronous and synchronous communications (e.g., Bell & Kozlowski, 2002). Empirical research, accordingly, refers to both the facets of geographic distribution (e.g., O'Leary & Cummings, 2007; O'Leary & Mortensen, 2010) as well as the relative amount of e-communication media usage (Griffith, Sawyer, & Neale, 2003; Kirkman et al., 2004; Mesmer-Magnus et al., 2011) as indicative of "team virtuality." This is now the established approach to conceptualizing virtuality.

However, virtual teams increasingly span national boundaries and differences in cultural background are becoming more important to consider as an aspect of virtuality (Hinds et al., 2011; Staples & Zhao, 2006; Tsui, Nifadkar, & Ou, 2007). Indeed, Hinds et al. (2011) criticized the lack of inclusion of national and cultural differences in conceptualizations of virtuality. As “organizations are increasingly compelled to establish a presence in multiple countries as a means of reducing labor costs, capturing specialized expertise, and understanding emerging markets . . . they often create conditions in which workers must collaborate across national boundaries” (Hinds et al., 2011, p. 136). Accordingly, researchers need to put the global back into “global work” by considering cultural differences.

Research is increasingly considering cultural differences as an important component of virtuality in globally dispersed teams (e.g., Chen, Kirkman, Kim, Farh, & Tangirala, 2010; Gibson & Gibbs, 2006; Tsui et al., 2007). Based on this evolving view of virtuality, our conceptualization comprises geographic distribution (e.g., O’Leary & Cummings, 2007), relative amount of e-communication media usage (e.g., Kirkman et al., 2004), and cultural diversity (e.g., Gibson & Gibbs, 2006; Hinds et al., 2011; Tsui et al., 2007) as an addition to the established components of team virtuality.

The Role of Hierarchical Leadership in Virtual Teams

Hierarchical leadership reflects formally designated leadership (Ensley, Hmieleski, & Pearce, 2006; Morgeson, DeRue, & Karam, 2010; Yukl, 2010). Two well-established leadership theories relevant to hierarchical leadership that have been widely supported in the empirical literature are transformational leadership and leader-member exchange (LMX). Both transformational leadership (Fuller, Patterson, Hester, & Stringer, 1996; Judge & Piccolo, 2004; Lowe, Kroeck, & Sivasubramaniam, 1996) and LMX (e.g., Gerstner & Day, 1997; Graen & Uhl-Bien, 1995) are strong predictors of individual and team performance. Moreover, transformational leadership and LMX are the most prevalent approaches used in research on virtual teams (e.g., Avolio et al., 2000; Hambley, O’Neill, & Kline, 2007; J. M. Howell & Hall-Merenda, 1999; J. M. Howell, Neufeld, & Avolio, 2005).

Although it has received less attention, we posit that supervisory career mentoring (e.g., Kram, 1985) is an important leadership technique in virtual teams. Supervisory career mentoring is related to career outcomes such as salary level, promotion rate, and job satisfaction, as well as to objective and subjective performance (Allen, Eby, Poteet, Lentz, & Lima, 2004; Chao, Walz, & Gardner, 1992; Scandura & Ragins, 1993; Whitely, Dougherty, & Dreher, 1991). Transformational leadership, LMX, and supervisory career mentoring are the three primary constructs that comprise hierarchical leadership in the model.

First, transformational leadership (e.g., Bass, 1985, 1998) has been found to enhance performance in a wide range of organizational settings (Fuller et al., 1996; Judge & Piccolo, 2004; Lowe et al., 1996). Transformational leader behaviors are aimed at inspiring follower motivation and stimulating them to stretch their capabilities and to go beyond typical performance (Judge & Piccolo, 2004). However, these forms of leader behavior have also been posited to have weaker relations for virtual teams (Hambley et al., 2007; J. M. Howell & Hall-Merenda, 1999; J. M. Howell et al., 2005). Interpretations of leader behavior as transformational

are likely facilitated by cues that are more difficult to transmit, detect, and interpret in a virtual work context.

Second, LMX also contributes to positive organizational outcomes (Gerstner & Day, 1997; Graen & Uhl-Bien, 1995). LMX is concerned with the nature and the quality of the dyadic relationship between the team leader and each member. It describes the nature of the leader-member relationship and, as such, is primarily developed through face-to-face contact (Gerstner & Day, 1997), although it can be maintained via forms of electronic communication such as e-mail and video-conferencing. LMX provides an alternative mechanism for leader influence (J. M. Howell & Hall-Merenda, 1999) since interpersonal relationships, once developed, might be less adversely affected by the lack of ongoing face-to-face contact in virtual teams, but may also be difficult to develop where the leader has little to no face-to-face contact with team members.

Third, Hamilton and Scandura (2003) highlighted e-mentoring as an important leadership function for managing virtual teams, since it is not restricted to face-to-face contact. Moreover, due to virtual interaction, demographic “cues” (e.g., age or gender) are less salient and less likely to influence protégé selection. Accordingly, decisions about who to mentor will be more likely based on performance criteria. Mentoring further aids in the development of strong personal relationships that help strengthen leader influence on the team member (Ostroff & Kozlowski, 1993). By increasing interaction among leaders and members, it can counteract the negative effects of limited face-to-face contact in virtual teams (Hamilton & Scandura, 2003).

Hypothesis 1: The positive relationship between hierarchical leadership (transformational leadership, LMX, and mentoring) and team performance decreases as team virtuality increases.

The Role of Structural Supports in Virtual Teams

Given that hierarchical leadership is assumed to be more difficult in virtual teams, it is then important to understand how hierarchical leadership can be supplemented when teams are more virtual in nature. Structural supports represent a form of indirect influence, where influence on the motivation and behavior of team members takes place via structural attributes (Bell & Kozlowski, 2002; Wunderer, 2002). Structural supports draw from the leadership substitutes approach (Kerr, 1977; Kerr & Jermier, 1978), which asserts that aspects of the organization and task structure can compensate, enhance, or neutralize the effects of leadership on employee behavior. While originally proposed as a moderating variable (J. P. Howell & Dorfman, 1981, 1986), empirical and meta-analytic studies have found strong support for main relationships of structural and compensating variables with team outcomes (Podsakoff, MacKenzie, & Bommer, 1996). Structural factors have been suggested by Bell and Kozlowski (2002) as a supplement for virtual team leadership, which is consistent with structural functions listed by other scholars who refer to managing information, resources, and material rewards (e.g., Fleishman et al., 1991).

In virtual teams, the stability and reduction of ambiguity provided by structural supports may compensate for the turbulence and unpredictability that characterizes virtual teamwork (Zaccaro & Bader, 2003; Zigurs, 2003). Bell and Kozlowski (2002) argued that because of the geographic dispersion of virtual teams, an

important function of leadership is to create structures and routines that substitute for direct leadership influence and regulate team behavior. Consistent with research that suggests structural supports have direct relationships with outcomes that supplement hierarchical leadership (Podsakoff et al., 1996), our model conceptualizes them as having a direct relationship rather than a moderating one.

Virtual team members usually work on virtual teams in addition to their line function and research has highlighted the importance of rewarding virtual team members for both aspects. Geographical dispersion can result in a lack of motivation to focus on virtual team responsibilities, makes monitoring of virtual team members difficult, and also creates higher levels of anonymity (Kiesler & Cummings, 2002; Wiesenfeld, Raghuram, & Garud, 1999). Further, reward systems need to be fair, such that individual employees perceive they are being rewarded according to their inputs (e.g., effort, time, performance, etc.) on their virtual team work (Colquitt, 2004; Dulebohn & Martocchio, 1998; Schminke, Cropanzano, & Rupp, 2002). Being rewarded in a fair and transparent way for the work performed on the virtual team will lead employees to put more efforts toward virtual teamwork.

Second, a major component of structural supports is the communication and information management systems used for virtual teams. Building and managing communication and information management systems that facilitate connectivity, remove perceptions of distance, and facilitate the organization and accessibility of information can reduce feelings of lack of trust, anonymity, deindividuation, and perceptions of low social control. In addition, virtual teamwork is typically white-collar, knowledge based, intellectual, and interdependent. The management of communication and information is central to cognitive tasks (Clampitt & Downs, 2004; Faraj & Sproull, 2000). Thus, a key aspect of performance in virtual teams is managing the “triangle” of factors: shared knowledge (in changing and flexible organization structure), via electronic communication systems, and with experts as primary collaborators (Griffith et al., 2003; Kanawattanachai & Yoo, 2007; Malhotra & Majchrzak, 2004). As a form of structural support, managing communication and information flow (Fleishman et al., 1991) include information infrastructure and quality of information received, as well as the transparency and adequacy of communication and information management. Communication and information management are posited to influence virtual team performance. We expect that team virtuality moderates the relationship between structural supports and team performance. Specifically,

Hypothesis 2: The positive relationship between structural supports (reward systems; communication and information) and team performance increases as team virtuality increases.

The Role of Shared Team Leadership in Virtual Teams

Shared team leadership describes a mutual influence process, characterized by collaborative decision-making and shared responsibility, whereby team members lead each other toward the achievement of goals (Day, Gronn, & Salas, 2004; Pearce & Conger, 2003). Shared team leadership is presumed to create stronger bonds among the team members; facilitate trust, cohesion, and commitment; and mitigate disadvantages of virtual teams

(Pearce & Conger, 2003). Thus, sharing leadership functions with team members provides a mechanism to supplement hierarchical leadership in virtual teams (Bell & Kozlowski, 2002; Pearce, Yoo, & Alavi, 2004; Tyran, Tyran, & Shepherd, 2003).

Scholars have argued that shared leadership is a more appropriate form of team leadership than hierarchical leadership represented by the solo leader (Brown & Gioia, 2002; Day et al., 2004; Yukl, 2010). Reasons for this include the notion that team member communication is less formal and less hierarchically based, and, therefore, team members can more easily overcome communication difficulties (Bell & Kozlowski, 2002; Pearce et al., 2004). In addition, work processes in virtual teams are characterized as cognitively loaded, highly interdependent, yet autonomous. Complex teamwork requires the use of self-managing teams (Bell & Kozlowski, 2002; Pearce, 2004; Pearce & Manz, 2005). Team self-management and empowerment, in this context, has been shown to enhance virtual team performance in a sample 35 sales and service virtual teams in a high-technology organization (Kirkman et al., 2004).

There is no “one best way” to measure shared leadership. The concept is in its infancy (Avolio, Jung, Murry, & Sivasubramaniam, 1996; Carson, Tesluk, & Marrone, 2007; Mayo, Meindl, & Pastor, 2003; Mehra, Smith, Dixon, & Robertson, 2006; Pearce & Conger, 2003), and, thus, a challenge facing researchers is determining how to measure shared team leadership. One primary approach has simply treated shared team leadership as analogous to hierarchical leadership, but conceptualized at the team level of analysis (e.g., Avolio et al., 1996; Bowers & Seashore, 1966; Pearce & Sims, 2002). This approach assesses shared leadership as collective concept in the form of traditional leadership behaviors (e.g., transformational leadership) that are performed by team members. Typically, a traditional leadership measure—like transformational leadership—is referenced to the team as a collective (reference shift model; Chan, 1998; e.g., “Our team engages in behaviors that help create a team vision”) to comprise shared team leadership.

However, consistent with other researchers (Carson et al., 2007; Mayo et al., 2003; Mehra et al., 2006), we do not conceptualize shared team leadership as parallel with hierarchical leadership. Team members do not need to necessarily perform the *same* kind of leadership behaviors as their supervisors (Künzle et al., 2010; Morgeson et al., 2010) in order to engage in shared leadership. Rather, shared leadership can be conceptualized as the extent to which team members behave in ways to prompt the team processes that underlie team performance. Team process researchers have distinguished cognitive, affective-motivational, and behavioral functions as keys to team effectiveness (Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006). Team leader effectiveness, as outlined in functional leadership (McGrath, 1962), is based on leaders addressing the cognitive, affective, and behavioral functioning of their teams (Zaccaro, Rittman, & Marks, 2001). These leadership functions can be performed through informal leadership mechanisms (Morgeson et al., 2010) such as shared team leadership.

In capturing shared leadership in virtual teams, affective-motivational functions can be represented in terms of perceived team support, which is related to building trust and team cohesion (Kasper-Fuehrer & Ashkanasy, 2001) and may compensate for specific gaps resulting from the lack of face-to-face meetings in virtual teams, that is, lack of trust, and higher levels of anonymity (Jarvenpaa, 2004; Jarvenpaa & Leidner, 1999). Cognitive func-

tioning can be represented in terms of team learning (Edmondson, 1999; Edmondson, Bohmer, & Pisano, 2001), which is highly relevant due to the cognitively loaded nature of work in virtual teams. For behavioral processes, member–member exchange quality (Sherony & Green, 2002), which reflects the application of traditional leader–member exchange (Gerstner & Day, 1997; Graen, 1976; Graen & Uhl-Bien, 1995; Seers, 1989) to lateral coworker exchange (i.e., among peers), is expected to be important (Baltes, Dickson, Sherman, Bauer, & LaGanke, 2002; Hollingshead & McGrath, 1995). We expect that shared team leadership will provide a means to compensate for the gaps and disadvantages in virtual teams such that it will be more strongly related to team performance with increasing levels of virtuality. Specifically,

Hypothesis 3: The positive relationship between shared team leadership (cognitive, affective, and behavioral leadership) and team performance increases as team virtuality increases.

Method

Sample

Study participants were comprised of 565 team members and team leaders on 101 research and development (R & D) teams from global manufacturing industries. Human resource leaders in several companies were contacted. A number agreed on company participation in the study and facilitated data collection in exchange for technical report feedback and personal debriefing on the teams. The teams were similar in that all participants worked on R & D projects that involved knowledge-based, interdependent group tasks. All teams worked under some degree of virtuality. That is, they worked across geographic distance, across different time zones, with employees from different cultural backgrounds, and primarily used electronic communication media for their work. However, the degree of virtuality among the teams varied. While some of them worked primarily face-to-face and to a limited degree virtually, others ranged widely in the degree to which they operated virtually. All of the teams primarily used electronic communication media for their work, although some teams were distributed across up to seven sites per team, whereas others primarily worked at one site. Team members on virtual teams worked on average 359.20 miles away from each other, and 12% of the virtual team members worked alone at one site.

Teams consisted of an average of five members ($SD = 2.94$, range = 3–13). The average tenure of team members was 4.18 years ($SD = 4.96$), and the average tenure of the leaders was 4.23 years ($SD = 4.97$). The average age of the team members was 37 years ($SD = 6.17$, range = 19–61 years). Team members averaged working on five projects at the same time ($M = 4.86$, $SD = 18.51$). Since they were developing products together, their work was interdependent. Therefore, task interdependence was measured as a control. Teams consisted of 77.1% male employees. Average team leader age was 41 years ($SD = 8.42$, range = 25–61 years), and 89.1% of the team leaders were male.

Measures

Scales. All constructs in the model center on the team as the focal unit of theory. Accordingly, all measures were specified at

the team level (i.e., team referents using a reference shift model of composition; Chan, 1998). Furthermore, all items were framed with respect to virtual team performance. The introduction of every page of the questionnaire stated: “Please respond to all items *with regard to your work on your virtual team* and not your regular line function,” or “please respond to all of the following items *with respect to your work on your virtual team.*” Team members rated leadership and team composition. Team leaders rated the team’s performance. All of those items were measured using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Hierarchical leadership was assessed using three indicators rated by team members. *Transformational leadership* was measured with the Multifactor Leadership Questionnaire (MLQ) 5X (Avolio & Bass, 2004). Twenty items were used to measure transformational leadership with its five subscales of attributed and behavioral idealized influence, intellectual stimulation, inspirational communication, and individual consideration. A sample item for inspirational communication was “My team leader talks optimistically about the future.” Cronbach’s α was .92. *Leader–member exchange (LMX)* was measured using a scale developed by Graen, Novak, and Sommerkamp (1982; Wayne, Shore, & Liden, 1997). A sample item was “My supervisor understands my problems and needs.” Cronbach’s α was .89. *Supervisor career mentoring* was measured by a validated scale (Blickle & Boujataoui, 2005; Noe, 1988) based on the career support scale by Riley and Wrench (1985) that assessed three dimensions: career support, socio-emotional support, and role model. A sample item is “My supervisor assigns tasks to me that foster the direct contact with important supervisors.” Cronbach’s α was .89.

Structural supports were measured by (1) reward management and (2) information and communication management, with one or two subscales each. *Reward management* was measured using a scale to assess the quality of reward systems and a scale for fairness of reward systems. First, *organizational reward management* was measured using five items from Podsakoff and MacKenzie (1994). A sample item was “My performance appraisal system is very motivating.” Cronbach’s α was .86. Second, a nine-item scale was used to measure the fairness, transparency, and accountability of *reward systems* based on Schminke et al. (2002). Specifically, items measured the three dimensions of performance evaluation, pay, and promotion systems with regard to the extent they were perceived as (a) fair, (b) accurate, and (c) transparent. Two sample items were “My performance appraisal systems is fair,” “. . . transparent,” and so forth. Cronbach’s α was .87.

Information and communication management comprised five items adapted from Clampitt and Downs (2004) assessing the *Information Quality*, or *Quality of Information Received*. A sample item was “Information that I receive is often unclear and not precise” (R). Cronbach’s α of this scale was .79. It also assessed the extent to which *Information Coordination Quality* with a scale adapted from Faraj and Sproull (2000). A sample item was: “There is seldom confusion about how to accomplish our task.” Cronbach’s α was .87.

Shared leadership was measured in terms of cognitive, affective, and behavioral dimensions (Kozlowski & Bell, 2003; Kozlowski & Ilgen, 2006; Zaccaro et al., 2001). Specifically, cognitive processes were measured with four items on *team learning* to assess the extent to which team members are active in obtaining feedback to improve their own performance. Here, a sample item

is “Our team actively searches our own performance for deficits.” Cronbach’s α was .92. Next, affective correlates were measured with five items on *perceived team support* (PTS), which had been developed on the basis of the perceived organizational support construct by Eisenberger, Huntington, Hutchison, and Sowa (1986) and previously used by Wayne et al. (1997; Bishop, Scott, & Burroughs, 2000). PTS measures the extent to which team members support each other. A sample item is “My team really cares about my well-being.” Cronbach’s α was .87. Finally, behavioral shared team leadership, in terms of *member–member exchange* (MMX) was measured with items that applied the leader–member exchange construct to the team consistent with Sherry and Green (2002). Specifically, following a referent shift approach (Chan, 1998), to measure MMX we referenced LMX-7 items (e.g., traditional measure of leader–member exchange; e.g., Gerstner & Day, 1997; Graen & Uhl-Bien, 1995) to the team. A sample item is “My team understands my problems and needs.” Cronbach’s α was .87.

Team performance was rated by team leaders on a scale based on Hoegl and colleagues (Gemuenden & Hoegl, 2001; Hoegl & Gemuenden, 2001). The team leader rated the team’s performance regarding the aspects of work quantity, quality, keeping within the project schedule, and keeping within the budget using a scale ranging from 0% to 100%. Cronbach’s α was .79.

Team virtuality. The degree of team virtuality was measured in terms of three indicators: geographic dispersion, electronic communication media usage, and cultural differences (Fiol & O’Connor, 2005; Gibson & Cohen, 2003; Gibson & Gibbs, 2006; Kirkman & Malthieu, 2005; Kirkman et al., 2004; Townsend, DeMarie, & Hendrickson, 1998). *Geographic dispersion* was assessed with a measure by O’Leary & Cummings (2007), which included seven indicators, such as distance in miles, number of sites per team, percentage of team members alone at one site, and others. The relative amount (frequency) of *electronic versus face-to-face communication* was measured with a scale based on Kacmar, Witt, Zivnuska, and Gully (2003) that included indicators of e-mail, chat, video and telephone conferencing, text and instant messaging, and face-to-face meetings that were rated with respect to frequency of use for communicating with colleagues and supervisors. Since we were interested in the relative frequency of electronic communication media use relative to total communication, we calculated a ratio of *relative communication frequency* by dividing the sum of the electronic communication media use by the sum of all communication (media and face-to-face communication). To account for *cultural differences*, we averaged the number of different nationalities per team. The number of nationalities per teams on average was 3.60 ($SD = 8.02$) nationalities per team.

The three scores of geographic distribution, electronic media usage, and cultural differences (nationalities per team) were subject to a z -transformation and were summed to form the team virtuality composite. Cronbach’s α was .77. The measure ranged from -3.80 to 16.17 , with $M = -0.32$, and $SD = 3.57$. Higher scores indicate increased virtuality.

Analyses

Hypothesis testing was conducted in a three-step procedure. First, we conducted confirmatory factor analyses (CFA; Arbuckle,

2003) on the individual level data to assess the fit of the measurement model for the input factors and for the virtuality moderator composite. We accounted for the two-level hierarchical structure of the inputs, with the construct measures specified to load onto their respective input variables. CFA also supported the two-level hierarchical structure of the virtuality moderator (i.e., geographical distance combined with e-communication, and culture sub-factors). Second, the main analyses were performed on group level data. Given the reduction in sample size, we used partial least squares structural equation modeling (PLS), a regression-based structural equation model (SEM) that is robust with regard to small samples (Chin, 2001; Ringle, Wende, & Will, 2006), which has been adopted by many team researchers (Jung & Sosik, 2002; Sambamurthy & Chin, 1994; Sosik, Avolio, & Kahai, 1997). Tests of significance in PLS were conducted using the bootstrap resampling procedure (Efron & Tibshirani, 1993). Third, we tested moderation effects by computing the interaction terms between team virtuality and the input variables using centered data following Aiken and West (1991).

Justification for aggregation. The theoretical focus of the virtual team leadership model is specified at the team level. Assessments of the input variables were obtained from individual team members using team referent items, which conforms to a referent shift composition model (Chan, 1998) for data aggregation. Thus, we examined restricted within-group variance for all variables prior to aggregation to the team level of analysis (Klein et al., 2000; Kozlowski & Klein, 2000). We calculated *ICC1*, which is an index of inter-rater reliability, and *ICC2*, which is an index of the stability of the aggregated mean for each measure (Bliese, 2000). On average, across measures, the *ICC1* was .45, and *ICC2* was .69 (following r -to- z conversion). Specifically, the *ICC1* and *ICC2*, respectively, were as follows: organizational reward management was .44 and .75, reward systems was .44 and .77, the quality of the information received was .46 and .67, the way the knowledge was coordinated was .46 and .76, transformational leadership was .43 and .81, LMX was .43 and .83, mentoring was .35 and .82, team learning was .43 and .80, perceived team support (PTS) was .44 and .83, and member–member exchange (MMX) was .39 and .83. Overall, the *ICC1* indices were substantial (Bliese, 2000), providing evidence to support aggregation, and the *ICC2* values indicated stability for the aggregated mean (Bliese, 2000).

Control variables. Since team age and gender composition correlated with several of the study variables, analyses were performed controlling for gender and age. We further controlled for task interdependence (three items, based on Van Der Veegt, Emans, & Van De Vliert, 2000; Cronbach’s $\alpha = .77$) and the number of projects an employee was working on (“How many projects are you working on at the same time?”). We entered all five variables as controls into the PLS model.

Results

Means, standard deviations, inter-correlations, and reliability coefficients of study variables are presented in Table 1.

Pre-Analyses

A CFA for the measurement model structure of the inputs was performed. In order to determine if all the scales loaded on a single

Table 1
Means, Standard Deviations, and Pearson Correlation Coefficients

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Age	37.22	6.16	—																
2. Gender ^a	1.33	0.35	.04	—															
3. Team size	5.36	2.97	-.10	-.12	—														
4. Nationalities/team	3.60	8.02	-.26 ^{***}	.03	.08	—													
5. Geographic dispersion	0.14	3.70	-.34 ^{***}	-.14	.05	.38 ^{***}	—												
6. Relative e-communication (Inv.)	3.59	1.30	.12	.07	-.02	-.34 ^{***}	-.33 ^{***}	—											
7. Reward systems	2.88	0.74	.02	.01	-.10	-.10	-.05	.20 [*]	—										
8. Extrinsic motivation	2.71	0.96	.07	.15	.10	.05	-.16	-.01	.86	—									
9. Information quality	2.42	0.58	.11	.01	-.02	-.21 ^{**}	-.11	.13	.35 ^{***}	-.13	—								
10. Coordination	3.60	0.71	.22 [†]	-.08	-.05	-.31 ^{***}	-.19	.06	.49 ^{***}	.06	.79	—							
11. Transformational	3.21	0.58	-.13	-.03	.10	-.16	.08	.23 [*]	.09	.21 [*]	.28 ^{***}	.92	—						
12. LMX	3.93	0.67	-.02	-.07	.13	-.18	-.01	.27 ^{***}	.39 ^{***}	.20 [*]	.32 ^{**}	.41 ^{***}	.72 ^{***}	—					
13. Mentoring	2.79	0.67	-.17	-.10	.12	.02	.22 [*]	.16	.41 ^{***}	.26 ^{***}	.11	.17	.68 ^{***}	.70 ^{***}	—				
14. PTS	3.14	0.52	.05	.03	.09	-.08	-.08	-.04	.01	.04	.03	.29 ^{**}	.32 ^{**}	.26 ^{**}	.89	—			
15. MMX	3.80	0.59	-.07	-.15	.10	-.10	-.06	.11	.22 [*]	.16	.24 [*]	.50 ^{**}	.39 ^{***}	.43 ^{***}	.26 ^{**}	.63 ^{***}	—		
16. Process feedback	3.20	0.76	-.06	-.06	-.02	-.01	.11	-.04	.23 [*]	.13	.11	.44 ^{***}	.31 ^{***}	.29 ^{**}	.27 ^{**}	.52 ^{**}	.50 ^{**}	—	
17. Team Performance ^b	89.45	9.41	-.05	.11	-.18	-.10	-.09	-.04	.09	.12	.19	.31 ^{***}	-.12	.13	-.09	.09	.18	.05	.79

Note. N = 101 teams. LMX = leader-member exchange; PTS = perceived team support; MMX = member-member exchange.
^a Gender: 1 = male; 2 = female. ^b Leader-rated variable.
^{*} p < .05. ^{**} p < .01.

factor (representing a lack of distinction among the input factors), we first tested a one-factor model. This did not fit the data well ($\chi^2/df = 2.68$, comparative fit index [CFI] = .89). Next, we computed a three-factor model, where hierarchical leadership, structural supports, and shared team leadership were specified as three separate constructs with all items loading on either hierarchical leadership, the structural supports, or the shared team leadership construct. This three-factor model had a better fit ($\chi^2/df = 1.53$, CFI = .96) and was a significant improvement compared to the one-factor model, $\Delta\chi^2(2) = 2,180.92$. Analyses were conducted using modification indices calculations (Buehner, 2004). We then examined a hierarchically structured three-factor model, where each item loaded first on their respective facet (i.e., transformational, LMX, mentoring, reward systems, extrinsic motivation, information quality, information coordination, process improvement, MMX, PTS). These 10 facets each formed the second-order, hierarchical constructs for hierarchical leadership, structural supports, or shared team leadership. The second-order constructs of hierarchical leadership, structural supports, and shared team leadership were allowed to intercorrelate. This second-order, hierarchical model provided a good fit to the data ($\chi^2/df = 1.18$, CFI = .99, root-mean-square error of approximation [RMSEA] = .02). Specifically, it demonstrated a better fit than the previously tested three-factor, non-hierarchical model, $\Delta\chi^2(10) = 1,300.94$, $p < .001$, and therefore provided the best fit for the theoretically expected factor structure. As a further indicator for the quality of the measurement model, in PLS, the AVE-score (Fornell & Larcker, 1981) was calculated. The AVE-score assesses the percentage of variance among the indicators caused by the latent variable in relation the measurement error. The AVE-score should exceed .5. In the model we tested, the total AVE-score was .85, which supports the quality of the measurement model. The measurement model findings provide support for our approach to use established constructs, validated measures, and composites to represent the conceptual structure for the inputs.

We next used CFA to evaluate the structure of the virtuality composite. Researchers have generally treated geographic distance and the use of electronic communication media as key components of virtuality (e.g., Gibson & Cohen, 2003; Griffith et al., 2003; Kirkman et al., 2004; Mesmer-Magnus et al., 2011; O'Leary & Cummings, 2007; O'Leary & Mortensen, 2010). With the rise of globalization, however, some theorists have made a conceptual case for incorporating cultural differences into the conceptualization of team virtuality (Hinds et al., 2011; Kirkman & Malthieu, 2005; Staples & Zhao, 2006; Tsui et al., 2007). Our composite conceptualization is consistent with this emerging perspective. Thus, we used CFA to evaluate the efficacy of this approach. We compared five models composed of the three virtuality components:

1. a one-factor structure (i.e., all items loading on one factor);
2. our composite—a one-factor hierarchical model with two sub-factors (i.e., electronic communication media combined with geographic dispersion; and nationality);
3. two separate factors (i.e., electronic media communication combined with geographic dispersion; and nationality);

4. a one-factor hierarchical model with three sub-factors (i.e., electronic communication media, geographic dispersion, and nationality) to represent separate contributions to a higher-order factor; and
5. three separate factors (i.e., electronic communication media, geographic dispersion, and nationality).

As shown in Table 2, results indicated that Model 2, the hierarchical one-factor model with two sub-factors (which reflected our composite conceptualization) provided the best fit to the data. Model 1, the one-factor model with no sub-factors, did not fit the data very well ($\chi^2/df = 1.91$, *goodness-of-fit index* [*GFI*] = .85, *CFI* = .93, *RMSEA* = .10). Fit for Model 2 ($\chi^2/df = 1.39$, *GFI* = .89, *CFI* = .97, *RMSEA* = .06) was good. Fit for Model 2 was significantly better than for Model 1, the one-factor model, $\Delta\chi^2(3) = 48.27, p < .001$, or for Model 3, the two-factor non-hierarchical model, $\Delta\chi^2(1) = 23.85, p < .001$. Model 2 also fit the data better than Model 5, the three-factor model, $\Delta\chi^2(14) = 29.58, p < .01$, which showed poor fit overall ($\chi^2/df = 1.85, GFI = .84, CFI = .93, RMSEA = .09$). Thus, there was good empirical support for our conceptualization and composite approach to capturing team virtuality.

Main Analyses: Inner Model Analyses

Next, we examined direct relationships via the inner (structural model analyses) from PLS with the three groups of predictor variables predicting team effectiveness on the team level data. The inner model analyses showed that both structural supports ($b = 0.88, p < .01$) and shared team leadership ($b = 1.80, p < .001$) predicted team performance, whereas hierarchical leadership did not ($b = 0.85, ns$). Those results are displayed in Table 3.

Moderation by Team Virtuality

Moderation analyses were conducted to determine whether the degree of team virtuality had a differential influence on the relationship between the inputs and team performance as predicted by the model. Centered data were used to compute the interaction terms between team virtuality and the three groups of predictor variables. When team virtuality was entered as a predictor, there was a marginally negative relationship with team performance ($b = -0.40, p < .10$), suggesting that with increasing levels of team virtuality teams performed less well.

Next, hierarchical leadership interacted with team virtuality in predicting team performance in a negative way ($b = -1.74, p < .01$). With regard to structural supports, there was no longer a

Table 3
Specifications of the Inner Model Path Coefficients of the Distributed Leadership Model

Predictor variables	Team performance (supervisor rating)		
	<i>b</i>	<i>SD</i>	<i>t</i>
Hierarchical leadership	0.85	0.13	0.67
Structural supports	0.88***	0.04	2.24
Shared team leadership	1.80***	0.04	2.23
Gender ^a	0.96***	0.03	3.89
Age	-1.33*	0.04	3.39
No. of projects	-3.01***	0.05	5.63
Task interdependence	0.96*	0.03	2.12
<i>R</i> ²	.18		

Note. *N* = 101 teams; Bootstrap 500: 2000.

^a Gender: 1 = male; 2 = female.

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

significant main relationship with team performance ($b = 0.55, ns$) when team virtuality was added, but structural supports interacted with virtuality in predicting team performance ($b = 2.77, p < .001$). Those results are displayed in Table 4.

As shown in Figures 2 and Figures 3, we graphed these relationships following Aiken and West (1991). Figure 1 shows that under high levels of virtuality hierarchical leadership was not related to team performance. Under low levels of virtuality, hierarchical leadership was significantly related to team performance. Figure 2 shows that structural supports were positively related to team performance under high levels of virtuality, but not under low virtuality. Hypotheses 1 and 2 were supported. Finally, for Hypothesis 3, team virtuality did not interact with shared leadership in predicting team performance (*ns*), whereas shared team leadership was still positively related to team performance ($b = 1.94, p < .001$). Hypothesis 3 was not supported; results are displayed in Table 4.

Discussion

Summary

This study examined the relationships between hierarchical leadership, structural supports, and shared team leadership with team performance, and the moderating effects of virtuality on these relationships. Our research approach, which assessed each of the inputs as construct composites, provided a measurement model

Table 2
Model Comparisons for Measurement of Virtuality

Model	χ^2/df	<i>GFI</i>	<i>CFI</i>	<i>RMSEA</i>
1. One-factor model (without sub-factors)	1.91	.85	.93	.10
2. One-factor model with two sub-factors (hierarchical two-factor model)	1.39	.89	.97	.06
3. Two-factor model (non-hierarchical)	1.66	.87	.95	.08
4. One-factor model with three sub-factors (hierarchical three-factor model)	1.85	.84	.93	.09
5. Three-factor model (non-hierarchical)	1.85	.84	.93	.09

Note. *N* = 101. *GFI* = goodness-of-fit index; *CFI* = comparative fit index; *RMSEA* = root-mean-square error of approximation.

Table 4
Moderation of Leadership Variables' Effects by Team Virtuality on Team Outcomes: Specification of Inner Model Path Coefficients of the Distributed Leadership Model

Predictor	Team performance (supervisor rating)		
	<i>b</i>	<i>SD</i>	<i>t</i>
Hierarchical leadership	-0.06	0.09	0.07
Hierarchical Leadership × Team Virtuality	-1.74**	0.07	2.32
Structural supports	0.55	0.05	0.75
Structural Supports × Team Virtuality	2.77***	0.06	4.34
Shared team leadership	1.94***	0.06	3.37
Shared Team Leadership × Team Virtuality	0.70	0.09	0.78
Team virtuality	-0.40†	0.07	0.89
Gender ^a	1.16***	0.03	3.21
Age	-1.59**	0.05	3.19
No. of projects	-3.01***	0.06	5.45
Task interdependence	0.39	0.04	0.89
<i>R</i> ²	.27		

Note. *N* = 101 teams; Bootstrap 500: 2,000 teams.

^a Gender: 1 = male; 2 = female.

† *p* < .10. ** *p* < .01. *** *p* < .001.

that exhibited a good fit to the data in our sample. With regard to direct relations, structural supports and shared leadership, but not hierarchical leadership, were positively associated with team performance. When testing for moderating effects, structural supports were more, and hierarchical leadership was less, strongly associated with team performance, the higher the level of team virtuality. The association between shared team leadership and team performance was not affected by the degree of virtuality.

Theoretical Implications

The conceptualization and measurement of team virtuality.

First, central to virtual team leadership is the need to examine the appropriate form of measurement to capture the multifaceted concept of team virtuality. This is a primary contribution of our research. The measure we developed incorporated the most recent theorizing regarding the underpinnings of the virtuality construct; it included geographic dispersion (O'Leary & Mortensen, 2010), the relative amount of face-to-face and electronic communication

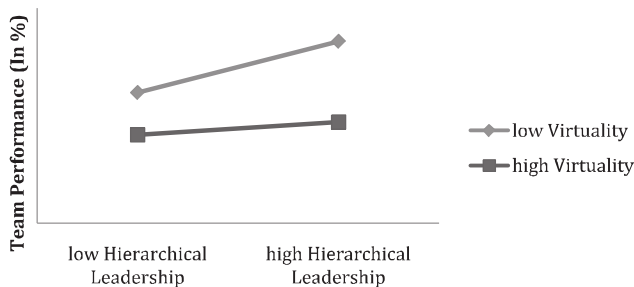


Figure 2. Interaction between hierarchical leadership and team virtuality predicting team performance.

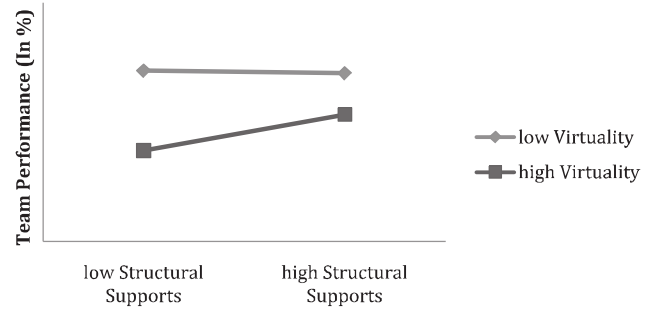


Figure 3. Interaction between structural supports and team virtuality predicting team performance.

media usage (Griffith et al., 2003; Kirkman et al., 2004), and cultural diversity (Hinds et al., 2011). With regard to cultural diversity, our work reflects recent theorizing in the literature that cultural differences add to virtuality (e.g., Chen et al., 2010; Hinds et al., 2011; Tsui et al., 2007).

Leadership in virtual teams. The main goal of the present research was to investigate hierarchical leadership in teams, the inhibitory impact of virtuality on hierarchical leadership, and the ability of structural supports and shared team leadership supplement it. Our findings showed that the influence of hierarchical leadership on team performance is weakened when teams are more virtual in nature. Thus, when teams are virtual, it is desirable to supplement the leader behaviors that are mitigated by distance, electronic media, and cultural differences. Following Bell and Kozlowski (2002), we examined the role of structural support mechanisms and shared team leadership as alternative inputs to team performance that could mitigate the loss of influence. Our findings show that hierarchical leadership had weaker relations, whereas structural supports were more strongly related, with team performance under increasing levels of team virtuality. Contrary to expectations, shared team leadership exhibited stable positive relations with team performance regardless of the degree of virtuality.

Limitations and Research Extensions

Theorists have speculated that the processes of hierarchical leadership are disadvantaged under conditions of virtuality, and that supplements by structural supports and shared team leadership can mitigate the loss of leadership influence (e.g., Bell & Kozlowski, 2002). Our approach to examining this speculation was deliberately focused; we examined these factors as inputs to independently rated team performance and treated them as construct composites. Although this allowed a parsimonious examination of the basic relationships of interest, it does not address the underlying process mechanisms by which hierarchical leadership is inhibited and structural supports provide supplements. Moreover, given that shared team leadership exhibited a consistent relationship with team performance regardless of the degree of virtuality, unpacking the mechanisms by which it manifests this broad influence is clearly in order.

There are some considerations that should be addressed in future research to extend these findings. First, with moderation of the

input factors to performance relationship by virtuality established, the next increment should turn attention to the mediating mechanisms that link the input factors with team performance. This will necessitate longitudinal research designs to appropriately capture the processes and minimize concerns about causal ambiguity. Second, although common source method variance is not an issue with respect to the relationship between the input factors and performance (which was rated independently), it will be desirable to distinguish inputs from mediating processes in future research. This may be accomplished by cross-splitting teams to examine relations between inputs and processes (e.g., Hofmann & Stetzer, 1996), although such designs necessitate large teams. With basic input-output-moderation relations established, mediating processes are obvious next steps for extension.

In addition, there are also issues surrounding the composite approach used to capture the degree of team virtuality—which has both advantages and disadvantages—that merit discussion. With respect to advantages, the composite—which combines the facets of geographical separation, use of electronic media, and cultural diversity—is consistent with the conceptual evolution of the concept of virtuality that has occurred over the last decade. Established conceptualizations of virtuality focus on geographical separation and the use of electronic media (Gibson & Cohen, 2003; Griffith et al., 2003; Kirkman et al., 2004; Mesmer-Magnus et al., 2011; O’Leary & Cummings, 2007; O’Leary & Mortensen, 2010). However, organizations have become increasingly multi-national, work teams are more frequently dispersed around the world, and technological interconnectivity continues to advance. By treating the facets as a composite, we captured a richer conceptualization of virtuality in a parsimonious fashion that was also empirically supported in our data.

This conceptualization and assessment, however, also introduces ambiguity with respect to the definition of virtuality and to the precise contribution of the distinct components. Each component is a unique characteristic, and it could be argued that their combination, while richer, is also less precise. Clearly, there is value in identifying the unique influences of the specific components of virtuality that we combined. Examining the effects of each component as a distinct moderator, in combination with the other components, however, will necessitate sampling that can achieve wide variance on each component and substantial sample sizes to allow robust evaluations. These sampling issues would be compounded as additional components of virtuality are proposed. This is desirable research extension, although we acknowledge that such data will be challenging to acquire.

Finally, generalization of research findings is always limited by the nature of the sample. Our teams were engaged in research and development activities and drawn from a diverse set of firms in the global automotive and automotive supplies industry. Clearly there is a need to replicate the findings in teams that work in other contexts, industries, and cultural settings.

Practical Implications and Future Research

There are three main practical implications. First, our data suggest that the influence of hierarchical leadership is mitigated in virtual teams, as it is less strongly related to team performance when teams are more virtual in nature. This finding suggests that providing virtual team leaders with appropriate support, orienta-

tion, and/or training could be potentially useful. They might also need more time and resources for leading their virtual team compared to leading their respective face-to-face team. Second, structural supports are more strongly related to team performance in more virtual teams. Thus, structural supports have the potential to be an effective management tool for augmenting hierarchical leadership and can be recommended to aid leaders managing virtual teams. Structural supports comprise fair and reliable reward systems, and transparent communication and information management. Based on our findings, structural supports should be implemented to augment hierarchical leaders in virtual teams. Third, although expected, shared leadership contributed to team performance regardless of the degree of virtuality. Therefore, shared leadership can be recommended for the management of all teams along the virtuality continuum.

Based on our findings, structural supports can be recommended for managing virtual teams and shared leadership can be recommended for managing teams in general. With regard to structural supports, future research should determine the extent to which leaders, or others in the organization, could influence perceptions of structural supports among virtual team members. For example, high structural supports might be less salient when there are restrictions in technology or resources, when reward systems do not reward team performance (or any performance!), or when there are low levels of organizational support. Another direction for future research is to more systematically investigate the boundary conditions of structural supports, as well as moderating variables that might influence the effectiveness of structural supports.

Shared team leadership enhanced team performance regardless of virtuality. This was unexpected, as the literature has viewed this supplement as more important under greater degrees of virtuality. This study extends prior literature with regard to the conception of shared leadership as a means to supplement team functions, as it captures the extent to which team members can collectively engage in cognitive, affective/motivational, and behavioral team leadership behaviors (Kozlowski & Bell, 2003).

Because the influence of shared leadership on team performance was not affected by degrees of virtuality, shared team leadership appears to have the potential to be a potent leadership approach. However, there is a lack of research focused on the antecedents of shared team leadership (e.g., Carson et al., 2007; Hoch, *in press*). This has implications for theoretical extension and practical application: the question of *how* to facilitate the emergence of shared leadership has not been addressed by prior research or this study (e.g., Pearce & Conger, 2003). Future research needs to identify antecedents, mediators, and moderators of shared team leadership, such as the impact of self-leadership and self-management (Manz, 1986; Neck & Houghton, 2006), group potency, group self-efficacy, and team cohesion (Bandura, 1997; Chen, Gully, & Eden, 2001; Guzzo & Shea, 1992) or team and task conditions on shared team leadership effects.

Conclusion

The nature of global competition and continuing advances in communication technologies means that virtual teams are an integral aspect of work structure worldwide. They challenge what we know and need to know about leading and managing teams. We hope that these findings help to advance additional research on the

role of leadership, and leadership supplements, for enhancing team performance across the range of team virtuality.

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Received August 27, 2011

Revision received July 9, 2012

Accepted July 18, 2012 ■