

Collaboration in Multiteam Systems: The Leader and the Architect

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ABSTRACT

As collaborative work arrangements are applied to increasingly urgent and complex problems, a consideration of the integrative processes occurring across diversely motivated teams, different organisations, and fields of expertise becomes ever more vital. A recent conceptualization of this type of collaborative approach is that of the multiteam system (MTS), which formally considers the internal and external characteristics of interdependent teams working together on a partially shared set of goals (Mathieu, Marks, & Zaccaro, 2001). The research presented in this paper extends the understanding of team process to the multiteam level and presents a more holistic perspective of the relationship between multiple processes and performance through the application of contingency theories. Within a laboratory experiment, the manipulation of three MTS determinants (trust, communication, and leadership) were all found to have relationships with relevant MTS processes and performance. These relationships, however, were found to be fully contingent on the structural characteristics of one another.

1.0 INTRODUCTION

Many of the most urgent and complex problems facing society today require collaboration among a large numbers of teams possessing diverse expertise, representing different embedded organisations (e.g., NGOs, governmental entities, nations), and distributed in time and space. The collaborative approach requires extensive integration across many differently motivated entities. Although inherently challenging, there is a growing awareness that such collaboration is essential to realizing long-term objectives.

This paper summarizes findings from a stream of research in organisational science that has focused on this very problem. The organizational entity used to elaborate the problem is the multiteam system. Multiteam systems (MTSs) are a relatively new unit of inquiry in the organisational sciences (DeChurch & Mathieu, 2009) that refer to networks of teams which work towards at least one shared goal, in addition to their individual team goals. More formally, a MTS is defined as “two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals” (Mathieu, Marks, & Zaccaro, 2001, p. 290). Thus, the MTS perspective focuses on network-level performance and the synchronization of components as opposed to the effectiveness of individual teams.

The current research presents findings from a recent experiment examining three determinants of MTS effectiveness: trust, communication, and leadership. We draw on structural contingency theory to advance and test a model whereby system effectiveness is maximized to the extent that forms of leadership match the task and socio-emotive structural determinants of the MTS.

Leadership research has long held that certain leadership styles and behaviors are differentially effective under different situational demands (Fiedler, 1967; Hershey & Blanchard, 1995; House, 1991; 1996; Kerr & Jermier, 1978). Fiedler’s least preferred coworker model proposed that situational favorability determines the relative effectiveness of task versus relationship oriented behaviors. House’s path-goal theory proposed that follower ability and satisfaction determine the relative effectiveness of various path-goal clarifying behaviors (House, 1996). While these situational contingency views hold that the content of what a leader needs to do depends on the situation, there are reasons to believe that the most appropriate form of leadership (i.e., the distribution of leadership behaviors displayed across individuals, irrespective of content) may also depend on the situation. We propose that the internal structure of trust and communication are two such determinants. Thus, while leader behaviors impact system functioning, the effectiveness of these behaviors is differentiated by the established affective, behavioral, and cognitive architectures. That is, the architect of the MTS structure, whether embodied by the members of the system (i.e., internally emergent) or some external source (i.e., formally imposed), is expected to have at least as strong an impact on functioning as the leaders themselves.

In a MTS, the goal hierarchy creates a situation wherein goals across teams may in fact compete for limited attentional resources. Individuals are working towards their team goal and also the multiteam system goal, and to the extent that effort cannot be simultaneously allocated to both goals, often team members will have to allot finite resources to either ensure the success of their team, or to subordinate the goal of the team in favor of meeting the goal of the larger system. A pivotal driver of individuals’ willingness to forgo team success in favor of the success of the system is the degree to which there is trust in the other teams in the system.

The second situational moderator important in multiteam systems is the communication structure. A core feature of organisational design is the extent to which structures are centralized versus decentralized. Decentralized organisations are flatter, with all members of the organisation exhibiting similar patterns of connectivity to other members. Centralized organisations have certain members exhibiting the bulk of the connectivity, with other members communicating through those “central” individuals. In addition to the need for alignment in the design of MTSs in terms of leadership and the two structural features of trust and communication, we further expect that independent of leadership, there is value in the alignment between the communication and trust structures of the system. Moreover, the cross-team processes of affect, behavior, and cognition will shape the multiteam performance. Figure 1 summarizes the key relationships important to our research questions.

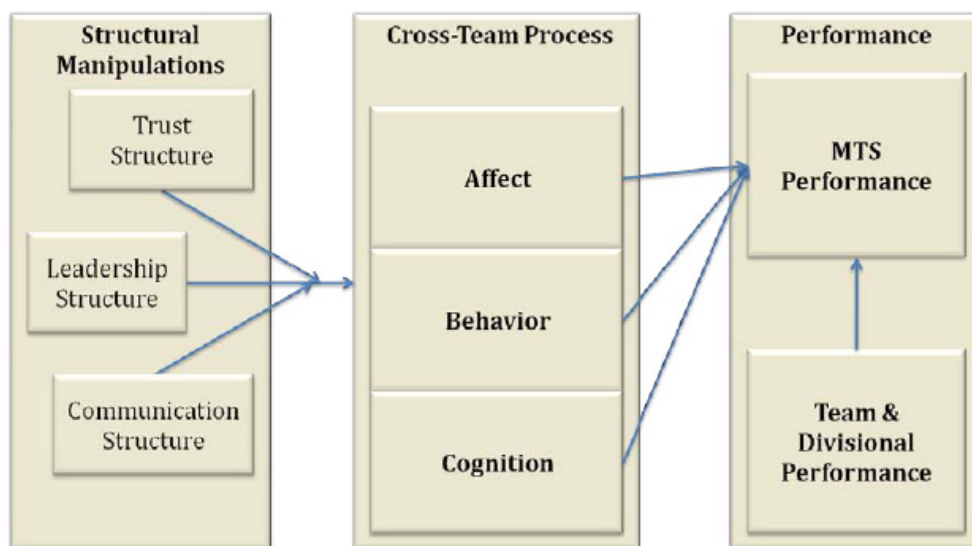


Figure 12 - 1. Summary of relationships between collective leadership, trust, and communication and multiteam performance.

This perspective of leadership forms was studied through the following three research questions (RQ):

- RQ1: To what extent does the level of trust within the MTS impact the relationship between leadership and the affect, behavior, cognition, and performance of an MTS?
- RQ2: To what extent does the communication structure within the MTS impact the relationship between leadership and the affect, behavior, cognition, and performance of an MTS?
- RQ3: To what extent does the level of trust and the communication structure within the MTS interact to impact the affect, behavior, cognition, and performance of an MTS?

2.0 MTS EXPERIMENTATION PROCEDURE

In order to test these research questions we conducted a laboratory experiment utilizing a research platform designed to study a MTS composed of four 2-person teams (two of the four teams were composed of one participant and one confederate) tasked with leading a humanitarian convoy through a hostile territory. This task was completed through a computer-based interface that required participants to locate and interpret information, complete appropriate actions, and coordinate with other members of their team and the MTS. The MTSs were studied across two levels of three manipulations:

- leadership form (vertical or collective),
- trust structure (dense or sparse), and
- communication structure (centralized or decentralized).

Each of the three manipulations was introduced into the experimental session through a different method. The leadership form was manipulated by providing different members of the MTS with a cross-team leadership training module. In the vertical condition, only two members designated as leaders received this module, whereas all members of the MTS received it in the collective condition. The trust structure was manipulated through false feedback that indicated either a large (dense) or small (sparse) number of strong trust relationships between members of different teams. Lastly, the communication structure was manipulated by enabling a different set of channels within the electronic communication system used by the MTS. The centralized condition instituted a structure wherein two members held all the channels, whereas the decentralized condition saw a structure wherein all members held at least one unique channel.

2.1 RQ1: TO WHAT EXTENT DOES THE LEVEL OF TRUST WITHIN THE MTS IMPACT THE RELATIONSHIP BETWEEN LEADERSHIP AND THE AFFECT, BEHAVIOR, COGNITION, AND PERFORMANCE OF AN MTS?

The extent to which component teams in the MTS believe that other teams will follow through on their promised behaviour (i.e., cross-team trust) sets an important context for leadership. Collective leadership is the shared, mutual enactment of leadership in a collective (Hiller, Day, & Vance, 2006). This construct has both a motivational and a behavioral component, capturing the extent to which team members are willing and able to lead the team. In this way, to be effective, collective leadership requires trust (Avolio, Jung, Murry, & Sivasubramaniam, 1996). In the absence of trust, collective leadership would be less effective than vertical leadership in directing collective functioning. However, when there are high levels of trust among component teams, collective leadership provides multiple adaptable hands available to pitch in and lead the team as becomes necessary to accomplish tasks and coordinate actions.

Taking into account the entire pattern of results, it was found in this study that under decentralized communication structures, collective leadership was more effective than vertical leadership in improving MTS affect, behavior, and cognition when trust was high whereas the opposite was true when trust was low.

Under centralized communication, however, a similar but reversed pattern was observed such that vertical leadership was more effective when trust was high and collective leadership was more effective when trust was low. This pattern was found to be largely consistent across several of the measured constructs previously theorized to be necessary conditions of system functioning (e.g., Mathieu et al., 2001; Marks, Mathieu, Zaccaro, 2001). These included two measures of collective affect: collective identification with the MTS and density of trust relationships, as well as a measure of collective behavior and cognition: density of interpersonal functional leadership behaviors and transactive memory (TMS) specialization, respectively.

Although we did not find fully analogous effects on MTS performance, a similar contingent relationship between the leadership form and situational demands due to trust was found. This relationship existed such that vertical leadership was more effective in improving MTS performance when trust was high while collective leadership was more effective when trust was low. Though this result may seem initially counterintuitive, it simply suggests that when there is strong trust, the system requires fewer leadership behaviors whereas when trust is weak, the system coordinates better when more members are able to engage in these same behaviors. These findings support extending the traditional logic of leadership contingency theories (i.e., different leadership behaviors for different situational demands; Fiedler, 1967; Hershey & Blanchard, 1995; House, 1991; 1996; Kerr & Jermier, 1978) such that the form of leadership must also be a considered contingency. Accordingly, it is not necessarily the behaviors of leaders that need to shift, as traditional contingency theories would suggest, but rather the pattern of enactment of these behaviors across members (e.g., vertical vs. collective leadership forms). These findings support the idea that MTS process and possibly performance depends on a match between the leadership structure and the degree of cross-team trust.

2.2 RQ2: TO WHAT EXTENT DOES THE COMMUNICATION PATTERN WITHIN THE MTS IMPACT THE RELATIONSHIP BETWEEN LEADERSHIP AND THE AFFECT, BEHAVIOR, COGNITION, AND PERFORMANCE OF AN MTS?

MTSs can operate under either centralized or decentralized structures, and we would anticipate that different forms of leadership would be more or less effective depending on this structural determinant. In centralized structures, it may be counterproductive for members to simultaneously share in leadership functions since all members are not equally positioned in the communication structure. Under the centralized structure, collective leadership is inefficient. Conversely, vertical leadership, wherein the leaders hold central positions in the communication network, maximizes efficiency under centralized forms.

If we consider the multiteam system that exhibits a more decentralized form, where all members hold similar degrees of connectivity, the advantage switches to collective leadership forms, where leaders become substitutable – there is now an advantage to having multiple members sharing in the enactment of the leadership functions. To the contrary, under a decentralized structure, it is inefficient to have a vertical leadership structure where teams need to rely on relatively fewer individuals to direct and manage the teams. As the core aspects of multiteam functioning are affective, behavioral, and cognitive architectures across teams, we propose that the optimal leadership form depends on the communication structure of the MTS, and that when there is alignment between leadership forms and communication structures, MTSs will better develop the needed affective, behavioral, and cognitive architecture needed for success, and will subsequently perform better than MTSs where there is a misalignment between leadership forms and communication networks.

We found in the present study that when MTSs operate in decentralized communication networks, collective leadership lead to higher levels of MTS affect, behavior, and cognition than did vertical leadership, whereas under centralized communication networks, vertical leadership lead to higher levels of MTS affect, behavior, and cognition. Once again, these relationships existed for social identification, greater density of functional

leadership behaviors, and more specialized TMS (i.e., transactive memory specialization). Additionally, it was found that the effect of leadership on TMS specialization was directly affected by the centralization of the MTS such that vertical leadership was more beneficial to TMS specialization under centralized structures and collective leadership was more beneficial under decentralized structures. This indicates a clear contingency in the preferred form of leadership as it improves the distribution of expertise perceived by the members of the MTS (i.e., transactive memory specialization), an important form of collective condition (DeChurch & Mesmer-Magnus, 2010).

Unlike the contingent MTS performance relationship between leadership form and trust, no effects were found for the analogous relationship contingent on the communication pattern. Taken with the findings reported for the first research question, however, these findings further support our assertion of the appropriateness of leadership contingency theories. Specifically, MTS process clearly depends on a match between the leadership structure and the communication structure of the MTS, in addition to the degree of cross-team trust. While there was no support in our findings of a direct effect of this match on MTS performance, previous research suggests the possibility of distal mediation due to the aforementioned impact on MTS process and established relationship between these processes and MTS performance (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; DeChurch & Marks, 2006).

2.3 RQ3: TO WHAT EXTENT DOES THE LEVEL OF TRUST AND THE COMMUNICATION PATTERN WITHIN THE MTS INTERACT TO IMPACT THE AFFECT, BEHAVIOR, COGNITION, AND PERFORMANCE OF AN MTS?

If we consider the situation where component teams exhibit low levels of cross-team trust, the preferred communication structure is highly centralized, where some individuals do the bulk of the cross-team communication on behalf of the team. Conversely, when trust is high, the efficiency afforded by a decentralized communication network can be realized. Members inherently trust the members of other teams, and therefore dividing work by allowing multiple members to traverse team boundaries is more efficient than conversing only through a subset of boundary-spanning team members.

We expected that under high component team trust, decentralized communication networks would result in higher levels of MTS affect, behavior, cognition and performance than centralized communication networks, whereas under low component team trust, centralized communication networks would result in higher levels of MTS affect, behavior, cognition, and performance. Support for these effects was found for MTS performance and measures of each MTS process: density of trust relationships, functional leadership behavior density, and shared cognition. While shared cognition is a frequent conceptualization of collective cognition (Fiore & Salas, 2004), it should not be confused to be synonymous with the aforementioned construct of transactive memory specialization. Shared cognition indicates the extent to which different members have a common understanding rather than a perception of a distribution of expertise.

Unlike with the aforementioned MTS process and what was found in the previous contingency relationships, the pattern did not hold for TMS specialization as it was found to be strongly impacted directly by trust. Beyond this, it was found that under distrust, there is an advantage to the centralized structure as compared to the decentralized structure. This pattern may be occurring because the centralized structure required communications to travel through fewer distrusting members than the decentralized structure. As opposed to what was found with the leadership contingencies, the interaction of trust and communication structure did have an effect on MTS performance such that MTS with complementary structures (high cross-team trust and decentralization or low cross-team trust and centralization) perform equally well and better than MTSs with unmatched structures. These findings support the contingency perspective beyond even leadership processes to incorporate two aspects of collective functioning: task and relationship maintenance in MTSs.

3.0 CONCLUSION

Overall, these findings indicate a clear need to consider not only the specific behaviors enacted by individuals within an MTS, but also the different relational structures that emerge. Previous research has supported the former in that the effectiveness of different behaviors is contingent on the situational demand characteristics (Zaccaro, Rittman, & Marks, 2000), whereas the current research supports the latter. These findings suggest a clear deficit in the current understanding of how multiteam systems can effectively function which is of great import as these collectives exist in many critical environments. While previous research espouses the benefits of collective leadership, open communication, and high levels of trust, which are all expected to be positive predictors of performance individually, it has largely failed to consider these effects in the presence of one another. Conversely, this research shows the contingent nature of these relationships and suggests a need to match the patterns of these emergent processes with one another to achieve optimal performance.

4.0 REFERENCES

- [1] Avolio, B.J., Jung, D.L., Murry, W., & Sivasbramaniam, N. (1996). Building highly developed teams: Focusing on shared leadership processes, efficacy, trust and performance. *Advances in Interdisciplinary Studies on Work Teams*, 3, 173-209.
- [2] DeChurch L.A., & Marks, M.A. (2006). Leadership in multiteam systems. *Journal of Applied Psychology*, 91, 311-329.
- [3] DeChurch, L.A., & Mathieu, J.E. (2009). Thinking in terms of multiteam systems. In E. Salas, G.F. Goodwin, & C.S. Burke (Eds.), *Team effectiveness in complex Organizations: Cross-disciplinary perspectives and approaches*.
- [4] DeChurch, L.A., & Mesmer-Magnus, J.R. (2010). The cognitive underpinnings of effective teamwork: A meta-analysis. *Journal of Applied Psychology*, 95, 32-53.
- [5] Fiedler, F. E. (1967). *A theory of leadership effectiveness*. New York, NY: McGraw-Hill.
- [6] Fiore, S.M., & Salas, E. (2004). Why we need team cognition. In *Team cognition: Understanding the factors that drive process and performance* (235-248). Washington, DC: American Psychological Association.
- [7] Hershey, P., & Blanchard, K. (1995). *Organization and behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- [8] Hiller, N.J., Day, D.V., & Vance, R.J. (2006). Collective enactment of leadership roles and team effectiveness: A field study. *The Leadership Quarterly*, 17, 387-397.
- [9] House, R. J. (1991). The distribution and exercise of power in complex organizations: A MESO-theory. *Leadership Quarterly*, 2, 23-58.
- [10] House, R. J. (1996). Path-goal theory of leadership: Lessons, legacy and reformulated theory. *The Leadership Quarterly*, 7, 323-352.
- [11] Kerr, S., & Jermier, J. M. (1978). Substitutes for leadership: Their meaning and measurement. *Organizational Behavior and Human Performance*, 22, 375-403.

- [12] Marks, M.A., DeChurch, L.A., Mathieu, J.E., Panzer, F.J., Alonso, A. (2005). Teamwork in multiteam systems. *Journal of Applied Psychology*, 90, 967-971.
- [13] Marks, M.A., Mathieu, J.E., Zaccaro, S.J. (2001). A temporally based framework and taxonomy of team processes. *The Academy of Management Review*, 26, 356-376.
- [14] Mathieu, J.E., Marks, M.A., & Zaccaro, S.J. (2001). Multiteam systems. In N. Anderson, D.S. Ones, H.K. Sinangil, & C. Viswesvaran (Eds.), *Organizational psychology: Vol. 2. Handbook of industrial, work and organizational psychology* (pp. 289-313). London: Sage.
- [15] Zaccaro, S.J., Rittman, A.L., Marks, M.A. (2001). Team leadership. *The Leadership Quarterly*, 12, 451-483.

