Oxford Handbooks Online

Leadership in Multiteam Systems: A Network Perspective

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The Oxford Handbook of Leadership and Organizations
Edited by David V. Day

Print Publication Date: May 2014 Subject: Psychology, Organizational Psychology
Online Publication Date: Jan 2014 DOI: 10.1093/oxfordhb/9780199755615.013.024

Abstract and Keywords

Multiteam systems (MTSs) are complex collective entities comprising two or more teams that share one or more common superordinate goal. In these systems, leadership is often the result of the joint actions of multiple members. In other words, MTS leadership is often a shared or collective phenomenon. The current chapter explains how the *form* of MTS leadership (e.g., vertical, shared) can be captured using network analytic techniques across multiple MTS *network foci* (e.g., within teams, between-teams, across the system). It extends this perspective to describe the application of specific ego-net and network indices to the evaluation of MTS leadership forms. Finally, it provides example prompts that could be used to elicit leadership *functions* and *goal foci* (e.g., leadership focused toward individual, team-level goals, or MTS-level goals) in MTS leadership networks, and it provides example research questions that stem from incorporation of network analytic techniques with the study of MTS leadership.

Keywords: collective leadership, multiteam systems, social network analysis

Leadership in Multiteam Systems: A Network Perspective

The scientific study of leadership has long recognized that the behavior of leaders can have extraordinary effects on collectives including teams, units, and organizations (Kaiser, Hogan, & Craig, 2008). Although much of the empirical research on leadership focuses on predicting outcomes that reside at the individual level of analysis (DeChurch, Hiller, Murase, Doty, & Salas, 2010), many of the situations in which leaders are potentially most pivotal require complex collective interactions (DeChurch et al., 2011;

Zaccaro, Rittman, & Marks, 2001). Hurricane disaster response, vaccine development, and provincial reconstruction are examples of goals that require collective effort, and thus require leaders who impact the orchestration of effort within the collective (Weick, 1993).

Three painful events in modern American history exemplify the inadequacies of current approaches to organizational leadership and mandate the need for a new era of leadership research: September 11, 2001, August 29, 2005, and April 20, 2010. Pre-9/11, intelligence-gathering teams working within the CIA and FBI failed to share the unique and critical information needed to understand fully the planned attacks. Post Katrina, emergency response teams failed to coordinate joint actions critical to saving lives and property. And post *Deepwater Horizon*, science teams working inside and outside of BP struggled to rapidly integrate ideas needed to produce a fast and innovative engineering solution to the gushing oil pouring into the Gulf of Mexico.

These events share three commonalities: (1) teams are the basic unit of effort (i.e., individuals are interdependent); (2) teams share a common fate with one (p. 483) another (i.e., teams are interdependent); and (3) the social forces that sustain and gel the team as a social unit may well simultaneously inhibit collaboration across team boundaries (e.g., Tajfel, 1982; Tajfel & Turner, 1985). The nature of the common-fate goals differed substantially across the three events: unique information sharing (9/11), effort synchronization (Katrina), and knowledge innovation (*Deepwater Horizon*). However, across all three of these catastrophic varietals, naturally occurring social dynamics prevented effective organization. A core scientific problem in need of solution is to understand how leadership can serve as an extraordinary force counteracting natural dysfunctional intergroup dynamics. We need to understand how leadership can orchestrate and sustain the effective networked organizational structures that are needed to tackle complex, high-impact societal problems. The urgent problems of today require complex virtually linked collectives that do not resemble singular cohesive task-performing teams. The current chapter considers the problem of leadership in these complex collectives, hereafter viewed through the lens of multiteam systems. The premise of this chapter is that major advancements in understanding the leadership of complex collectives will follow from a greater integration of network analytic concepts.

The chapter flows as follows. First, current theory and research on leadership in multiteam systems are reviewed. Second, a brief overview of the network perspective and the particular insights regarding leadership that have stemmed from this research are presented. Third, the chapter lays out a new framework for integrating MTS leadership and network analytic techniques, which we believe is critical for future knowledge advancement in this area.

Theory and Research on Multiteam Leadership

Practical Importance of Multiteam Systems

The past decade has witnessed an increase in attention to a new organizational form: the multiteam system (i.e., MTS; Mathieu, Marks, & Zaccaro, 2001). While Mathieu et al. were observing large military exercises with their lenses set on the "team setting" a notable pattern caught their attention. They observed conflict, breaks in cohesion, and communication problems. However, these problems were not located *within* the teams. Rather problems emerged *between* the component teams in the system. The challenges were interpersonal and coordinative, but they were not team problems (Mathieu et al., 2001).

Defining MTS

Broadly defined, MTSs are "tightly coupled constellations of teams" that contribute unique knowledge, skills, expertise, and functions in pursuit of the accomplishment of goals too large to be performed by a single team (DeChurch & Marks, 2006, p. 311). The increased reliance on MTSs has been fueled by globalization, digitization, and empowerment.

Ultimately the rise of MTSs has been an outgrowth of the move for organizations to become flatter and to organize work into teams. Teams allow organizations to draw quickly on the skills and expertise of multiple individuals to solve complex problems (Gully, 2000; Kozlowski & Bell, 2003). Because many important organizational tasks span the expertise of multiple teams, and are too large in scope to be tasked to a single team, teams often link up with other teams. Through carefully orchestrated coordination and collaboration, these complex collectives of teams can address large-scale organizational issues. Moreover, MTSs emerge often as one type of complex collective entity that allows for adaptive responses to environmental challenges (Davison, Hollenbeck, Barnes, Sleesman, & Ilgen, 2012; Zaccaro, Marks, & DeChurch, 2012).

We draw attention to the core characteristics of MTSs stemming from their initial formal definition as:

> Two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals. MTS

> boundaries are defined by virtue of the fact that all teams within the system, while pursuing different proximal goals, share at least one common distal goal; and in doing so exhibit input, process, and outcome interdependence with at least one other team in the system.
>
> (Mathieu et al., 2001, p. 289)

Accordingly, MTSs are larger than teams, but can be smaller than the organization(s) that they are embedded within (Mathieu, et al., 2001). In fact, MTSs often traverse organizations such that individuals embedded within the same MTS may hail from multiple organizations.
In recent years, MTS research has challenged organizational scholars to consider the inadvertent consequences of building strong teams in organizations. Although creating a system of strong teams maximizes goal attainment *within* each team individually, if the ultimate system-level goal requires synchronization across teams, then building better teams may not necessarily benefit these valued outcomes (Lanaj, Hollenbeck, Ilgen, Barnes, & Harmon, (p. 484) 2013). DeChurch and Zaccaro (2010) argue that social scientists attempting to solve the problem of how systems deal with time-sensitive multifaceted problems could benefit by focusing more attention on the macro-level dynamics that are central to the resolution of such issues. They contend that organizational scientists may have their "microscopes set at the wrong magnification" (DeChurch & Zaccaro, 2010, p. 329). Although there exists much research to date about the basic building blocks of successful systems (i.e., teams; Kozlowski & Ilgen, 2006) and about the strategic behaviors of leaders in the "upper echelons" of organizations (e.g., CEOs; Finkelstein & Hambrick, 1996), research is still needed regarding the unique requirements of *MTS* effectiveness.

For example, research is warranted that identifies the ways in which team processes and emergent states found to impact component team effectiveness (e.g., Kozlowski & Ilgen, 2006; Mayer, Davis, & Schoorman, 1995; McAllister, 1995) may emerge and impact effectiveness at the system level. The increased use of technology and virtual communication tools that allow geographically distributed teams to work together presents MTS researchers with new problems to solve with regard to methods of promoting and maintaining system-level effectiveness. New methodologies for systematic data collection in MTSs in the field need to be developed to address these new developments (DeVries, Walter, Van der Vegt, Essents, & Vogelaar, 2011).

Finally, more research is needed that identifies the aspects of leadership that enable MTS effectiveness. Leadership of MTSs is a unique challenge owing to the complexity inherent within these systems. MTS leadership must operate to direct the actions of component team members, while simultaneously facilitating the synchronization of distinct teams in the system (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005).

MTS Leadership Functions

Past work on leadership in MTSs took a functional view, directly extending functional team leadership to the MTS context. Functional leadership theory has been presented as especially appropriate for conceptualizing the role of a team leader. This theory addresses the leader's broad relationship to the team (Hackman & Walton, 1986; Lord, 1977) in that the core duty of the leader is "to do, or get done, whatever is not being adequately handled for group needs" (McGrath, 1962, p. 5). Functional leadership theory is consistent with the systems view of organizations (Katz & Kahn, 1978) as well as the input–process–output (I–P–O) team effectiveness model (McGrath, 1984), or the more recent input mediator output input (IMOI) model (Ilgen, Hollenbeck, Johnson, & Jundt, 2005), in that leadership *inputs* shape interaction processes, emergent states, and other types of mediators, which in turn shape system-level outcomes.

Kozlowski and colleagues further established functional leadership theory in the team context by suggesting that a team leader's role is to deliver inputs aligned with the teams' needs (Kozlowski, Gully, McHugh, Salas, & Cannon-Bowers, 1996). Team leaders are thought to develop effective teamwork throughout team development and team performance management cycles (Bell & Kozlowski, 2002). Moreover, the functional perspective views leadership as a *role* that facilitates team needs over time. The key role of a team leader is one of *problem solver*; involving behaviors that allow leaders to identify problems in the team, generate solutions, and implement those solutions within social domains (Fleishman et al., 1991).

Fleishman et al. (1991) organized the leader activities that are thought to impact effective problem identification, solution generation, and solution implementation into four superordinate dimensions of behavior: (1) information search and structuring; (2) information use in problem solving; (3) managing personnel resources; and (4) managing material resources. Information search and structuring involve a leader's systematic search for information within and outside of the team. Information use in problem solving refers to the leader's synthesis of acquired information and generation of solutions to identified problems. Thus, one major function of the team leader is to generate plans and communicate these plans to team members (Zaccaro et al., 2001). The final two superordinate dimensions—managing personnel resources and managing material resources, refer to activities that involve the implementation of plans and solutions. In particular, managing personnel resources in a team context involves motivating, coordinating, monitoring, and developing team members (Zaccaro et al., 2001). In sum, functional leadership theory would suggest there are three general types of leader activities that directly involve *interactions* between team leaders and other team members. Team leaders generate and communicate plans to team members, and monitor

team members as they carry out plans (i.e., *direction-setting activities*). Team leaders also coordinate the collective actions of multiple individuals toward team-level goals (i.e., *coordination activities*) (p. 485) and motivate and develop individual team members (i.e., *motivational activities*).

The view of team leaders through the functional leadership lens has, in recent years, been extended to the MTS context. A MTS leader typically is responsible for interpreting and defining MTS task requirements (Mathieu et al., 2001). MTS leadership, consistent with the functional leadership viewpoint, is conceptualized as including discretion and choice in the solutions applied to a given problem. For example, when requirements shift, as is the case in dynamically changing environments, and entrained team/MTS responses are no longer appropriate; MTS leaders must define or redefine new directions (e.g., vision, task requirements) for the system (Mathieu et al., 2001).

MTS Leadership Focus

Similar to the leadership of teams, key MTS leadership activities include setting directions for MTS members, coordinating collective endeavors, and ensuring motivation throughout the system. However, MTS effectiveness depends on accomplishment of proximal individual and team-level goals, and, in addition, on how well the MTS as a whole collectively coordinates and accomplishes distal goals shared by multiple teams in the system (Mathieu et al., 2001). This view of MTSs as defined by their multilevel goal hierarchy suggests that MTS leadership activities should be focused toward multiple goal levels (e.g., team, system). In other words, the direction setting, motivation, and coordination activities leaders engage in (e.g., DeChurch & Marks, 2006; Zaccaro et al., 2001) should be focused toward goals throughout the system—individual-level, team-level, and system-level goals.

Previous MTS leadership conceptualizations (DeChurch & Marks, 2006; Marks et al., 2005; Mathieu et al., 2001) have emphasized the importance of examining the influence of MTS leadership at multiple levels. Effective MTS leadership ensures that component team efforts throughout the system are aligned appropriately. Specifically, Marks et al. (2005) argued that effective MTS leadership must balance the management of component team actions while, at the same time, leadership must maintain cross-team interdependencies. DeChurch and Marks (2006) found that training manipulations focused on leader strategizing and coordinating between teams, enhanced functional MTS leadership behaviors, and interteam coordination and, in turn, enhanced MTS-level performance.

The concept of MTS leadership focused toward multiple levels was advanced further in a recent historiometric study that examined and classified critical incidents of leadership in emergency response MTSs (e.g., systems of disaster relief teams; DeChurch et al., 2011). Consistent with prior theorizing, these researchers were able to categorize many of the critical incidents as relating to leadership functions (e.g., strategizing and coordination) focused toward goal accomplishment within teams and throughout the system. However, many of the critical incidents referenced leader functions that occurred across the boundaries of the MTS with entities in the greater environment that do not share common goals with MTS component teams (DeChurch et al., 2011).

First, these findings reiterate the *multilevel* nature of MTS leadership focus. Second, they emphasize the inherent *embeddedness* of the MTS as a whole within the greater environment and the importance of the *relationships* that exist within teams, among the component teams, and with external individuals or groups outside of a MTS's boundaries. Furthermore, they highlight the importance of *boundary spanning* activities for MTS leadership. Team and MTS leaders are responsible for boundary activities, such as linking component teams within the MTS to one another or linking the MTS to its broader environment. As such, MTS leaders serve as the "liaison" (Zaccaro & Marks, 1998) between the component teams in the MTS and between the MTS and the outside environment by learning of developments and events occurring within and outside the MTS and then, by interpreting and defining these events.

In sum, MTS leadership functions to facilitate MTS effectiveness by providing direction and motivation for individuals, teams, and the system as a whole. Furthermore, MTS leadership serves to coordinate the collective actions of individuals within teams, component teams within the system, and the system with the external environment. As such, leadership functions are focused toward goal accomplishment across multiple levels of the MTS goal hierarchy.

MTS Leadership Forms

A third aspect of leadership in multiteam systems that moves toward a structural conceptualization is MTS leadership is *form*. Researchers have been careful to acknowledge that the leadership role is not always the sole responsibility of a "formal" leader. Rather, within teams, important leadership functions can (p. 486) be shared among multiple team members (e.g., Day, Gronn, & Salas, 2004; Hackman & Walton, 1986; McGrath, 1962; Morgeson, DeRue, & Karam, 2009). This shared or collective view of leadership is often contrasted with traditional "top-down" vertical perspectives (e.g., Pearce & Conger, 2003).

Vertical leadership refers to a hierarchical structure in which one or a few individuals are held accountable for the functioning of the group (Friedrich, Vessey, Schuelke, Ruark, & Mumford, 2009). In this form of leadership, an appointed leader "serves as the primary source of influence, wisdom, and guidance for team members" (Houghton, Neck, & Manz, 2003, p. 125). On the other hand, the shared or collective perspective views leadership as emerging throughout a group through the collective efforts of many individuals. Rather than viewing leadership as centered on formal leaders and their followers, the shared perspective contends leadership is the result of the joint actions of multiple individuals and it emerges through these interactions (Pearce & Conger, 2003).

In their theoretical conceptualization of possible MTS leadership forms, Zaccaro and DeChurch (2012) highlighted the notion that multiple members can enact MTS leadership functions, simultaneously, or over time. Specifically, these authors offered an initial description of possible leadership forms that may occur within MTSs (Zaccaro & DeChurch, 2012). These forms ranged from highly vertical to highly shared.

Zaccaro and DeChurch (2012) delineated two forms of vertical MTS leadership: fully centralized vertical leadership and multilevel vertical leadership. In *fully centralized vertical leadership* forms, all MTS members are subordinated to a single MTS leader. This formal leader is held accountable to stakeholders for all aspects of system functioning and performance. On the other hand, in many systems, subordinate leaders are also held accountable for key leadership responsibilities. In these *multilevel vertical leadership* forms, lower level leaders are subordinated to higher level leaders (Jaques, 1990, 1996).

Zaccaro and DeChurch (2012) described three general forms of *shared* MTS leadership: rotated, distributed, and simultaneously shared. *Rotated leadership* forms are those in which different members assume the leadership role across time (Carson, Tesluk, & Marrone, 2007; Erez, LePine, & Elmms, 2002). At any point in time, the leadership structure is primarily hierarchical, but the MTS member who is the "leader" changes (e.g., to fit task demands). Leadership in these rotated forms is be considered analogous to a "baton" that is be passed from person to person (Klein, Ziegert, Knight, & Xiao, 2006). Erez and colleagues (2002) argued that rotated leadership allows all team members to feel responsibility for the team's success. They also reported that such leadership increased the degree to which members offer suggestions for change in the team, and the overall level of cooperation within the team. However, rotated leadership may reduce continuity over time, and this form may not always be matched to team or task needs.

Distributed leadership refers to situations in which members of a collective take on different leadership functions at the same time. For example, groups might have a leader that manages internal dynamics (i.e., internal leaders), another that manages external

relationships (i.e., external leaders), and another that focuses on strategies for collective actions (i.e., executive coordinators; Zaccaro, Heinen, & Shuffler, 2009). The key advantage of this form of leadership is that it maximizes goal accomplishment by placing those individuals most suited for a given task in a position that allows optimal control over the task.

Finally, the most extreme form of shared leadership—*simultaneous shared leadership*—refers to those instances when all members of the collective are mutually engaged in leadership activities throughout all phases of a performance cycle (Mehra, Smith, Dixon, & Robertson, 2006). In such instances, "every person is a leader and a follower" in the same performance cycle (Mehra, et al., 2006, p. 235).

A Need for New Measurement Techniques for MTS Leadership Forms

The traditional approach to the study of leadership focused on the traits (e.g., Judge, Bono, Ilies, & Gerhardt, 2002; Stogdill, 1948), behaviors (Kerr, Schriesheim, Murphy, & Stogdill, 1974; Judge, Piccolo, & Illies, 2004), and/or relationships of formal leaders and followers (e.g., Bass, 1985; Burns, 1978; Dansereau, Graen, & Haga, 1975). This prior work has generated a considerable body of knowledge and many important insights into the nature of leadership. However, the commonly employed technique of investigating the traits, behaviors, and relationships of *one* (or a few) formal leader(s) does not provide a clear picture of the way in which leadership can be distributed among many individuals within a team or across a system. Specifically, these prior methods do not capture the various leadership *forms* that can emerge in MTSs. **(p. 487)**

Because of the characteristics that often describe MTSs (e.g., large size, functional diversity, geographic distribution, distributed power) MTS leadership is quite often the role of multiple individuals (Zaccaro & DeChurch, 2012). As such, researchers should employ methods of analysis that fully capture the way that leadership is distributed in the study of MTS leadership. We argue that social network analysis (SNA) techniques (Wasserman & Faust, 1994) hold particular promise for the evaluation of leadership distribution (Bavelas, 1950; Carson et al., 2007; Mehra et al., 2006). In the reminder of this chapter, we advance a framework to study MTS leadership from a network perspective.

Network Leadership Theory

Social Networks

Organizational systems can be viewed as social networks. A social network is a set of nodes or actors (i.e., people) joined together through a variety of relationships (i.e., ties; Tichy, Tushman, & Fombrun, 1979). These relationships affect and are affected by system-level outcomes. Typically studied relationships in network research include communication, affect, workflow, advice, and friendship (Brass & Krackhardt, 1999). For example, actors in a network could be asked to respond to prompts such as “Whom do you communicate with?” or “Who do you consider an important source of advice?” Existing ties between actors are typically captured using one of two key survey formats—full network methods (i.e., sociometric measures) or snowball methods (Hanneman & Riddle, 2005). Full network methods require that each actor in the network respond about each other actor. In other words, this method takes a census of ties in a population of actors. Snowball methods, on the other hand, begin by targeting an initial focal group of actors. These focal actors are asked to generate a list of some or all of their ties (e.g., all of the people they communicate with on a regular basis). These new actors are then identified and surveyed. Researchers continue this process until no new actors are identified. To survey the relationships within a MTS, the more appropriate of these two methods is to use the full network or *sociometric* approach to measurement. Because the MTS boundary is likely to be defined, researchers should be able to identify and survey each actor within the system without using the snowball method.

Leadership in Social Networks

In their theory of network leadership, Balkundi and Kilduff (2006) draw from social network theory (e.g., Kilduff & Tsai, 2003), the acknowledgment that cognition is important to leadership effectiveness (e.g., the cognitive revolution; Lord & Emrich, 2001) and research extending the LMX perspective (e.g., Graen & Uhl-Bien, 1995; Liden, Sparrowe, & Wayne, 1997) to assert that leadership is the *social capital* that collects around certain individuals and groups of individuals in a social structure (Balkundi & Kilduff, 2006). Leadership in networks begins with the cognitions of the actors (e.g., leaders) themselves, and then these cognitions lead to dynamic interactions between the organizational and interorganizational (external) networks. In other words, leadership enables and is enabled by network structure.

Balkundi and Kilduff (2006) illustrate how four key network principles—(1) relations between actors, (2) embeddedness, (3) social capital, and (4) structural patterning—are fundamental to the study of leadership in networks. The success of leadership is thought to derive from the relational patterns or ties between actors within and outside of the system. Moreover, network analysis allows researchers to assess the patterns of ties that exist between individuals and how such patterns impact leadership.

Relations between Actors

Just as leadership is a relational concept, a key emphasis in social network theory is on the *relations between actors.* The specific content of the relations between actors in the network has implications for leadership. The occupancy of a central position (i.e., centrality; Wasserman & Faust, 1994) in a network of positive relationships (e.g., communication, friendship) can lead to beneficial outcomes for a leader. For example, centrality in an organization's advice or friendship network (i.e., those networks reflecting who people turn to for advice/friendship) has been shown to lead to leadership-relevant outcomes including influence, access to information, and positive performance ratings (Baldwin, Bedell, & Johnson, 1997; Brass, 1984). On the other hand, centrality in a network of negative relationships such as adversarial networks (i.e., those networks reflecting who others in the network find it difficult to interact with) is related to negative outcomes such as feelings of discomfort and dissatisfaction within the organization (Baldwin et al., 1997; Sparrowe, Liden, Wayne, & Kraimer, 2001).

Embedded Relationships

Another key focus of network theory is the realization that relationships within a system are (p. 488) not random. Rather, they are inherently *embedded* within the system as a whole. People are embedded in their own networks of existing interpersonal relationships. They tend to enter more frequently into exchange relationships with those who are already closer to them (e.g., family, friends, or close acquaintances) as opposed to individuals whom they have less direct contact with (Balkundi & Kilduff, 2006).

In their examination of the relationship between network structure and team effectiveness, Balkundi and Harrison (2006) emphasized the importance of considering both a team's internal environment as well the greater environment that they are embedded within. These researchers found the density (i.e., the ratio of observed relationships divided by possible relationships in the network; Wasserman & Faust, 1994) of advice and friendship ties within teams as well as the centrality of team leaders within internal team advice and friendship networks is positively predictive of team performance. Furthermore, the centrality of the *team* within the greater environment (i.e., the intergroup network) is positively associated with team performance (Balkundi & Harrison, 2006).

Social Capital

Network theory emphasizes the idea that network connections represent *social capital* with inherent *value* (e.g., social support, monetary value, access to resources; Balkundi & Kilduff, 2006; Burt, 1997). For example, a friendship link to a prominent organizational member relates to an increase in an individual's performance reputation (Kilduff & Krackhardt, 1994). Close relationships with influential individuals, in or outside of the system, who have access to resources necessary to system functioning, might be beneficial to leader effectiveness (e.g., Brass, 1984; Galbraith, 1973). However, relationships take time and effort to develop and maintain. Certain relationships are more valuable to leadership effectiveness than others. Relationships that are draining and/or time consuming, but do not offer needed resources (e.g., social support, advice, etc.) may be detrimental.

Social capital relates to important organizational activities, such as exchanges and collaborations between units (Adler & Kwon, 2002). Thus, Bilhuber Galli and Müller-Stewens (2012) argue that leadership development should combine traditional individual-level "human capital" approaches with systematic development of optimal levels (dependent on context) of social capital. Specifically, they suggest that complementing the development of individual-level competencies with experiences leading to social capital development can lead to greater impact at the organizational level (Bilhuber Galli & Müller-Stewens, 2012).

Not only is social capital vital to individual effectiveness, but it is also relevant for group performance. At the team level, Oh, Chung, and Labianca (2004) found that optimal *configurations* of members' relations (i.e., social capital) within and outside of the team can maximize group-level effectiveness. For instance, access to heterogeneous knowledge through relationships with external individuals who possess different functional expertise may yield information necessary to effective team innovation (Hansen, 1999; Rodan & Galunic, 2004).

Structural Patterning

A final key principle of social network research is the emphasis on structural patterning (Balkundi & Kilduff, 2006). Structural patterning refers to the patterns of connections (or lack thereof) that exist within a system. In combination with the other key network principles, structural patterning has significant implications for leadership. Balkundi and Kilduff (2006) argue that one cannot conceptualize leadership in a network without examining the specific social-structural position occupied by the person or persons enacting leadership.

Leadership as a Network

The notion that the structural patterning of relationships is central to the study of leadership can be further extended to the study of shared or collective leadership by conceptualizing the system as a network of *leadership relationships*. Whereas the patterning of ties such as communication, friendship, or advice may impact the degree to which leaders can function effectively in a system, the patterning of leadership ties can yield important information about the way in which leadership is *distributed* in the system. Rather than viewing leadership as impacted by a network of relationships (e.g., friendship ties) the leadership phenomena, itself, can be considered a network. Rather than asking organizational members: "Whom do you communicate with?" researchers can elicit leadership networks by asking: "Whom do you rely on for leadership?" Evaluation of leadership networks elicited in this manner can enable identification of leadership forms in teams and multiteam systems.

The study of leadership networks dates back over 50 years (Bavelas, 1950; Stogdill, 1948; Shaw, 1964). For example, Bavelas (1950) found that (p. 489) manipulating team members' ability to pass information to one another influenced members' perceptions of how leadership was distributed in the team. In recent years, empirical studies examining shared leadership in teams have begun to adopt the leadership network approach (e.g., Carson et al., 2007; Mehra et al., 2006). Whereas aggregating team members' perceptions regarding the degree of shared leadership within the team does not provide precise information about how or where collective leadership emerges and functions, evaluating leadership as a network of ties provides a viable alternative to this practice.

Carson and colleagues (2007) conceptualized shared leadership in teams as the density of the team's leadership network. In a leadership network, density is defined as the number of observed leadership ties divided by the number of leadership ties that could exist. For example, in a five-person team, if every person views and is viewed by every other person as enacting leadership, there are 20 possible leadership connections in the team. If only one person is viewed as the leader, then there are 4 out of 20 leadership ties. Thus, pure vertical leadership (i.e., one hierarchical leader) would have a density score of 0.20. The absence of leadership in the team would correspond to a density of 0. The purest case of collective leadership, in which all five members are seen and see all other teammates as leading the team, would correspond to a density of 1.0. Carson et al. (2007) found that shared leadership, defined as the density of leadership ties, was predictive of consultant team performance as rated by external clients.

Mehra and colleagues (2006) also compared vertical to shared leadership by examining leadership network structures. However, rather than calculating density scores, this

study categorized team leadership structures visually into one of four categories: leader centered, distributed, distributed-coordinated, and distributed-fragmented. The structures these authors termed “leader-centered” refer to a strict vertical form of leadership with only one leader, whereas the structures referred to as “distributed” were those where leadership was shared by all members of the team. The distributed-coordinated structure referred to a leadership form in which leadership was distributed among more than one team member (but not all members) and those “leaders” relied on one another for leadership. The distributed-fragmented structure was a leadership form in which leadership was distributed among more than one team member but those leaders did *not* rely on one another for leadership. Interestingly, Mehra et al. (2006) did not find support for the notion that distributed leadership in teams is superior in terms of generating more effective performance as compared to vertical structures. However, the comparison among the three types of distributed leadership structures (i.e., all members sharing, a few connected leaders, a few disconnected leaders) revealed that the most effective structure of these three is one in which leadership is distributed among a few members who are connected to one another through leadership ties. Moreover, this study revealed that coupling in the leadership network (i.e., sharing in leadership) might be more relevant to team performance at certain network locations than others.

MTS Leadership as Leadership Networks

For leadership of MTSs, viewing the leadership network as a strict continuum ranging from highly vertical (low density) to highly shared (high density) may miss important information concerning the multilevel nature of MTS leadership. There are numerous leadership structures possible within a MTS context. In fact, leadership could be highly shared or highly vertical within component teams, but demonstrate a different structure across the system as a whole. For example, members of each component teams may share in leadership functions within their respective teams, while one group of individuals in the system serves as the “leadership team” enacting a more vertical leadership structure across the system as a whole (Zaccaro & DeChurch, 2012). In alignment with the findings of Mehra et al. (2006), MTS leadership forms that display some combination of shared and vertical leadership may be more effective for aligning the efforts of multiple teams as compared to simultaneously shared leadership. SNA allows researchers to identify and differentiate among relationships that exist within subgroups in a network and across the network as a whole. Therefore, SNA is a particularly appropriate method of illustrating the leadership structures that exist within MTS component teams and across the entire MTS. In the remainder of this section, we first explain how indices that describe the position a MTS member occupies within the leadership structure (i.e., ego-net indices)

and those that describe the relationships of two or more actors in the network (i.e., network indices) can be calculated within teams and across the MTS. These indices can provide a comprehensive method of illustrating MTS leadership forms across multiple locations in the network (i.e., network foci). Next, we describe how (p. 490) sociometric prompts can be worded to elicit leadership networks that describe specific leadership functions (e.g., direction setting, coordination, motivation) and goal foci (e.g., individual-level goals, component team goals, MTS-level goals). Such sociometric prompts could allow for better integration of psychosocial leadership research with network analytic techniques. Finally we provide exemplar research questions that stem from the leadership network approach to MTS leadership.

Network Indices for MTS Leadership Forms and Network Foci

Social network indices allow researchers to evaluate network structure at multiple levels of analysis. First, there are a variety of indices that capture the nature of an *individual's* relationship with the network (i.e., ego-net indices). These individual-level indices evaluate the structure of an individual's ego-net (his or her personal network; Wasserman & Faust, 1994). Using ego-net indices, researchers can assess the role that specific individuals play in the MTS leadership structure. Second, there are many indices that assess the structure of relations that exist among *multiple* actors. Indices that evaluate relationships between dyads, triads, and groups can provide a thorough description of the network structure of leadership. Each of these indices can be calculated within teams and across the system as a whole to provide a full description of the structure of MTS leadership across network foci. Table 22.1 lists example network indices that evaluate an individual actor's relationship with the network (i.e., ego-net indices), and those that evaluate the relationship structures of dyads, triads, and groups. In addition, Table 22.1 lists example insights from past research applicable to the study of leadership.

Table 22.1. Exemplars of Ego-Net and Network Indices and Insights for Leadership Ego-net Relationships

Centrality	Degree: Number of ties connected to a node Betweenness: Connecting two unconnected nodes Closeness: Proximity of a node to another node Eigenvector: Measure of the importance of a node in a network	Centrality in informal communication networks related to promotion (Brass, 1984).
		Centrality within advice and friendship networks leads to influence, access to information, positive performance ratings, pay raises (Baldwin et al., 1997; Brass, 1984). The degree to which teams are central in the interteam network within which they are embedded is positively related to team performance (Balkundi & Harrison, 2006).
		Followers attribute charisma to those leaders who are socially active in terms of giving and receiving advice (i.e., those who are central in influence/advice networks; Balkundi, Kilduff, & Harrison, 2011).
Brokerage	Degree to which an actor in the network bridges structural holes (i.e., gaps in interpersonal relationships; Burt, 1995)	People with more bridging ties tend to hear about a wider range of information and opportunities earlier than their peers (and those with more open networks have greater ability to convey complex ideas to diverse audiences) (Burt, 1992; Grannovetter, 1973).

		Ties to those with other functional expertise yield unique/ heterogeneous knowledge (Hansen, 1999; Rodan & Galunic, 2004). Optimal configurations of group social capital maximize group effectiveness (Oh, Chung, & Labianca, 2004).
Actor Attributes	Attributes related to position in social network	Demographic characteristics, values, and personality influence acquisition of central positions within advice, friendship, and adversarial networks. High education and low neuroticism leads to high advice and friendship centrality (Klein et al., 2004).
		Attribute similarity (homophily) facilitates dyadic friendship ties, network centrality, and social position (Gibbons & Olk, 2003).
(p. 491) Dyadic Relationships		
Reciprocity	The propensity for directional ties to be mutual (Wasserman & Faust, 1994)	Reciprocity in trust (important to transactions) is more likely to develop between dyads who are strongly tied (Granovetter, 1985).
Triadic Relationships		

Transitivity	Property in which two nodes that are both connected to the same node have a heightened probability of being connected (Girvan & Newman, 2002)	Group performance is highest when there is network closure within groups and brokerage beyond or between groups (Burt, 2004).
Group Relationships—Within teams, Across MTS		
Cliques	Cluster of actors connected to one another through cohesive bonds	Cohesive teams or cliques may experience less difficulty in communication and coordination (Balkundi et al., 2007).
		Cohesion might promote consistent norms, trust, cooperation, and knowledge sharing (Coleman, 1988; Granovetter, 1985).
		Closed or highly cohesive cliques may experience highly validating interactions and a deficiency in new information (Mizruchi & Stearns, 2001).

Diameter	"The largest geodesic distance in the (connected) network...The diameter of a network tells us how "big" it is, how many steps are necessary to get from one side of it to another" (Hanneman & Riddle, 2005, pp. 7.14)	Groups with longer path links in communication networks (i.e., fewer opportunities for direct communication with all members) have better long-term problem solving ability (Lazer & Friedman, 2007), suggesting MTS leadership may need to limit direct communication among all members when the MTS is engaged in creativity-based tasks.
Centralization	Degree to which links in a network are dispersed around one or a few nodes	Certain kinds of decentralized leadership structures are associated with better team performance than others (Mehra et al., 2006).
Density	Degree to which actors in network are connected to one another	Shared leadership in teams (defined as leadership network density) positively predicts consultant team performance (Carson et al., 2007).

Note. Definitions are from Hanneman & Riddle (2005) unless otherwise indicated.

Ego-Net Indices

As mentioned previously, each actor in a network has a unique ego-net. An actor's ego-net refers to the structure of his or her relationships with other members of the network. One prominent ego-net index is *centrality*. Centrality, broadly construed, describes the extent to which an actor is at a positional advantage in the network (Wasserman & Faust, 1994). Centrality is a structural indicator that can be calculated based on any type of relational tie. There are several indices of centrality that can be calculated for a given actor (e.g., degree, betweenness, eignevector; Hanneman & Riddle, 2005). However, the simplest conceptualization of centrality is degree centrality (i.e., the number of ties connected to an actor). An actor's degree centrality can be calculated based on the number of ties that are connected to the actor (i.e., undirected ties). Or, more specific degree centrality scores can be calculated based on the number of incoming ties (i.e., other members of the network nominated the individual) or outgoing ties (i.e., the focal actor nominated other members of the network). In terms of leadership networks, a (p. 492) high incoming degree centrality implies that a large proportion of other actors in the network identified

the focal actor as a leader. In MTSs, members' incoming degree centrality scores can be calculated within component teams to indicate the degree to which a member is considered a leader within his or her team. Centrality scores can also be calculated across the system as a whole to identify individuals who have emerged as central MTS leaders. Thus, centrality scores within teams and across the MTS represent one way to examine the nature of MTS leadership across multiple network foci.

Another ego-net index with implications for MTS leadership networks is *brokerage*. Brokerage is calculated by considering the number of pairs of other actors the focal actor is connected to who are *not* connected to one another. Brokerage implies the degree to which an actor in the network bridges *structural holes* (i.e., gaps in interpersonal relationships; Burt, 1992). According to structural hole theory, actors that bridge structural holes between disconnected groups of others are at an advantage in terms of access to diverse ideas and control of information flow. As such, the position of broker between two unconnected groups implies power (Burt, 2005). Brokerage in communication networks has been shown to lead to positive outcomes for the brokering individual. For example, those actors who bridge more structural holes tend to hear about a wider variety of opportunities as compared to their peers and, in turn, are more likely to receive early promotions, have greater career mobility, and be adept at changing environments (Burt, 1992; Grannovetter, 1973). However, the brokerage position in the leadership network of a complex system is less clear. For example, in a MTS leadership structure, one central MTS leader who serves as the "leadership broker" might connect two disconnected component teams by setting directions for both teams. In alignment with structural hole theory, this may be a powerful position for this individual to occupy, as he or she may direct the activities of two or more component teams. However, this implies a vertical leadership form between teams, which might not be appropriate within some MTS contexts.

Network Indices

Examination of structural formations at the network-level allows researchers to identify patterns of relations that are of importance to system-level effectiveness (e.g., leadership emergence, communication breakdowns, opportunities for collaboration). There are several key network indices that are important to consider when conceptualizing leadership as a network. The following network indices capture the structure of relationships within dyads, triads, and groups. Note that each of these indices can be calculated for multiple network foci within MTS leadership networks. For example, each index could capture the patterns of relationships that occur within teams—by considering the team as its own "network," or could capture the patterning of relationships across the entire MTS.

Dyadic Relationships

Dyads constitute the smallest possible social structure (Hanneman & Riddle, 2005), and dyadic relationships (i.e., the configurations of ties between two system members) represent a basic unit of network analysis (Wasserman & Faust, 1994). *Reciprocity* is a dyadic measure that assesses the extent to which relationships between actors are mutual. Lack of reciprocation in relationships can have negative consequences. For example, low reciprocation in support relationships with colleagues and supervisors is associated with negative affect (Buunk, Doosje, Jans, & Hopstaken, 1993). Reciprocity in a dyadic leadership relationship indicates that Person A relies on Person B for leadership and Person B relies on Person A for leadership. MTS leadership networks may demonstrate reciprocity at multiple network foci. For example, within component teams, leadership ties may be unidirectional (i.e., not reciprocated), but the leadership ties that link teams together may be highly reciprocated (i.e., between-team reciprocation in leadership).

Triadic Relationships

Triads have a much wider range of possible relational structures than do dyads (Hanneman & Riddle, 2005). Thus, examination of triads allows researchers to answer many more interesting questions about small group interactions. For undirected data (i.e., ignoring the direction of ties and considering whether or not there is a tie present), three nodes can demonstrate four possible triadic relations: (1) no ties, (2) one tie, (3) two ties, or (4) three ties. For directed data (i.e., accounting for the direction of ties), there are, in fact, a total of 16 possible triadic relations. Examination of the complex directional relationships in triads can allow for initial identification of hierarchical structures, equality in relations, or the presence/absence of exclusive groups and isolated individuals (Hanneman & Riddle, 2005). **(p. 493)**

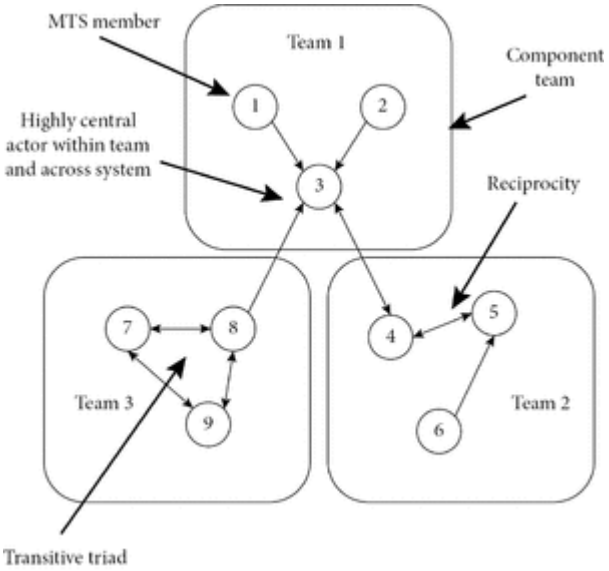
Triads have a tendency toward equilibrium in relationships. In particular, the property of *transitivity* implies that two nodes that are both connected to the same node have a heightened probability of being connected to one another (Girvan & Newman, 2002). The theoretical basis for this idea can be traced to balance theory (Heider, 1958), which argued that if two individuals were friends, they were likely to have the same evaluations of a given object. Network theorists extended this position by arguing that this object could be a third person in a network (e.g., Harary, Norman, & Cartwright, 1965; Holland & Leinhardt, 1979). Closure (i.e., all actors are connected to one another) within triads is thought to allow for more consistency in affect and behavior between members. These norms could, in turn, lead to positive outcomes such as satisfaction and performance (Krackhardt & Porter, 1985). As with reciprocity, the degree to which triads demonstrate transitivity in leadership may differ depending on the network foci of interest (i.e.,

network location) such that leadership ties *within* a certain team may demonstrate more or less transitivity as compared to the MTS as a whole.

Figure 22.1 displays a simplified diagram of a nine-person MTS network. The MTS in Figure 22.1 is composed of three teams, each with three team members. The boxes represent the three different teams, and the circles represent the nine members of the teams. The arrows in the diagram represent directional leadership ties that were identified by each person in the network. For example, if one MTS member has an arrow pointing to another, it implies that the first MTS member relies on the second for leadership. The diagram highlights network properties of centrality, reciprocity, and transitivity. First, in Team 1, MTS member 3 is highly central within his or her component team. Both of other members of Team 1 have directional ties to MTS member 3 but are unconnected to one another. Similarly, MTS member 3 is highly central in the MTS because he or she has more incoming leadership ties than any other MTS member. Second, the property of reciprocity in leadership ties within teams is demonstrated between MTS members 4 and 5 such that member 4 nominated member 5 as a leader, and member 5 nominated member 4 as a leader. The property of reciprocity is also demonstrated between teams because MTS members 3 and 4 (members of two different component teams) rely on one another for leadership. Finally, the property of transitivity is demonstrated within Team 3 such that that all three team members in this team rely on one another for leadership.

Group Relationships

Cliques.



Click to view larger

Figure 22.1 . Nine-person MTS with three component teams demonstrating network concepts of centrality, reciprocity, and transitivity.

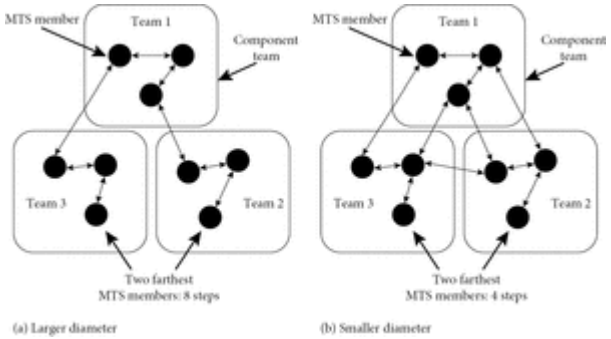
A clique is a highly cohesive subset of actors in a network in which the actors are more closely tied to one another as compared to other network members (Hanneman & Riddle, 2005; Knoke & Kuklinski, 1982). Network analysis allows researchers to identify the degree to which highly cohesive (p. 494) cliques exist in the network. The presence of highly cohesive cliques in a network may be a double-edged sword. Highly cohesive bonds within a team are likely to promote consistent norms, trust, cooperation, and sharing of information (Coleman, 1988; Granovetter, 1985). Because of this consistency, highly cohesive teams or cliques may experience far less difficulty in communication and coordination within their teams (Balkundi, Kilduff, Barsness, & Michael, 2007). However, overly cohesive cliques may experience validating interactions with no dissenting or questioning opinions, and may not have enough exposure to outside information (e.g., Mizruchi & Stearns, 2001). In a MTS leadership network, cliques could be identified that represent component teams or subsets of component teams with highly shared leadership structures. Or across the MTS, cohesive “leadership cliques” with members from multiple teams who are linked together through mutual leadership ties could be identified.

Diameter.

The measure of a network’s *diameter* indicates the largest “geodistic” distance in the network. Geodistic distance is the number of relations in the shortest possible path from one actor to another in a given network (Hanneman & Riddle, 2005). In terms of leadership, a large diameter indicates the presence of many intermediaries between two members who directly influence one another. Large diameters may negatively impact group performance because of the delay in communication and coordination that is likely to occur when one member needs to work with another. However, systems with large diameters—those whose members are not closely and densely connected—may be better able to generate more unique solutions to challenging problems because the members

may not be as susceptible to the “groupthink” phenomenon. In a MTS leadership network, a large diameter across the system might indicate that leadership efforts are not coordinated. For example, Figure 22.2a and b displays two identical nine-person MTSs, each comprising three teams of three members. For clarity, all leadership ties are reciprocated in both of these MTSs. The only difference between the two MTSs shown is the *size* of the networks. Whereas Figure 22.2a shows MTS with a large leadership network diameter, Figure 22.2b shows a MTS with a smaller network diameter. In Figure 22.2a, for the two individuals who are farthest away from one another to influence each other, this influence must traverse eight leadership ties—or in network terms it takes eight steps for these people to reach one another. In Figure 22.2b, the two of individuals farthest away from one another in MTS 2 are separated by only four leadership network steps.

Density.



Click to view larger

Figure 22.2 . Two Identical Nine-person MTSs, Each with Three Component Teams, Representing Larger **(a)** and Smaller **(b)** Leadership Network Diameters.

Density of ties indicates the degree to which actors in a network or subset of a network are connected to one another. As described in previous sections, density is calculated by dividing the number of observed ties by the number of possible ties in a network. In past work on shared leadership, the density of leadership ties in a team has been conceptualized (p. 495) as a proxy for the amount of shared team leadership (Carson et al., 2007). In a MTS leadership network, shared leadership can be assessed at multiple network foci. For example, researchers could identify the degree to which leadership is shared *within* teams or *across* the MTS as a whole by calculating the density of ties within teams or the density of ties across the system. Furthermore, the degree to which leadership is shared *between teams* could be evaluated by dividing the number of observed leadership ties that traverse multiple teams by the total possible leadership ties that could traverse multiple teams. Finally, researchers can identify the degree to which leadership is shared among specific members of the MTS (e.g., formal leaders) by calculating the density among these members. Figure 22.3 provides examples of these four conceptualizations of MTS leadership network density. Figure 22.3a depicts high density within component teams but zero density between. Figure 22.3b depicts a MTS with zero density within teams but higher density between teams. Figure 22.3c

displays the degree of shared leadership among specific MTS members. Figure 22.3d depicts MTSs with high density across the entire MTS.

Centralization.

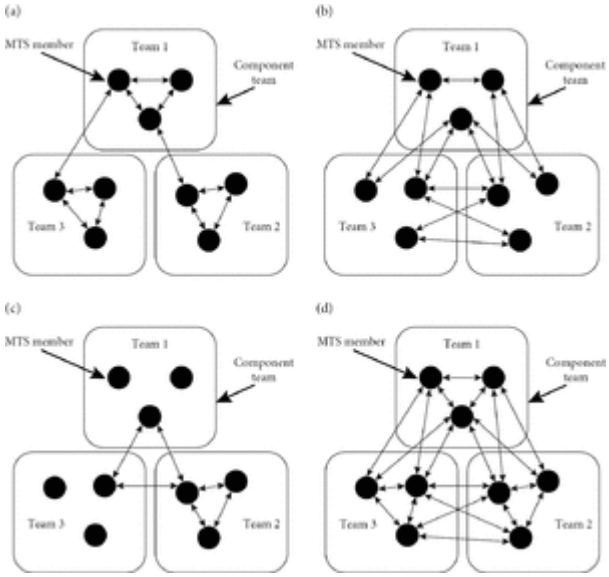


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Figure 22.3 . Four Nine-person, Three-team MTSs Demonstrating Leadership Density Across Multiple Network Foci. Leadership Density **(a)** Within Teams, **(b)** Between Teams, **(c)** Among Specific MTS Members, and **(d)** Across the MTS.

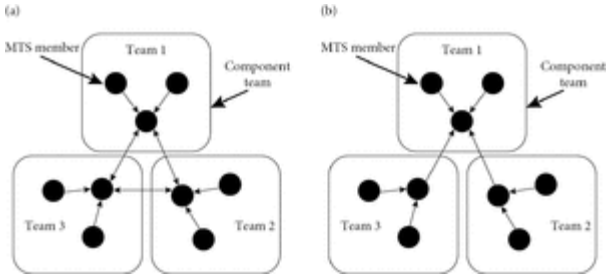

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Figure 22.4 . Centralized Leadership Network Structures Within Teams and **(a)** Shared (Decentralized) Structures Among Central Team Leaders or (b) Centralized Structure Among Central Team Leaders.

Finally, a measure of *centralization* indicates the degree to which ties in a network are dispersed around one or a few nodes (Hanneman & Riddle, 2005). In a leadership network, centralization could be considered a measure of vertical leadership. As with the previous network indices, centralization could be calculated within teams or across the entire system to assess vertical leadership forms across multiple network foci. For example, component teams could each display high levels of centralization—with leadership power in the hands of one or a few individuals. However, these central team leaders may or may not share in leadership. Figure 22.4 demonstrates the importance of considering centralization across these multiple network foci levels. Figure 22.4a depicts centralized leadership structures within teams, but shared structures among central team leaders. Figure 22.4b shows (p. 496) a multitier vertical leadership structure such that leadership is centralized within each component team, and each component team leader is subordinated to a higher-level MTS leader.

Sociometric Prompts to Incorporate Leadership Forms, Functions, and Foci

As described in the previous section, leadership structural forms may differ depending on the portion of the MTS leadership network that is examined (i.e., *network foci*; within teams, between teams, across the entire MTS). However, leadership structures may also differ based on the content of the leadership relationships. Sociometric prompts (i.e., network measures) that elicit different aspects of leadership may yield highly different patterns of relations. Initial work examining leadership networks (e.g., Mehra et al., 2006; Stogdill, 1948) used prompts that asked respondents to nominate individuals whom they perceived to be a leader. These initial studies did not clarify what was meant by the term "leader." This technique allows researchers to capture respondents' innate perceptions of leadership. However, years of leadership theory development and research have provided much guidance regarding the specific behaviors and interactions that are involved in successful leadership of groups (e.g., Ohio State studies; Halpin & Winer, 1957, transformational leadership theories; Bass, 1985; Burn, 1978; functional leadership; Fleishman et al., 1991; Zaccaro et al., 2001; Leader–Member Exchange [LMX] theories; Deluga, 1998; Liden et al., 1997). Thus, we propose that incorporating prior work on leadership activities with the network perspective could yield a more comprehensive picture of the leadership structures that emerge within complex systems. Specifically, sociometric prompts could more thoroughly integrate psychosocial work on leadership with the network perspective by eliciting networks that refer directly to leadership activities rather than members' own innate theories of leadership.

In the MTS context, leadership networks can be elicited that identify the leadership *functions* MTS members engage in and to what level of the MTS goal hierarchy these functional leadership activities are *focused* (i.e., goal foci). As mentioned previously, in the description of past theory on MTS leadership, three key MTS leadership activities that involve interactions between "leaders" and "followers" include (1) direction setting (i.e., planning, organizing, problem solving; DeChurch & Marks, 2006; DeChurch et al., 2011; Hiller, Day, & Vance, 2006); (2) coordination (e.g., DeChurch & Marks, 2006; DeChurch et al., 2011); and (3) motivation (e.g., Zaccaro et al., 2001). The inherent interactive nature of these three leadership activities makes them particularly suited for evaluation using network analysis techniques, which identify the presence or absence of relationships between actors.

Furthermore, leadership activities impact individuals, teams, and systems at multiple levels of the system's goal hierarchy. Individuals nested within MTSs work simultaneously toward their own personal goals, the collective goals of their component teams, and the superordinate collective goals of the system as a whole. At times these different goals

may be in conflict (Mathieu et al., 2001). MTS leadership exists to create emergence in the higher level patterning of the behavior of lower level units (Marks et al., 2005). Individual-level leadership (p. 497) focuses and motivates individuals to achieve their personal goals. Team-level leadership routinizes the thoughts, feelings, and interactions among individuals toward the goal of the team. MTS-level leadership routinizes the thoughts feelings and interactions of teams with those of other teams and aligns the MTS with the external embedding environment. Examining the degree to which individuals are directed, motivated, and/or coordinated in regards to their personal-, team-, and/or MTS-level goals can improve the knowledge base regarding how leadership can best align goals across multiple levels. Thus, we suggest the use of sociometric prompts that generate MTS leadership structures containing information about both the *function* and the *goal focus* of MTS leadership.

Table 22.2 displays this two-dimensional view of MTS leadership supported by prior research. The functional dimension captures the particular leadership activities that are enacted within the system. The goal-focus dimension captures the level of goals these behaviors impact. Table 22.2 includes illustrative prompts to elicit person-to-person leadership networks containing information regarding leadership functions and goal foci. For example, to assess direction setting for individual-level goals, MTS members could be prompted: “Who provides you with direction in working toward your individual goals?” To assess direction setting for team-level goals, the members could be asked: “Who provides you with direction in working toward your team’s goals?” Lastly, to assess direction setting for MTS-level goals, members could be asked: “Who provides you with direction in working toward MTS goals?”

Responses to these prompts can be binary (i.e., 0 or 1) or valued (e.g., Likert-type scale). The prompts in Table 22.2 are worded to elicit binary ties, creating an adjacency matrix filled with 1’s for individuals who are exhibiting a particular function/leadership relation, and 0’s for individuals not exhibiting a particular function/level of leadership. These leadership network prompts could easily be adapted to use valued ties. For example, the direction setting team network prompt could read: “To what extent does each person provide you with direction in working toward the team goals?” Responses might be on a 5- or 7-point Likert-type scale ranging from “Not at all” to “To a great extent.” Although valued ties capture greater gradation in the underlying construct of leadership enactment, many network analytic methods using ties as a dependent variable will require ties to be represented as binary data (e.g., ERGM, Siena).

Once leadership networks are elicited, leadership structural *forms* can be represented using the ego-net and network indices discussed in the preceding section. Finally, these structural forms can be examined at multiple *network foci* throughout the leadership structure (within teams, between teams, across the MTS). Combining these four

dimensions of MTS leadership—forms, functions, network foci, and goal foci—can provide a comprehensive view of the way that MTS leadership emerges and impacts system-level effectiveness. (p. 498)

Table 22.2. Leadership Sociometric Prompts to Elicit Forms and Foci

			Focus		
			Individual goals	***Team goals***	***MTS goals***
Function	*Direction Setting*	(i.e., Planning, organizing, problem solving; DeChurch & Marks, 2006; DeChurch et al., 2011; Hiller et al., 2006)	“Who provides you with direction in working toward your individual goals?”	“Who provides you with direction in working toward your team’s goals?”	“Who provides you with direction in working toward your MTS’s goals?”
	Motivation	(e.g., Zaccaro et al., 2001)	“Who energizes you to work toward your individual goals?”	“Who energizes you to work toward your team’s goals?”	“Who energizes you to work toward your MTS’s overall goals?”

	Coordination of Collective Actions	(i.e., Task; DeChurch & Marks, 2006; DeChurch et al., 2011)	—	“Who helps you coordinate with members of your team?”	“Who helps you coordinate with members of your MTS?”

Summary, Conclusions, and Future Research Directions

We have discussed four key concepts regarding MTS leadership networks. First, using network analysis indices, leadership *forms* (i.e., structures) that emerge within MTSs can be identified. Second, these indices can be used to capture leadership structure at multiple *network foci* within a MTS leadership network (e.g., within teams, throughout the system). Third, sociometric prompts can be used to identify the leadership *functions* (e.g., direction setting, coordination, motivation) MTS members enact. Finally, these sociometric prompts can be modified to identify the *focus* of leadership activities. Namely, the goals (i.e., individual-level, team-level, MTS-level) can be identified that are most affected by MTS leadership activities.

For each of the ego-net and network indices discussed, we offer exemplar research questions that drive future investigation into this new genre of MTS leadership by incorporating network structure (i.e., forms) with leadership function, network foci, and goal foci. Incorporating a network perspective into MTS leadership research allows us to ask new questions regarding leadership capacity. Table 22.3 presents a mapping of network concepts to future MTS leadership research questions. This list is a far from exhaustive. We offer it as an illustration of the type of questions about leadership in MTSs that this network approach enables us to answer.

Ego-Net Structure Questions

The first category of questions centers on the positioning of particular individuals within the network. In the context of a MTS, these individuals may be formal leaders of teams, or emergent leaders defined by their influence. Two broad types of questions related to individuals' positional features are: (1) What gives rise to these network positions? and (2) What are the consequences that stem from occupation of these positions? Research on personality, values, and skills relevant to leadership can ground predictions that detail how individual differences enable certain MTS members to occupy positions in the functional leadership networks within teams and across systems. Thus, our example question is: What individual differences (p. 499) predict occupancy of different positions in a leadership network (i.e., across functions, goal foci, and network foci)?

Table 22.3. Example Research Questions for MTS Leadership Networks

Relationship Structure	**Network Construct(s)**	**Example MTS Leadership Research Question(s)**
Ego-Net Structure	Centrality Brokerage	RQ1: What individual differences predict occupancy of different positions in a leadership network (i.e., across functions, goal foci, and network foci)?
Dyadic Structures	Reciprocity	RQ2: Does the extent to which leadership network ties (i.e., across functions, goal foci, and network foci) are mutual predict MTS effectiveness?
Triadic Structures	Transitivity	RQ3: To what extent does triadic closure in leadership networks (i.e., a high percentage of closed triads across functions, goal foci, and network foci) predict MTS effectiveness?
Group Structures	Cliques	RQ4: To what extent does the emergence of cohesive cliques in leadership networks (i.e., across functions, goal foci, and network foci) augment or detract from MTS effectiveness?
	Diameter	RQ5: To what extent does the overall size of leadership networks (i.e., across functions, goal foci, and network foci) enable MTS effectiveness?
	Centralization Density	RQ6: To what extent does centralization and/or density of leadership networks (i.e., across functions, goal foci, and network foci) enable MTS effectiveness?

		RQ7: To what extent does the relative density and/or centralization of leadership networks at one network foci (e.g., within teams) compared to another (e.g., across the entire system) enable MTS effectiveness? RQ8: To what extent does the optimal configuration of within team and across MTS centralization and/or density differ based on the stage of development and/or task cycle of the MTS?

Dyadic Relationship Structure Questions

A second set of questions examines the predictors and consequences of dyadic relationships. In the case of leadership networks, reciprocity in a dyad refers to the degree to which leadership influence is mutual between two individuals. Thus, our second example question is: Does the extent to which leadership network ties (i.e., across functions, goal foci, and network foci) are mutual predict MTS effectiveness?

Triadic Relationship Structure Questions

The third set of questions concern the triadic structures in leadership networks. Triads have been found to be influential stabilizing forces in networks. However, the extent to which teams and MTSs benefit from closure in their leadership networks is an open question. For example, if person A is energized to work on behalf of the team by person B, and person B is energized by person C, what is the likelihood that person C will also be energized by person A, and does this balance in the leadership motivational function underlie effectiveness? Thus, our example question related to triads is: To what extent does triadic closure in leadership networks (i.e., a high percentage of closed triads across functions, goal foci, and network foci) predict MTS effectiveness?

Group Relationship Structure Questions

A final set of questions concerns the effects of group-level leadership structures. In MTSs, there are a variety of questions about the leadership cliques that emerge. For example: To

what extent does the emergence of cohesive cliques in leadership networks (i.e., across functions, goal foci, and network foci) augment or detract from MTS effectiveness? With diameter (i.e., the size of MTS leadership networks), to what extent does the overall size of leadership networks (i.e., across functions, goal foci, and network foci) enable MTS effectiveness? For centralization (i.e., leadership in the hands of a few) and for density (i.e., degree of sharing in leadership) we wonder: To what extent does centralization and/or density of leadership networks (i.e., across functions, goal foci, and network foci) enable MTS effectiveness?

Interesting multilevel questions arise when evaluating leadership structure at multiple network foci. For example, within MTSs, centralization can have influence, not only within and across teams, but also in their relative combination. There are likely to be combinative effects when leadership is centralized at one level but decentralized at another. One set of predictions would suggest that alignment in structure at multiple levels would allow members to achieve cognitive congruence, and would benefit the MTS by creating a common set of expectations regarding the structural patterning of leadership. For example, if leadership is centralized within teams, and centralized across the MTS, members expect and normalize hierarchical influence. An alternative set of predictions might suggest that differences in structures across levels are beneficial. For example, perhaps patterns reflecting decentralization within teams and centralization across MTSs are effective. The decentralization within teams would afford the benefits of motivation and empowerment stemming from flat leadership structures, whereas the centralization present in the larger system affords needed efficiency in combining the efforts of a large number of individuals. Thus, an exemplar question in this area is: To what extent does the relative density and/or centralization of leadership networks at one network foci (e.g., within teams) compared to another network foci (e.g., across the entire system) enable MTS effectiveness?

Lastly, we call attention to questions about the impact of structure over time. Perhaps a particular leadership structure is needed in one task cycle (i.e., transition versus action phases; Marks, Mathieu, & Zaccaro, 2001) or particular stage of team development (e.g., team formation versus role compilation; Kozlowski et al., 1996) but a restructuring of leadership is needed in another task cycle or stage. Therefore, we advance the question: To what extent does the optimal configuration of within team and across MTS centralization and/or density differ based on the stage of development and/or task cycle of the MTS?

We opened this chapter by drawing attention to the dire consequences that arise when leadership fails to unite constituent teams within MTSs. This chapter builds on two research traditions—one on multiteam leadership and one on social networks—to suggest a new way to conceptualize and test relationships about the configurations of enactment

of leadership within complex systems. We hope that these ideas stimulate additional thinking in this area, and ultimately, that empirical research testing of these ideas will follow.

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Notes:

(*) Authors contributed equally to this publication and are listed alphabetically. This research was made possible by support from the National Science Foundation, OCI-1056217.

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