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Organizational Learning and Multiteam Systems

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Abstract and Keywords

Multiteam systems consist of two or more teams, each of which pursues subordinate team goals, while working interdependently with at least one other team toward a superordinate goal. Many teams work in these larger organizational systems, where oft-cited challenges involve learning processes within and between teams. This chapter brings a learning perspective to multiteam systems and a multiteam system perspective to organizational learning. Several classic illustrations of organizational learning—for example, the Challenger and Columbia disasters—actually point to failures in organizational learning processes within and between teams. We offer the focus on intrateam knowledge creation and retention, and interteam knowledge transfer as a useful starting point for thinking about how to conceptually and operationally define learning in multiteam systems. Furthermore, we think leadership structures and multiteam emergent states are particularly valuable drivers of learning.

Keywords: team, multiteam system, team learning, organizational learning, shared leadership, team affect, team cognition, emergent states

Consider these four scenarios:

Scenario 1. Local hospitals mobilize medical teams to treat the more than 260 victims of two homemade bombs detonated at the Boston Marathon.

Scenario 2. Nongovernmental organization (NGO) teams work to reduce neonatal mortality in Bihar, India.

Scenario 3. NASA sets a goal of sending humans to Mars by the end of the 2030s.

> *Scenario 4. The US National Science Foundation (NSF) issues a call for bold interdisciplinary proposals to advance "10 Big Ideas."*
>
> (Ten Big Ideas, n.d.)

These scenarios are about organizational learning, but there are clear differences in what needs to be learned and how quickly. The first two scenarios require learning that is reactive and defensive; the latter two involve learning that is proactive and offensive. All four scenarios require learning as an integral aspect of achieving organizational goals: saving lives and avoiding amputations, saving the lives of newborns, advancing science and exploration capability, and fueling innovation.

More specifically, these scenarios are about organizational learning in teams. Victims of the Boston Marathon bombings were routed through a series of teams: first-responder teams, ambulatory teams, triage teams, surgical teams, recovery teams. To combat neonatal mortality, newborns in India are relying on teams of nurses to apply chlorhexidine to their umbilical cords soon after birth, and also on technical support unit teams from the NGO Care India to work with their health providers to ensure that they understand the benefits of chlorhexidine use. The human crew setting off to Mars will count on mission control teams representing different nations and disciplines to plan, execute, and troubleshoot the most complex human voyage ever attempted. Realizing the NSF's "Big Ideas" will require interdisciplinary research teams.

Indeed, these scenarios are not just about organizational learning in teams but are also about those who work in multiteam systems (MTSs). Accomplishing the organizational goals laid out in each of these scenarios will require learning on the part of a *system* of teams. That is, knowledge must be created, retained, and transferred within teams, and across the boundaries of multiple interdependent teams. Scenarios like these have long been the focus of research on organizational learning (March, Sproull, & Tamuz, 1991). For instance, many organizational learning scholars have identified space exploration teams—Columbia and Challenger, in particular—as exemplars through which we can see the causes and consequences of organizational learning (Madsen & Desai, 2010; Mahler, 2009; March et al., 1991; Starbuck & Farjoun, 2005). Health care has provided another important context for understanding organizational learning (Edmondson, 1999). Prior work in this domain has extensively considered the critical role that teams play in organizational learning (Argote & Ren, 2012; Edmondson, 2002; 2003; Ren, Carley, & Argote, 2006; Tucker, Nembhard, & Edmondson, 2007). This chapter builds on these traditions, focusing on the importance of understanding the factors that shape intrateam and interteam learning in MTSs.

Small groups and teams provide a powerful social context for the individual. In fact, individuals largely experience organizational life through the social lenses of the groups to which they belong. Work teams, functional groups, divisions, branches, and task forces are all examples of salient group memberships that exert a powerful force on individuals, directing their attention and ultimately shaping their learning. The social context of organizations is rich in information and ideas that can potentially stimulate learning and adaptation. At the same time, the social context of organizations creates forces that can inhibit such learning and adaptation. Our chapter brings a learning perspective to MTSs. The learning lens offers a critical and undertheorized developmental perspective to understanding MTSs.

An MTS is defined as a network of two or more interdependent teams. Individuals who work in MTSs pursue both proximal team goals and more distal system goals. MTSs provide a meaningful unit of analysis for understanding the large, complex, and specialized groups that work within and across many organizations. In science, MTSs are needed to tackle bold interdisciplinary problems. The component teams are research groups residing in different disciplines who come together to solve scientific problems requiring expertise from multiple areas. MTSs can also be found in disaster response. The component teams here represent the different functional areas whose efforts need to be combined to ensure public well-being following a disaster—government agencies, utility and transportation companies, and health care providers are often among the array of teams that come together. In the private sector, MTSs often manifest as strategic alliances enabling companies to gain a competitive advantage by partnering with other organizations that provide capital, market share, or other resources that complement those of the focal company.

Although the area of MTSs is developing both a solid theoretical foundation (Luciano, DeChurch, & Mathieu, 2015) and relevant empirical findings (Shuffler, Jiménez-Rodríguez, & Kramer, 2015), a basic understanding of MTSs would benefit from a more explicit focus on intrateam and interteam learning as a process and outcome. Existing research on MTSs has been performance focused, identifying the enabling conditions that relate positively to the attainment of system goals. The performance focus is well suited for MTSs that engage in the short term and perform highly behavioral tasks like those found in disaster response, health care, and the military. However, many MTSs are more permanent and more knowledge oriented. The knowledge economy creates teams and MTSs whose work is more intellective than behavioral—product design teams, for instance. Many organizational teams have fluid boundaries, with some members having a relatively short tenure, or others serving as the founding members who remain in the team for a longer time serving the role of socializing new members and passing on norms and values of the group. This chapter advances a learning perspective on such MTSs.

We consider the core aspects of MTSs and develop propositions about how these aspects of MTSs may affect their capacity to create, retain, and transfer knowledge. MTSs present an interesting unit of analysis for a learning focus because there are at least two salient groups affecting learning: the team and the system. In many organizations, one's work team is the most immediate social context affecting learning. However, when teams are interdependent in MTSs, the embedding group creates social forces that shape and constrain individual and team learning.

Multiteam systems are inherently intergroup situations. Individuals operate in an “ingroup” or team with members who not only share a common team goal but who are typically more proximate and more similar on a variety of characteristics than are the “outgroup” members in other component teams within the MTS. Whereas outgroups can be stimulating to teams when the goal is to motivate and direct effort toward the pursuit of team goals, outgroups can also undermine cooperation, information sharing, and coordination between teams. Outgroups can also form within teams, when there are meaningful identity subgroups (Carton & Cummings, 2012). The component teams within MTSs experience subgroups both within and between teams, yet the outgroups created between teams are especially salient because they are reinforced by the presence of differing team goals. A defining feature of an MTS is the presence of both subordinate (team) and superordinate (MTS) goals. Work on superordinate goals illustrates their value in promoting positive intergroup relations (Sherif, 1958), but this effect is predicated on the absence of a competing “subordinate” goal at the team level. In MTSs, the team does not abandon its team goal for the good of the system. Nor do multiple teams each pursuing their own goals ensure the system will succeed. The challenge of MTSs is to recognize that teams are motivated by both subordinate and superordinate goals.

Not only does a learning perspective benefit research on MTSs, a MTS perspective can also benefit research on organizational learning by illuminating a set of interaction processes that consider individuals who interact within teams that interact with other teams. This meso-level lens is a useful way to conceptualize the multilevel aspects of organizational learning so that ideas about how things work at one level can inform understanding of how things work at another level. In MTSs, the meso level connects processes that occur among individuals, teams, and MTSs.

In this chapter, we elaborate a research framework for understanding the factors influencing intrateam and interteam learning. We develop this framework in three sections: (1) a learning perspective on MTSs, (2) structure and learning in MTSs, and (3) leadership and learning in MTSs. The first section considers the three aspects of learning—knowledge creation, retention, and transfer—in MTSs. In the second section, we consider the impact of MTS structure on learning. We argue that learning is moderated by two key structural dimensions along which MTSs vary—the degree of differentiation between the teams and their degree of dynamism. This second section goes on to advance propositions about the effects of these structures on the three dimensions of learning. In the third section, we consider the critical role of leadership functions and forms on learning in MTSs. This third section develops propositions about the role of leadership in facilitating cognitive and affective emergent states in MTSs, and the importance of considering shared forms of leadership, particularly in large social systems.

A Learning Perspective on Multiteam Systems

Organizational learning has been characterized as a process-like change that occurs when an organization accumulates experience (Argote & Miron-Spektor, 2011). The "change" that occurs affects the amount of knowledge held by an organization in a positive direction; that is, organizations acquire more knowledge through developmental experiences, such as using new technology or collaborating with outside experts. Organizational learning often occurs within and between teams, and then it is amplified through a set of processes that generate, embed, and distribute the gained knowledge throughout the organization.

In this section, we consider knowledge creation, retention, and transfer as they relate to organizational learning within and between teams. There has been a substantial body of research in this domain, but organizational learning and its contributing processes have not been explicitly examined from an MTS perspective. We will describe the processes of knowledge creation, retention, and transfer as they have been conceptualized thus far and provide research propositions that suggest how these processes should be studied at an MTS level.

Knowledge Creation

A critical first step in organizational learning is knowledge creation. A broad definition of knowledge creation relates it to any generation of new knowledge in organizations (Argote, McEvily, & Reagans, 2003). Nonaka, von Krogh, and Voelpel (2006) state that knowledge creation is "the process of making available and amplifying knowledge created by individuals as well as crystallizing and connecting it to an organization's knowledge system" (p. 1). Knowledge creation is important to both organizational and MTS success because it is central to goals such as innovation. Innovation is a form of knowledge creation wherein an organization "creates and defines problems and then actively develops new knowledge to solve them" (Nonaka, 1994, p. 14). Organizations utilize different types of teams (e.g., from marketing, technology, engineering, etc.) to spur innovation for new products and services, so an understanding of *how* such innovation occurs between teams is essential if those processes are to be maximized.

The processes involved in knowledge creation that "make available and amplify" knowledge are linked to the two types of knowledge: tacit knowledge and explicit knowledge (Nonaka, 1994). Explicit knowledge, also called declarative knowledge, is easily codified, accessed, and transferred. Tacit knowledge, also called procedural knowledge, is difficult to transfer between people. Explicit knowledge can be thought of as "know what" and tacit knowledge as "know how." Tacit knowledge is rooted in experiences and difficult to verbalize (Polanyi, 1966). Some examples are riding a bike or playing a musical instrument.

Knowledge creation can be thought of as an interplay between explicit and tacit knowledge, where one type is converted into another within an individual, or where knowledge is transferred between individuals. Nonaka (1994) describes four modes through which this interplay between tacit and explicit knowledge leads to knowledge creation. The first mode of knowledge creation is socialization; this occurs when tacit knowledge is transferred from one person to another, through some shared experience or direct interaction. The second mode of knowledge creation is combination, where different sets of explicit knowledge are combined to create new knowledge. The third mode of knowledge creation is externalization, when tacit knowledge is made explicit. Externalization occurs when what was once tacit knowledge is articulated concretely with words, analogies, and/or metaphors, so that it becomes explicit. The fourth mode, internalization, involves the transfer of explicit knowledge into tacit knowledge. This model of knowledge creation is useful for understanding how knowledge is created in teams, or intrateam knowledge creation.

Two factors that improve the quality of knowledge creation are variety of experience and knowledge of experience (Nonaka, 1994). A team's variety of experience stems from exposure: Are teams able to perform many types of tasks and learn different types of information, or are they restricted to routine operations? Knowledge of experience relates to learning and retention (discussed in further detail in the next section): Are team experiences embedded through the aforementioned conversion processes, or are experiences forgotten or ignored post knowledge creation?

Knowledge Retention

After knowledge has been created, that knowledge must also be retained over a meaningful amount of time in order to be useful to the team. Knowledge retention refers to the embedding of knowledge in a repository so that it persists over a period of time (Argote, McEvily, & Reagans, 2003). Knowledge can be retained in many different ways, and Argote and Ingram (2000) suggest that there are five major types of knowledge repositories or bins in an organization: (1) individual members, (2) roles and organizational structures, (3) organizational operating procedures and practices, (4) culture, and (5) the physical structure of the workplace. These repositories may also form networks, such that knowledge is embedded between repositories (e.g., a member-task network).

Organizations and teams differ in their ability to retain knowledge. Researchers interested in organizational knowledge retention (also referred to as organizational memory) have found that knowledge decay occurs over time (Argote et al., 1990; Thompson, 2007), although the rate of the decay varies across different types of organizations. Organizations in some industries adopt explicit practices to retain knowledge (Zollo & Winter, 2002), which helps to buffer against knowledge forgetting, whereas organizations in other industries may rely solely on latent knowledge retention processes, which could be less effective.

Additionally, some industries lend themselves to knowledge retention better than others. Fast-food and other low-skill industries are more prone to knowledge decay due to high rates of member turnover, whereas high-skill industries may be more effective at knowledge retention, due to lower member turnover and higher demand for a developed knowledge base. Teams within a MTS may also be more or less prone to knowledge retention or forgetting, depending on these factors, or factors such as the types and variety of repositories used to retain knowledge and the diversity or similarity of knowledge within and across teams.

Knowledge Transfer

Once knowledge has been created and retained within a team, the process of knowledge transfer allows that information to be shared. Formally, knowledge transfer is the "process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote & Ingram, 2000), a construct that lends itself well to its examination in an MTS context. Interteam knowledge transfer can be measured by changes in one team's knowledge or performance as a result of interaction with another team. For example, the opening example considers teams of health workers trying to reduce neonatal mortality in Bihar, India. Many of these teams' boundaries are defined by the small communities they serve, a local village or block. Foundations like the Bill & Melinda Gates Foundation establish technical support teams within these blocks whose goal it is to transfer knowledge about new medical practices to the health care delivery teams in the villages and blocks. When a technical support team member shares a new health care practice with a health worker from a local village, interteam knowledge transfer has occured. Similarly, when a health worker in one village interacts with a health worker in another, explaining how the new practice has been successfully adopted, we see a second instance of interteam knowledge transfer.

Interteam knowledge transfer is generally quite difficult to examine due to the number of potential influences that might account for changes in team knowledge. The most basic of these is intrateam knowledge creation, or team learning. For example, a health care team may start using a new practice not because they have learned about it from their neighboring village or from a technical support team member, but because they discover the practice on their own while working with their patients, or happen to read a media article about the practice. Even when team learning does occur through interteam knowledge transfer, it can be difficult to measure because there are many different ways through which knowledge may be transferred and embedded, including the following: (1) shared experiences or interactions between the members of two teams, (2) the creation of tools by one team that codify knowledge so that it is subsequently learned by other teams using the tool, and (3) the development of task procedures and norms that are then observed by another team.

Despite its importance to organizational effectiveness, there are many factors that can inhibit effective knowledge transfer between teams, and in organizations more generally (Argote, 1982). A key factor is the embeddedness of knowledge. When knowledge is embedded in a particular context, it can be difficult to see how it applies to other people, other tasks, and/or the use of other tools (Argote & Ingram, 2000). A related factor that might hurt knowledge transfer is the interdependence of various components of knowledge within a network, such that the successful transfer of knowledge A is contingent upon the transfer of knowledge B in order for the external team or organization to benefit (Teece, Pisano, & Shuen, 1997). Other factors that can influence knowledge transfer, for better or for worse, are characteristics of the involved social network (Darr, Argote, & Epple, 1995; McEvily & Zaheer, 1999), the interaction between social ties and the characteristics of the knowledge to be transferred (Hansen, 1999), characteristics of tasks (Thorndike, 1906), and technology characteristics (Galbraith, 1990).

Although knowledge transfer must necessarily occur across teams in an MTS to achieve an interdependent, superordinate goal, interteam knowledge transfer has not yet received much attention from an MTS perspective. Although Argote and Ingram (2000) have acknowledged that knowledge transfer does occur more readily within rather than across independent organizations, there has not been explicit research explicating how knowledge transfer may be maximized within MTSs. For example, while we know that knowledge transfer is heavily influenced by the organizational context within which teams are embedded (Argote & Ingram, 2000), less is known about how organizational contexts can be cultivated to best facilitate knowledge transfer. We know that some level of similarity across teams allows an easier transfer of knowledge (Argote & Ingram, 2000), but will too much similarity be costly to creativity or some other beneficial aspect of component teams within an MTS? Relatedly, we may expect that an organizational climate that emphasizes innovation and change will be a better facilitator of knowledge transfer than an organizational climate that emphasizes tradition and stasis. At a team level, future research efforts should focus on the aspects of teams that make them better or worse at transferring or receiving knowledge. Additionally, future research should also focus on the development of better methods to measure knowledge transfer, which might examine characteristics of transferred knowledge, such as quality or totality, or which aspects of knowledge are more likely to be transferred than others.

Thus far we have identified three learning processes that are important to MTSs: intrateam knowledge creation, intrateam knowledge retention, and interteam knowledge transfer. In the remaining sections, we turn attention to the impact of MTS structures and leadership process on each of these aspects of team learning. These sections will develop propositions about the two main thematic areas of MTS research, structure and leadership, from a learning perspective.

Structure and Learning in Multiteam Systems

As previously discussed, MTSs have two key defining features: (1) they pursue one or more superordinate goals, and (2) to accomplish these goals, they are required to work interdependently within and across component teams (Mathieu, Marks, & Zaccaro, 2001). This creates a particularly interesting predicament such that organizations consisting of MTSs require component teams that are both strong on their own and also able to behave cooperatively with other teams in the system.

The factors that promote effective teamwork can also create boundary forces that undermine cooperation and knowledge sharing across teams. Conversely, the factors that promote integration at the system level can undermine the focus and identity needed for the component teams to achieve team-level goals. DeChurch and Zaccaro (2013) characterize this conundrum as one of countervailing forces. *Countervailing forces* are processes or properties that have divergent consequences at different levels. They either promote the functioning of teams but undermine MTS functioning, or they promote the functioning of the system while undermining the entitativity of the teams. This complexity in supporting both team and system functioning is a central theme in MTS research. In this section we consider the implications of countervailing forces for learning at the multiteam level.

Research regarding the between-within relationship structure of MTSs has been somewhat inconsistent. For example, some research suggested that cross-team processes positively predict performance (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005), whereas others found that system performance is much more complex in terms of the cross-team processes (Davison, Hollenbeck, Barnes, Sleesman, & Ilgen, 2012). There are likely moderators that explain these differences in findings. A key moderator of interest is the nature of the MTS. To advance this area, Luciano and her colleagues elaborated a taxonomy of structural aspects of MTSs (Luciano et al., 2015). They explained the social forces created by these structures and how these forces give rise to emergent states within and between teams. We extend that thinking here to consider how these social forces specifically affect learning within and between teams.

In this section, we will discuss how the processes involved in organizational learning can be understood using the Luciano et al. (2015) MTS structural framework. After providing a summary overview of the MTS framework, we provide research propositions regarding how that framework clarifies the success or failure of intrateam and interteam learning processes.

Multiteam System Structures

The Luciano et al. (2015) framework posits that there are two primary structural dimensions of MTSs: differentiation and dynamism. Differentiation refers to sources of difference between component teams that create boundary-enhancing forces. Dynamism reflects the degree of stability or change experienced by MTS component teams. High levels of dynamism create disruptive forces. These two overarching dimensions address the shape of structure and how the structure changes over time. As previously mentioned, organizational learning can be conceptualized through three primary processes: knowledge creation, knowledge transfer, and knowledge retention. We now consider how these two structural aspects of MTSs affect the three organizational learning processes.

Differentiation

Simply put, differentiation is the degree of difference and separation of the component teams within an MTS at a particular point in time. Through differentiation, boundary-enhancing forces reinforce the division and dissimilarity between component teams, which, in turn, intensifies the salience of team membership. Differentiation is comprised of five subdomains that describe the interrelationships and boundaries among the component teams. These subdomains are *goal discordancy, competency separation, norm diversity, work process dissonance*, and *information opacity*. Overall, having high levels of differentiation between component teams will benefit some aspects of learning and impede others.

The first subdimension of differentiation is goal discordancy. Having a superordinate goal and a subgroup of interconnected collective goals is a key component of the MTS framework (Mathieu et al., 2001); therefore, ensuring goals are properly prioritized and organized across component teams is critical. *Goal discordancy* refers to the degree of goal incompatibility and disagreement of priority between teams within the system. When the priority level and subordinate goals are clear within a system, this subdimension is low. However, in more complex situations where component teams might have different opinions and underlying intentions regarding the subordinate goals, things get messier and goal discordancy is higher. Goal discordancy increases the salience of team goals, thereby increasing the attention and commitment to team goals. This can benefit team knowledge creation and retention but, at the same time, inhibit knowledge transfer across teams with discordant goals.

The second subdimension of differentiation is *competency separation*, which captures the way knowledge and functional capabilities are distributed across component teams. Competency separation describes the discriminant knowledge and skills within specific teams that make it difficult to substitute one team for another. Although some MTSs do not involve disparate functions between the individual teams, the existing MTS research primarily focuses on systems with siloed competencies in specialized teams (Davison et al. 2012; Marks et al., 2005). The relationship between competency separation and organizational learning is complex. Although high levels of competency separation may intensify group differences and segregate the teams, a sense of within-group pride and identity might emerge within individual teams. This pride and identity would enhance knowledge creation and retention.

Each component team within an MTS will have its own way of getting work done. The third subdimension of differentiation, norm diversity, characterizes this variability from team to team in these work processes. From policies, to culture, to cognitive systems, norm diversity addresses how these facets vary across teams. It has been suggested that systems with a high degree of norm variation across component teams will have more difficulty coordinating efforts (Zaccaro, Marks, & DeChurch, 2012). This is a clear impediment to knowledge transfer. However, this variation in expectations about norms and work processes can enhance knowledge creation and retention within the various teams. The greater norms differ between teams, the more teams are aware of their distinctiveness.

The fourth subdimension of differentiation is *work process dissonance*, capturing the degree of incongruence of processes across teams. This subdomain is especially important in terms of the interdependence of tasks. Without synchronization of processes across teams, the system will likely fail. Luciano et al. (2015) note that systems with low levels of work process dissonance may be more likely to collaborate. This level of collaboration could result in more innovation from greater knowledge creation (Nonaka, 1994).

The final subdomain of differentiation refers to the level of ambiguity of information about the inputs, processes, and outputs of other teams within the system. *Information opacity* is low when teams are readily aware of the actions of other teams. Conversely, information opacity is high when teams have little information about one another, or when the information is difficult to understand.

The five subdomains of differentiation between component teams create boundary-enhancing forces that have mixed effects on organizational learning. Differentiation brings about conflict, and it increases the degree to which team members introspect on their previously held ideas. In this way, differentiation may benefit intrateam learning through knowledge creation and retention. Teams in an MTS may be different, but they are also mutually reliant on one another regarding the attainment of some shared objective. This defining aspect of an MTS creates the conditions whereby individuals can benefit from exposure to different ideas. Thus, we posit:

> *Proposition 1: MTS differentiation promotes team learning by increasing intrateam knowledge creation and retention.*

Whereas differentiation among the component teams of an MTS may well benefit the learning that occurs *within* component teams, these differences can impede the degree to which knowledge is effectively transferred *across* them. Knowledge transfer requires both a sharing of information by one team, as well as a receptiveness by the other. Differences in intergroup relations make information less likely to be both shared and received. Accordingly, we posit:

> *Proposition 2: MTS differentiation impedes MTS learning by decreasing interteam knowledge transfer.*

Returning to the four opening scenarios, we can see the dimensions of differentiation and dynamism as they play out in different contexts. It is important to note that these contexts contain MTSs fitting into most if not all of these structural dimensions. We have simply chosen an exemplar of each for illustrative purposes. Figure 1 illustrates the differentiation and dynamism associated with each scenario.

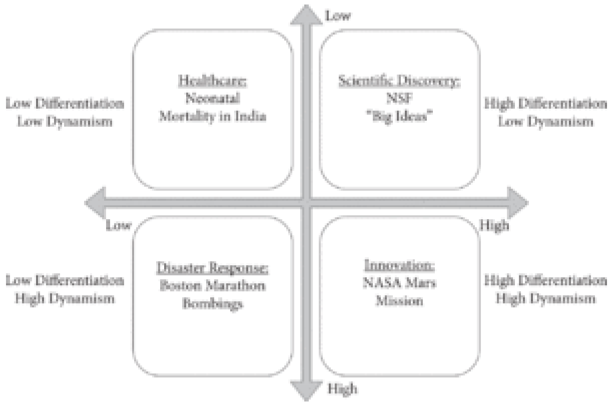

Figure 1. Structural features of exemplar multiteam systems.

In Scenario 1 (lower left quadrant), the MTSs who saved innumerable lives and limbs after the Boston bombings were relatively low on differentiation. Differentiation captures the degree of difference between the component teams in terms of skills, expertise, norms, and so on. Whereas there were a great many teams, and team members may have been highly diverse within the team, the different teams were somewhat comparable in terms of their expertise, the protocols they follow for triaging and treating patients, and so on. These teams have relatively low levels of *goal discordancy*. Their extensive medical training involves clear protocols for managing and prioritizing various aspects of patient care.

In Scenario 2 (upper left quadrant), the MTSs working to reduce neonatal mortality in India are also an example of an MTS relatively low on differentiation. Many teams of female health workers, called "Ashas," and technical support unit personnel work together to bring new health practices to the community. These teams are not particularly diverse either internally or across teams. Teams work in more of a divisional structure, where they are assigned to specific blocks within districts. The teams are interdependent because they must share supplies and other resources based on variations in local demands. The similarity in procedures followed by the different component teams illustrates one way these systems exhibit low levels of *work process dissonance*.

In Scenario 3 (lower right quadrant), the expert teams at NASA working to send humans to Mars are, unlike the two scenarios discussed earlier, an example of an MTS relatively high on differentiation. The component teams work on different aspects of the mission—for example, medical care, software systems, robotics, and mission training. These teams are highly specialized. The medical teams and software teams for example, have largely different educational backgrounds, and they differ substantially from the mostly engineering background of the robotics and training teams. These teams have different timelines on which they operate, and they use different norms to complete their work tasks. Furthermore, the crew and mission control for the Mars mission will represent a most extreme form of *information opacity*. When the crew is near Mars, they could face one-way communication delays of up to 21 minutes with teams back on Earth.

In Scenario 4 (upper right quadrant), the visionary research teams that will respond to the NSF's "10 Big Ideas" call are also an example of an MTS that is also relatively high on differentiation. The call emphasizes the need for interdisciplinary teams. Many of the teams that come together to write proposals will be comprised of different research groups, with relative homogeneity in interests and expertise within research teams, and heterophily between the different teams. This type of MTS illustrates a high level of *competency separation*, where members of a given component team are highly expert PhDs in similar fields who must work with members of other teams who have PhDs in other fields and disciplines.

Dynamism

As mentioned earlier, the Luciano et al. (2015) framework posits that there are two primary structural dimensions of MTSs: differentiation (discussed earlier) and dynamism. In this section we discuss dynamism, which is characterized by the rate and intensity of change to which teams are exposed. At the extremes, we can imagine MTSs, in emergency response for instance, that experience moment-to-moment shifts in multiple aspects of their tasks. At the other extreme, an academic research center that works on a decade-long study would be subject to much less frequent and lower intensity change. There are five aspects of dynamism in MTSs, all of which entail a change in the source of the change: goal hierarchy, task requirements, structural configuration, system composition, and attentional demands. Next we consider each of the five in more detail to illustrate the ways in which they can impede intrateam knowledge creation and retention and enhance interteam knowledge transfer.

The first aspect of dynamism is the degree to which *changes occur in the goal hierarchy*. In some more permanent MTSs, the goal hierarchy is predetermined and changes little over time. Disaster response MTSs often follow a predetermined emergency management plan that dictates the order or priority of various goals, such as prioritizing saving lives and property. This will result in pre-established relationships and priorities among the component teams. As an emergency management MTS illustrates, the environment can be quite turbulent in many ways, and yet the goal hierarchy can be rather stable. This MTS would be characterized as low on dynamism.

The second aspect of dynamism is the degree of *uncertainty in task requirements*. High dynamism occurs when MTS component teams are unsure or unclear about what is required to achieve their goals. Low dynamism occurs when the requirements of the various teams are well established and clearly understood by all.

The third aspect of dynamism is the *fluidity of the system's structural configuration*. Highly dynamic MTS experience many changes in how the component teams relate to one another. Less dynamic MTSs, in contrast, have stable and predictable links between teams.

The fourth aspect of dynamism is the *fluidity of system composition*. A dynamic MTS experiences shifts in team membership within the component teams and/or shifts in which teams are part of the MTS. In a stable MTS, the teams and their members are enduring, allowing strong, trusting relationships to form both within and between component teams.

The fifth aspect of dynamism is the *diversion of attention* among the component teams. This final aspect of dynamism reflects the degree to which component teams are also focused on accomplishing goals that are not part of the MTS goal hierarchy. Dynamic MTSs have component teams that pursue multiple goals simultaneously, only some of which contribute to the MTS goal. Stable MTSs include teams whose primary focus is the MTS and its goals.

Whereas dynamism would serve as an impediment to knowledge creation and retention, it may actually benefit knowledge transfer by changing the way teams experience differentiation. In the definition of differentiation, we note that it is a characteristic of an MTS at a particular point in time. To the extent that MTSs are highly fluid, differentiation may not fully take hold in generating the significant boundary-enhancing forces that would otherwise occur under more stable conditions. Thus, knowledge transfer may benefit from dynamism. A second reason why dynamism may benefit knowledge transfer involves the need for uncertainty reduction. As dynamism activates a need for order and control over the situation, MTS members may be more willing to share and receive information from across team boundaries. Therefore, we posit:

> *Proposition 3: MTS dynamism impedes team learning by decreasing intrateam knowledge creation and retention.*

> *Proposition 4: MTS dynamism enhances team learning by increasing interteam knowledge transfer.*

The four opening scenarios in Figure 1 can also be used to illustrate the dimensions of dynamism in MTSs. In Scenario 1 (lower left quadrant), the disaster response and medical team that saved innumerable lives and limbs after the Boston bombings were relatively high on dynamism. These MTSs are especially high on the *fluidity of the system's structural configuration*. Whereas many of the teams regularly worked together in predictable ways in the same hospitals, the unique wounds they encountered meant these teams had to reconfigure to bring in expertise from medical specialties that would not ordinarily work together. In fact, the low amputation rates at one of the hospitals have been credited to the pre-established relationships that enabled these teams to adapt when they were faced with new patient conditions (McChrystal, Collins, Silverman, & Fussell, 2015).

In Scenario 2 (upper left quadrant), the teams working to reduce neonatal mortality in India are an example of an MTS relatively low on dynamism. The composition of the teams stays relatively constant, providing a useful example of an MTS with low *fluidity of system composition*. Most of the field workers spend their entire careers living and working in their hometowns. They are not very mobile, and field workers typically continue to live and work close to their extended families. This continuity both helps and hinders learning. It facilitates trust within the local community, but it can make changing ideas and practices a challenge as they become deeply engrained in the culture.

In Scenario 3 (lower right quadrant), the expert teams at NASA working to send humans to Mars are an example of an MTS relatively high on dynamism. These MTSs will likely experience high levels of the dynamism dimension of *uncertainty in task requirements*. At the early stages of the mission, tasks may be relatively clear and predictable, but as with the Apollo and Gemini programs, the Skylab missions, and the shuttle program, countless scenarios will introduce high levels of uncertainty in the task requirements. For example, there was a high degree of uncertainty over the functioning of O rings when deciding whether or not to launch the Challenger. Similarly, there was a high degree of uncertainty surrounding the decision to land Columbia without waiting for images that could potentially show damage in the carbon panels of the shuttle’s exterior. The uncertainty that was disruptive to this MTS was not about what was the best overall decision, but rather how to perform the critical task faced by the MTS. In the case of Columbia, valuable imagery could have been ordered as part of the task. This would have required enlarging the MTS to include military units who could provide satellite imagery. However, the leadership of the NASA MTS decided instead that the task should not include this component.

In Scenario 4 (upper right quadrant), the visionary MTSs mobilized in response to the NSF’s “10 Big Ideas” call are examples that are relatively low on dynamism. These MTSs will write a grant proposal that requires them to identify who is in the MTS, what tasks they will perform, when those tasks will be completed, and how the various component teams will coordinate with one other. This a priori planning creates low dynamism on most of the subdimensions, especially the fluidity of structural configuration and system composition.

Concluding Remarks About Structure and Learning in Multiteam Systems

In this section, we have considered how the degree of differentiation and dynamism of MTSs create important boundary-enhancing and disruptive forces that affect the three subprocesses of organizational learning: creation, retention, and transfer. Differentiation and dynamism factors are inherent to the MTS and often difficult to directly alter. Much research on MTSs has examined structural forces as a way to explain what is likely to happen in MTSs. However, a second area of MTS research has taken a more prescriptive approach, focusing on leadership processes that can improve the functioning of MTSs. In the preceding section, we elaborated the boundary-enhancing and disruptive forces likely to affect learning processes. In the following section, we consider the role of leadership in promoting learning in MTS.

Leadership and Learning in Multiteam Systems

Given the complexity of teams working together in MTSs, leadership is especially critical (DeChurch & Mesmer-Magnus, 2010). As the previous section discussed, the differentiation and dynamism present in many MTSs give rise to boundary-enhancing and disruptive forces that enable or undermine effective intrateam and intergroup processes such as learning. Leadership is essential in these systems to balance these forces.

Before focusing on learning in particular, we review several critical functions of leadership in MTSs. Some of the basic ones include providing direction to teams on how their efforts contribute to the attainment of superordinate goals and directly facilitating coordination and information sharing with other teams. MTS leadership is needed to build emergent states that facilitate constructive between-team relations in MTSs. These emergent states are both cognitive and affective in nature. For example, shared between-team cognition is essential for MTS success (Murase, Carter, DeChurch, & Marks, 2014). Leadership is needed to help ensure that team members understand the role of their team in the larger system and the role of other teams. MTS leadership is needed to build affective emergent states as well. Positive affective states such as trust, cohesion, and efficacy have been well established bases for productive teamwork (Beal, Cohen, Burke, & McLendon, 2003; Gully, Devine, & Whitney, 1995; Gully, Incalcaterra, Joshi, & Beaubien, 2002; Mullen & Copper, 1994). Kanfer and Kerry (2012) elaborate the importance of MTS motivation and detail the process through which MTS members allocate effort and self-regulate across multiple levels of goals, and are affected by the quality of emergent states at the team and system levels. Kanfer and Kerry go on to consider these states at the system level and argue they are critical in motivating positive contributions to superordinate goals. Taken together, the research on MTSs suggests that cognitive and affective emergent states between teams are critical to MTS performance. These states are integral to the capacity for intrateam and interteam learning. Before returning to the nature of leadership systems in MTSs, we elaborate three intervening psychosocial mechanisms through which leadership promotes learning in MTSs: transactive memory, shared mental models, and affective states.

Leadership and Cognition

Cognitive emergent states, especially transactive memory, have been found to be a critical aspect of team learning (Argote & Ren, 2012; Ren & Argote, 2011). Team transactive memory is a shared system for encoding and retrieving information among team members. It is not only the differentiation of knowledge within a team but the development of a team directory where team members all know (accurately) who knows what so that this knowledge can be efficiently retrieved and combined as needed. This concept needs to be extended to the MTS level. MTS component teams have separate transactive memory systems, and these can be quite different between teams. MTS component teams also need to have transactive memory systems at the MTS level that allow knowledge needed for superordinate goals to be distributed across teams and to share a directory of which team knows what.

MTS transactive memory not only aids between-team knowledge transfer but also promotes intrateam knowledge creation and retention. As teams develop a larger system of differentiated knowledge, they are able to better attend to information for which the other teams are relying on them. This makes the team more responsible for its part of the superordinate goal and promotes intrateam knowledge creation and retention. This, coupled with the improved interteam knowledge transfer created by accurate directories of which teams know what, is an essential property of MTS transactive memory system enabling them to learn. Accordingly:

> *Proposition 5: MTS transactive memory systems promote intrateam knowledge creation and retention and interteam knowledge transfer, and they are especially critical in MTSs high (rather than low) on differentiation.*

Research on cognitive emergent states in teams has distinguished cognition that is shared among team members (i.e., shared mental models; DeChurch & Mesmer-Magnus, 2010) from cognition that is distributed among team members (i.e., transactive memory systems; Argote & Ren, 2012). To the degree that differentiation is high in MTSs, and teams have different norms, competencies, and so on, distributed forms of cognition will be essential. In fact, many failures in organizational learning can be traced to knowledge transfer problems that occur between teams. The failure to share intelligence between the CIA and FBI in the weeks and months preceding 9-11 is an example. The intelligence teams working within each agency may not have fully understood the interdependence of their work in protecting against a foreign enemy operating on domestic soil.

MTS shared mental models refer to cognitive structures or schemas of the task, the people, and procedures that are held in common by team members. Shared mental models allow team members to anticipate one another's needs often without the need for direct communication. Highly expert teams possess shared mental models that enable them to work as one, seamlessly coordinating their actions without the need to request information or to elaborate on or explain their actions. These cognitive states are also invaluable for learning, particularly in MTSs low on differentiation. In low-differentiation

MTSs, such as those who responded to the victims of the Boston Marathon bombing, component teams need to have a shared understanding of the situation and how to adapt to it. To the extent that teams hold different schema, their efforts will not be easily combined. They may not prioritize patient conditions appropriately or allocate treatment teams to patients in an optimal fashion. To the extent that the component teams in the MTS share an understanding of the task and situation, they can work in parallel coordinating with one another and transferring knowledge between teams as needed. Working in parallel will allow them to attend more carefully to their immediate tasks, facilitating their creation and retention of knowledge within the team. Accordingly:

> *Proposition 6: MTS shared mental models promote intrateam knowledge creation and retention and interteam knowledge transfer, and they are especially critical in MTSs low (rather than high) on differentiation.*

Leadership and Affect

Affective emergent states, in addition to the cognitive emergent states discussed earlier, have also been found to underpin effective processes between teams in MTSs (DiRosa, Estrada, & DeCostanza, 2015; DiRosa, 2013). These states, including motivation and cohesion, are also critical to other processes. For example, in the neonatal health care MTS in India, teams often need to share medical supplies based on local demand. Health centers with more demand will often request supplies from those with less demand. The accurate reporting of supply levels and willingness to share them will require the teams to trust one another's capability and to feel cohesive as a health delivery system in the larger community. Accordingly:

> *Proposition 7: MTS positive affective states promote intrateam knowledge creation and retention and interteam knowledge transfer.*

Though productive cognitive and affective emergent states can develop spontaneously, they often need cultivation by leaders. Abundant research on MTSs document the failures of these emergent states to develop on their own, and these failures can be attributed to boundary-enhancing and disruptive forces (DeChurch & Zaccaro, 2010; Shuffler et al., 2015). Given this natural tendency for teams to work closely internally and not to integrate with other teams, leadership processes are particularly important. The three psychosocial mechanisms discussed earlier, MTS transactive memory, mental models, and affective states, explain how leadership can improve learning in MTS.

> *Proposition 8: MTS leadership affects intrateam knowledge creation and retention and interteam knowledge transfer through three psychosocial mechanisms: MTS transactive memory, mental models, and affective states.*

The Structure of Leadership

Now that we have considered the function of leadership in MTS, we explore the kinds of leadership structures, or forms, that benefit MTS learning. Research on leadership in MTSs largely adopts a systems approach (Zaccaro & DeChurch, 2012). According to this approach, the leadership system is a set of relationships through which multiple members of an MTS lead and follow to accomplish MTS goals. This perspective was elaborated by Contractor et al. (2012) and Carter et al. (2015), who argued that MTS leadership is the process of directing, coordinating, and motivating activities needed to accomplish MTS goals. Because of its inherent complexity, MTS leadership is typically carried out by multiple members at any given time. Previous work on MTS leadership has elaborated the group functions that need to be met by leadership (DeChurch & Marks, 2006) and the leadership configurations (Sullivan, Lungeanu, DeChurch, & Contractor, 2015; Zaccaro & DeChurch, 2012) through which these functions are enacted in MTSs.

Shared leadership is a dynamic and interactive influence process whereby individuals influence one another to achieve collective goals (Conger & Pearce, 2003). Conversely, vertical leadership occurs when one individual or a few individuals fulfill leadership roles on a team. Research suggests that shared leadership is more likely to occur when members have high but diverse levels of expertise (e.g., distributed expertise; informational diversity; functional heterogeneity) or when the collective task is highly interdependent (Zaccaro & DeChurch, 2012). Evidence indicates that shared leadership has a positive relationship with team performance in a variety of contexts (Nicolaides et al., 2014). Studies also show that shared leadership indirectly relates to other important outcomes as well, such as team confidence (Nicolaides et al., 2014) and positive affective tone (Hmieleski, Cole, & Baron, 2012).

At the MTS level, shared leadership occurs when influence is relatively even and mutual between the component teams (Zaccaro et al., 2012). Influence processes across teams can range from *centralized*, with influence concentrated among a few members or component teams, to *decentralized*, with all members or component teams having relatively equal influence. Several factors may affect the influence of component teams, such as a team's placement in the MTS goal hierarchy, team size, or functional expertise.

A team's placement in the goal hierarchy can also shape its influence relative to other teams. This is especially prominent in what are called sequential MTSs. A *sequential MTS* is one that exhibits a serial form of interdependence between teams—one team's output becomes the input for a subsequent team. Teams that are involved first may make choices that ultimately constrain the actions of subsequent teams, thereby giving the "first" teams greater influence within the MTS. Teams that are involved earlier also typically have more information and experience with the task than teams that come in later in the MTS life cycle. Larger component teams may also wield greater influence than smaller ones. And certain functions often align with meaningful status differences affording certain teams greater influence than others. For example, in medical MTSs, surgical teams typically have greater status than recovery teams.

Research has found that decentralization or sharing of leadership is good for stand-alone teams (e.g., Cordery, Morrison, Wright, & Wall, 2010; Pearce & Sims, 2002), but findings for MTSs are not as clear cut. Some scholars suggest that decentralization might be beneficial for performance outcomes in MTSs. For example, Zaccaro and DeChurch (2012) suggest that when influence is centralized, then shared leadership is less likely to occur, which should have negative outcomes. Similarly, a “leader team” for communication of strategic plans is beneficial for between-team coordination, as it positively affects component team cognition (Murase et al., 2014). This supports the claim that an MTS with centralized influence using a leader team will have positive performance due to accurate team cognition leading to sufficient between-team coordination.

However, because MTSs are large and real-time communication among all team members is often difficult, shared leadership has the potential to create problems involving risk management and knowledge sharing (Lanaj, Hollenbeck, Ilgen, Barnes, & Harmon, 2013; Mintzberg, 1983). Indeed, researchers studying MTSs have found that decentralized planning has positive effects on productivity and aspiration, but negative effects on performance due to risk seeking and coordination failures (Lanaj et al., 2013). These costs of decentralized planning outweighed the benefits overall. Clearly, centralization of power has the potential to produce complex effects and differential outcomes in MTSs.

The aforementioned dimensions of differentiation and dynamism have the potential to explain these differential outcomes. The MTSs investigated by Lanaj and her colleagues were relatively low in differentiation and dynamism. At the other end of the continuum, we can consider how MTSs focused on creativity and innovation may experience shared leadership. When leadership is shared rather than vertical, team members have a greater opportunity to think collaboratively. Shared leadership means that multiple members are engaged in problem-solving activities and contributing their ideas and solutions. The diversity of ideas and skills across MTS component teams generally necessitates shared leadership, and this collaborative engagement in leading the MTS benefits the creation and retention of knowledge, as well as its transfer across teams. Accordingly:

> *Proposition 9: Shared leadership in an MTS promotes higher levels of intrateam knowledge creation and retention, and interteam knowledge transfer.*

Though shared leadership ought to benefit knowledge processes in general, this effect is likely to be especially pronounced in MTSs with low levels of either differentiation or dynamism. When an MTS is characterized by low differentiation or dynamism, shared leadership can provide an important generator for needed intrateam and interteam learning processes. Recall that earlier we explained how differentiation among teams likely benefits intrateam processes, namely knowledge creation and retention (Proposition 1). When the MTS structure does not create the conditions necessary to fuel these two learning subprocesses within the team, shared leadership will be especially valuable as a way to substitute for the structure and stimulate knowledge creation and retention within the team. Similarly, we expect that MTS dynamism improves interteam knowledge transfer (Proposition 4). In MTSs with low dynamism, shared leadership can serve as a substitute, stimulating interteam knowledge transfer. Accordingly:

> *Proposition 10: The effects of shared leadership on intrateam knowledge creation and retention, and interteam knowledge transfer, are strongest for MTSs low on differentiation and/or dynamism.*

To illustrate how shared leadership would be more and less important to learning for MTSs exhibiting different degrees of differentiation or dynamism (Proposition 10), we return to the four exemplar MTSs described earlier, which are depicted in Figure 1. With regard to differentiation, the health care MTS (upper left quadrant) and disaster response MTS (lower left quadrant) have component teams with relatively low or weak differentiation, as compared to those in scientific discovery or space exploration. We would expect that shared leadership would play an even more important role when the structure is not creating strong boundary forces that promote intrateam knowledge creation and retention. Shared leadership, wherein multiple members of the MTS are actively engaged in directing, motivating, coordinating, and integrating effort and ideation, can provide the engagement needed for intrateam learning.

Consider the MTSs working to reduce neonatal mortality in India (upper left quadrant), teams of workers with largely similar backgrounds and skills need to bring new health practices to their blocks. One health practice related to neonatal mortality is the application of chlorhexidine solution on the umbilical cords of newborn babies. Each of the teams working in a particular block will need to understand the specific obstacles preventing the adoption of this practice in their district and develop strategies to increase its use. A team may develop a way to explain the practice to new mothers or health workers that allays their fears. This is intrateam knowledge creation. The team may develop checklists to be used by those delivering babies that codifies the new practice (intrateam knowledge retention). Shared leadership is a valuable way to stimulate these intrateam learning processes.

Compare this health care MTS with an exemplar that is high on differentiation: scientific discovery (upper right quadrant). In the scientific MTS comprised of teams working in different disciplines, the strong boundaries between teams can stimulate intergroup competition and reinforce the norms and procedures within each team. In this way, the structure may stimulate intrateam learning. This is not to say that shared leadership is unimportant in these MTSs, but rather that it is especially critical in the case of low differentiation.

Similarly, shared leadership is especially critical to stimulate interteam knowledge transfer in MTSs low on dynamism. Returning to the exemplars in Figure 1, we compare the interdisciplinary science MTS (upper right quadrant) to the space exploration MTS (lower right quadrant). The interdisciplinary science MTS experiences relatively low dynamism as compared to the space exploration MTS. With the Mars MTSs, the uncertainty and unpredictability inherent in the mission provide a useful catalyst for interteam knowledge transfer. In contrast, the relative predictability of the mission of the interdisciplinary science MTS will render shared leadership especially important to interteam knowledge transfer. We offer these propositions about the role of shared leadership, MTS structures, and intrateam and interteam learning processes as a starting point for future theory and research about MTS learning.

Figure 2 provides a summary of our overall conceptualization of learning in MTSs. The core learning processes in MTSs are intrateam knowledge creation and retention, and interteam knowledge transfer. These learning processes within and between teams are likely to be shaped by the boundary-enhancing and disruptive forces arising out of MTS differentiation and dynamism. We submit that shared leadership, promoting positive affective and cognitive emergent states, is an important lever of learning in MTSs, especially when the structural aspects of the MTS fail to stimulate one or more learning processes.

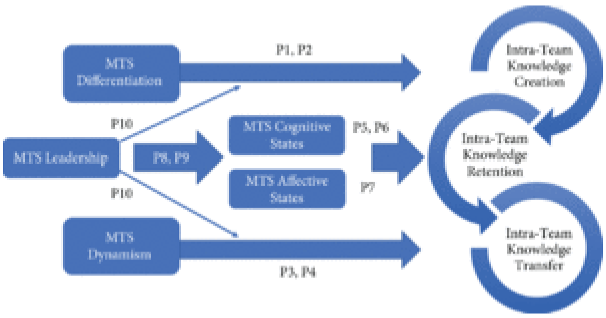

Figure 2. Conceptualizing learning in multiteam systems. MTS, multiteam system.

Conclusion

Research on MTSs has become increasingly sophisticated in the last 20 years. Exploration of this topic began around the turn of the century (Mathieu et al., 2001), investigating interteam process and performance in relatively small systems—two or three teams each with two or three members—in highly controlled laboratory settings (DeChurch & Marks, 2006; Marks et al., 2005; Murase et al., 2014). Since those early studies, the science has flourished. MTS research has studied larger systems in more field-like settings (Chen et al., 2014; Davison et al., 2012; Firth, Hollenbeck, Miles, Ilgen, & Barnes, 2015; Lanaj et al., 2013). The science has also expanded from studying primarily behavioral MTSs, such as those used in military tasks, to knowledge-intensive organizational systems that pursue innovation (Asencio et al., 2012; DeChurch & Zaccaro, 2013). As the science has begun to formalize key concepts and relations that explain interteam processes and outcomes in these systems, interventions have been designed to improve the effectiveness of these systems in applied settings ranging from medicine to space exploration (Shuffler, Rico, & Salas, 2014).

Despite these advances in the science and practice of MTSs, the learning perspective has been curiously absent. Consider the following excerpt from the NASA team investigating the Mars Climate Orbiter crash:

> The peer review preliminary findings indicate that one team used English units (e.g., inches, feet and pounds) while the other used metric units for a key spacecraft operation. This information was critical to the maneuvers required to place the spacecraft in the proper Mars orbit.
>
> (Isbell, Hardin, & Underwood, 1999, para. 3)

This incident illustrates many of the ideas laid out in this chapter. First, we can understand how the high degree of structural differentiation in the Mars Climate Orbiter MTS created boundary-enhancing forces that isolated the component teams and hindered their awareness of what other teams had done. This reflects a very high level of work process dissonance, wherein “component team processes are incongruent and conducted independently” (Luciano et al., 2015, p. 8). Second, we can see inadequate cognitive and affective emergent states. Third, leadership within these teams was needed to create these states and ensure the teams understood how their separate work products needed to integrate in order for the larger mission to succeed.

If we focus on MTS performance, we can perhaps fix these problems. However, many MTS failures are low–base rate and high-consequence events (March et al., 1991). This means that much of the experience of working in MTSs will involve successes or near misses that can inflate members’ confidence in their abilities and impede learning (Madsen & Desai, 2010). In their analysis of the space shuttle Columbia disaster, Madsen and Desai pointed out that:

> The board argued that NASA’s long history of success in the shuttle program contributed to the Columbia accident by artificially inflating NASA managers’ confidence in their ability to manage the risks of human space flight. (p. 452)

This is a poignant illustration of the critical need to incorporate a learning focus in MTS research. Future theory building, qualitative, and quantitative investigations are needed.

In this chapter, we have tried to pave the way for a systematic learning focus within the MTS research community (summarized in Figure 2). Likewise, we hope to introduce MTSs as an important unit of inquiry into the discourse on organizational learning. Many of the classic illustrations of organizational learning—for example, the Challenger and Columbia disasters—actually point to failures in organizational learning processes within and between teams. We offer the focus on intrateam knowledge creation and retention, and interteam knowledge transfer as a useful starting point for thinking about how to conceptually and operationally define learning in MTSs. Furthermore, we think leadership structures and multiteam emergent states are particularly valuable drivers of learning.

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