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Structural influences upon coordination and performance in multiteam systems

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ABSTRACT

Building upon organizational design and boundary spanning and multilevel literatures, we propose a theoretical framework that extends previous work on the drivers of multiteam system (MTS) coordination and performance. Our proposal integrates aspects of functional process interdependence and different integration mechanisms used within MTSs to better elucidate how different coordination processes emerge. The framework exposes potential countervailing or confluent effects of coordination processes on performance and, thereby, reconciles seemingly incongruent findings regarding the effect of different approaches to coordination on MTSs performance. In addition, our framework helps managers consider the multilevel nature of MTS coordination processes in ways that assist them in selecting an approach to effectively address the coordination challenges inherent in these complex systems.

1. Introduction

The leading organ transplant organization in the world, the Spanish National Transplant Organization, transplanted 2552 kidneys, 285 lungs and 249 hearts in 2013. This complex, life-saving and hope-giving task is only possible because of an extremely well-coordinated system of highly specialized teams. From a team of psychologists and grief counselors who talk to a heart-broken family to authorize a donation, to an intensive care unit (ICU) team keeping the vital organs viable after brain death of the donor, to a surgery team that extracts the donated organs, to a transplant coordinating unit arranging teams to transport the organs and coordinating the recipient surgery and anesthesia teams to receive the organs and complete the transplant. These teams have goals of their own to achieve, yet as highly interdependent members of an integrated system of work, their ultimate success is defined by a common superordinate goal – the successfully transplant of an organ. Achieving this life-saving goal requires effective integration and coordination of activities both within and across team boundaries. Highly interdependent teams of specialists, each with their own goals, yet sharing a superordinate goal (or set of goals), is the quintessential description of a multiteam system (Mathieu, Marks, & Zaccaro, 2001).

Multiteam systems (MTSs) are enacted to address complex and urgent problems across a broad range of economic sectors. Environmental disasters, security crises, agricultural crop developments, cleaner energy, more sustainable mobility, key military operations, scientific discoveries, medical operations, and space exploration are examples of productive activities managed by teams of

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interdependent teams. Consequently, understanding the drivers of MTS performance and learning to manage them effectively continues to be a matter of great interest to scholars and practitioners alike (de Vries, Hollenbeck, Davison, Walter, & van der Vegt, 2016). Extant research has identified coordination of activities within and between component teams as a key determinant of MTS performance, yet a more nuanced description of how effective coordination might be realized in practice is yet to be articulated. The purpose of this paper is to present a theoretical framework that describes how coordination processes emerge across levels in MTSs and to explain how coordination processes relate to effective performance in multiteam systems.

MTSs are complex organizational units that can be conceptualized as tension systems in which effective functioning requires reconciling the opposing forces emanating from the simultaneous need for both self-reliant component teams and a tightly coupled system (Lewin, 1936; Mathieu, Luciano, & DeChurch, 2017). The notion of tension systems was articulated by Luciano, DeChurch, and Mathieu (2015) when describing the structural forces that power MTSs and concurrently threaten their performance. Differentiation structural forces are boundary-enhancing forces that bolster the differences within a system. Specific to MTSs, organizing component teams by specialization enhances team membership salience while diminishing MTS identification. As a result, inter-group conflicts and workflow disruptions increasingly impair system performance (Rico, Hinsz, Burke, & Salas, 2017). Dynamism structural forces are disruptive forces that increase uncertainty and destabilize a system (Luciano et al., 2015). Shifts in the performance environments faced by MTSs alter goal priorities and, thereby, task demands (i.e., dynamic centrality; Davison, Hollenbeck, Barnes, Sleesman, & Ilgen, 2012). The resultant workflow disruptions impair effective MTS governance and goal attainment.

Accordingly, creating MTSs that work effectively requires compensating for both differentiation and dynamism forces such that a state of dynamic equilibrium is achieved within the system. MTS scholars have proposed that coordination is a key compensatory process that serves to stabilize a MTS (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; DeChurch & Marks, 2006; Mathieu, Maynard, Taylor, Gilson, & Ruddy, 2007). However, extant research has shown that coordination in a MTS is more complex than originally thought (Davison et al., 2012; Lanaj, Hollenbeck, Ilgen, Barnes, & Harmon, 2013). Findings suggest that unfettered direct coordination between members of different component teams (i.e., anyone with anyone) is inefficient and becomes increasingly detrimental to MTS performance as relational and information processing complexity increases. Although coordinated action within component teams remained positively related to MTS performance, the use of informal coordination mechanisms between component teams causes MTSs to operate like a large undifferentiated team, negatively impacting the effects of between component team coordination on MTS performance. These findings illustrate that MTSs coordination processes may have confluent (i.e., convergent) effects within and between component teams, but they can have countervailing (i.e., opposite) consequences on system performance as well (DeChurch & Zaccaro, 2013). Thus, while coordination is clearly vital to MTS success, its main performance enhancing role appears to change across levels within the system.

Therefore, for the advancement of the MTS science and for the proper management of these ubiquitous systems in practice, it is necessary that the factors contributing to the countervailing or confluent effects of coordination processes on MTS performance be identified and understood. That is the first goal of the theoretical framework we propose here. In addition, our aim is to develop a theoretical framework that has practical application as well; thus, our second goal is to provide guidance as to what managers might do to maximize confluent and minimize countervailing process consequences of coordination in MTSs.

Building upon coordination, organizational design and boundary spanning literatures, we propose a framework that contributes in several ways to extant knowledge in the MTS field. The theoretical framework expands previous work and deepens our understanding by relating aspects of functional process interdependence and different integration mechanisms used within MTSs to better understand how different coordination process types (i.e., implicit and explicit) emerge and drive performance (DeChurch & Mathieu, 2009; Zaccaro, Marks, & DeChurch, 2012). The framework also reconciles seemingly incongruent findings regarding the effects of coordination on MTSs performance by considering the multilevel nature (i.e., within and between component teams) of MTS activity. Finally, the framework helps managers consider the multilevel nature of MTS coordination processes in a way that assists them in selecting an approach to address the coordination challenges inherent in these complex systems effectively. Fig. 1 provides a summary of the framework and the related propositions.

2. Theoretical background and propositions

The highly specialized component teams that comprise a MTS pursue a shared superordinate goal or set of goals in addition to their own goals. Teams are functionally interdependent and, thus, the processes employed by component teams to accomplish tasks and achieve system-level goals involve reciprocal influence, reliance, dedication, and common interest (Mathieu et al., 2001).

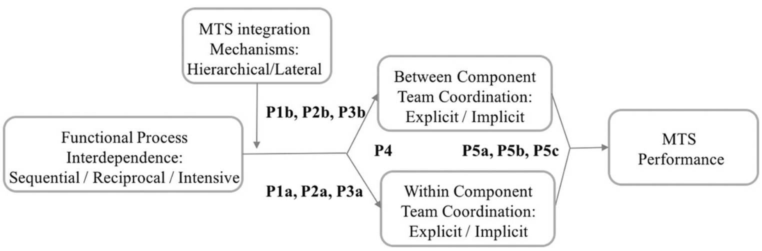

Fig. 1. Structural and temporal influences on coordination processes and MTS performance.

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Functional interdependence forms the basis for the coordination needs of the system and MTS performance is critically dependent on how well component teams coordinate their activities (Davison & Hollenbeck, 2012). Component teams must coordinate across two levels, at the same time, to integrate efforts and achieve desired system performance: internally in the performance of their specialized function (i.e., team-level coordination) and externally with other component teams (i.e., system-level coordination). To accomplish this, the organizational design literature proposes two distinct system integration mechanisms: lateral (e.g., enacted by peers within an organizational level; Davison et al., 2012) or hierarchical (e.g., enacted by a leadership team infused with formal decision authority; Davison et al., 2012).

From a multilevel theoretical standpoint, functional process interdependence and MTS integrative mechanisms are higher-level contextual factors that influence the emergence of lower-level processes (e.g., component team coordination) and overall system performance (Kozlowski, Gully, Nason, & Smith, 1999). Importantly, while the countervailing and confluent consequences of coordination processes on MTS performance are shaped (i.e., moderated) by higher-level factors, the coordination processes that result are not constrained to a single form across levels (Kozlowski & Klein, 2000).

Accordingly, the following sub-sections elaborate on functional process interdependence and MTS integrative mechanisms, specify which types of coordination processes emerge both within and between component teams, and articulate how coordination processes impact MTS performance during transition and action phases.

2.1. Functional process interdependence, MTS integration mechanisms and coordination processes in MTSs

2.1.1. Functional process interdependence

Functional process interdependence involves the shared processes that component teams use to affect MTS functioning and performance. Functional process interdependence arises in three ways: sequential, reciprocal and intensive (Mathieu et al., 2001; Van de Ven, Delbecq, & Koenig, 1976). Fig. 2 illustrates the three ways in which functional process occur in MTSs.

Sequential functional process interdependence occurs under task requirements imposing a unidirectional workflow. That is, the interaction between component teams needed for the MTS to achieve its goals requires that certain component teams enact and complete their tasks before handing their work off to the next team or teams in the chain. Our opening example of the Spanish National Transplants Organization is a perfect example of sequential functioning. First, the medical team removing organs starts its operation on the donor when they receive the signed approval from a specialized counseling team residing in a hospital. After the operation, a set of transportation teams carries the organ(s) to the implanting team. The implanting team then performs the implantation to the organ recipient. Finally, another team cares for the recovery of the organ recipient. In this example, the component teams act sequentially regarding each other.

Reciprocal functional process interdependence results when task requirements demand component teams to complete different parts of the task in a give-and-take and cyclical fashion. This type of interdependence implies some degree of flexibility in the ordering of tasks and, due to the cyclical nature of the workflow, adjustments between component teams occur iteratively. This type of interdependence is illustrated by wildness firefighting MTSs in which satellite and land surveillance teams directing firefighting squads relinquish operational control to hydroplanes that drop water on the fire. The surveillance teams then retake control to direct firefighting squads where to build firewalls. The squads then leave the fire scene again to permit more hydroplane dispatches. The satellite teams then resume command to further guide firefighting squads to build more firewalls. Meanwhile, volunteer firefighters dispose of embers between firewalls. The surveillance teams then authorize more hydroplanes passes and give orders for a final check by firefighting squads as well as to civil volunteer forces to remove the safety cordon around fire area. Thus, different teams in the

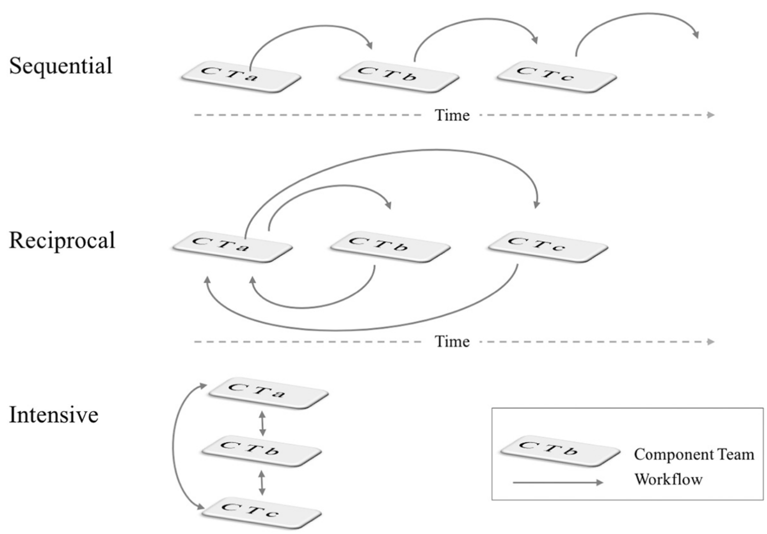

Fig. 2. Functional process interdependencies in MTSs.

system assume the focal position (i.e., point team; Davison et al., 2012) at different times as the MTS iteratively performs activities until a fire is extinguished.

Finally, task demands that require the concerted action of multiple component teams mutually adjusting in real time give rise to intensive functional process interdependence. Paralleling team interdependence forms (Saavedra, Earley, & van Dyne, 1993), intensive functional process interdependence employs a multi-directional workflow to enable the simultaneous enactment of cross-system coordinated action and the requisite amount of component team autonomy. Airport security personnel, sanitation units, airport firefighters, air traffic controllers and ground crews working simultaneously to evacuate an aircraft that landed without its undercarriage, while air traffic is managed both on the ground and in the air is an example of intensive functional process interdependence.

Sequential, reciprocal and intensive functional process interdependencies impose different coordination demands on the MTS. Further, the relationship between functional process interdependencies and the emergence of coordination processes across levels (i.e., within and between component teams) will be moderated by the kind of integration mechanisms in place within the MTS. We elaborate on these integration mechanisms in the following subsection.

2.1.2. MTS integration mechanisms

Organizational theory states that the fundamental principle of integration mechanism design in team-based organizational forms is that component teams should incorporate as many self-contained processes, key dialogues and discussions, and highly interdependent tasks as are needed to accomplish the required goals (Mohrman, Cohen, & Morhman, 1995; Sinha & Van de Ven, 2005). However, Mohrman et al. (1995) argue that while the economical way to integrate different teams is through mutual adjustment and procedure specification (Jay, 1973), demands internal and external to the system create conditions that require different component teams to be in charge of addressing broader scope issues. Thus, Mohrman et al. (1995) identify two main integration approaches: a) hierarchically, in which interdependencies among component teams are managed at a position higher in the decision structure in order to minimize or eliminate horizontal coordination activities across team boundaries (Sinha & Van de Ven, 2005; Thompson, 1967); and b) laterally, in which environmental demands and/or task complexities require non-hierarchical mechanisms that enable coordination decisions to be made near or at the task – environment interface (Levinthal & Warglien, 1999). Davison et al. (2012) refined this further by introducing the concept of differentiated component team roles. This concept specifies that coordination decisions are driven by the needs of the team or set of teams most central or critical to meeting the immediate needs of the task environment (i.e., 'point' teams), and that coordinating with the point teams is the priority even if this means coordination within the other 'support' component teams suffers. In this case, between component team (i.e., system-level) coordination supersedes within component team (i.e., team-level) coordination.

Hierarchical integration mechanisms bring together needs that transcend particular component team domains and deal with processes and trade-offs of a broader scope. Hierarchical integration mechanisms yield component teams with the authority to make decisions in defining other component teams' operating context. Thus, hierarchical integration mechanisms imply hierarchical relationships in the system with certain units having formal authority over the others. Two clear examples of hierarchical integration mechanisms are: 1) management component teams that align component team actions with MTS strategy; and 2) representative integration component teams that are non-managerial in nature such as coordinating councils with authority to set priorities, resolve conflicts and insure compliance (Davison et al., 2012).

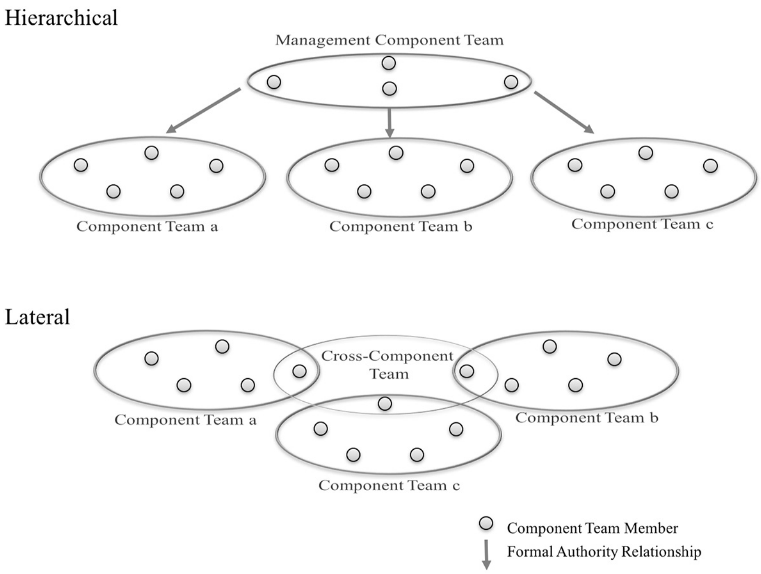

Fig. 3. MTSs integration mechanisms.

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Lateral integration mechanisms aim to coordinate activities horizontally across the same hierarchical level (Mohrman et al., 1995) with many notions related to Likert's (1967) linking pin model of organizational functioning. We identify three examples of lateral integration mechanisms. First, liaison roles that require a team member who links between their primary component team with any other team (e.g., attending meetings of another team). Second, overlapping memberships whereby certain team members simultaneously have membership in different component teams. Both liaison roles and overlapping memberships require that team members in these roles have their boundary-spanning requirements formalized in their component teams such that the members can integrate the actions of different component teams (Faraj & Yan, 2009). Third, cross-component teams in which a new component team comprising representatives from the interdependent component teams is formed. The essence of cross-component teams is the recognition that the best path forward for the system is to be negotiated and agreed upon by knowledgeable parties sharing a common set of objectives. Cross-component teams are also responsible for insuring that agreements are documented and communicated in a timely manner to all affected component teams. Fig. 3 illustrates a MTS integrated hierarchically, using a management component team, and laterally through a cross-component team.

Although hierarchical and lateral integration mechanisms both funnel integrative interactions through a limited number of component team members, it is the differences between these mechanisms that are important. Recent findings on MTSs coordination (Davison et al., 2012; Lanaj et al., 2013) suggest that direct mutual adjustment laterally between component teams may constrain MTS performance when hierarchical integration mechanisms are also employed. These results appear incongruous with findings on MTSs which focus predominantly on lateral integration mechanisms (e.g. Marks et al., 2005; DeChurch & Marks, 2006). Collectively, extant research suggests that the type of MTS integration mechanisms employed may interact with the kind of functional process interdependence involved to create specific coordination requirements for the system. These coordination requirements will determine the coordination process types that emerge within and between component teams, which will in turn impact MTS performance. Thus, the type of MTS integration mechanism enacted has a moderating effect on the causal chain linking functional process interdependence to coordination processes which ultimately impact MTS performance (see Fig. 1). Before articulating the logic to support several propositions about this moderated causal chain, we will briefly discuss the implicit and explicit types of MTSs coordination process.

2.1.3. MTS coordination process

MTS coordination can be defined as the use of behavioral strategies and guidelines to integrate and align the actions, knowledge and goals of component teams to achieve common goals (DeChurch & Marks, 2006). Coordination in MTSs ensures the functioning of the entire system as a unified whole (Van de Ven et al., 1976) and extant research has demonstrated that this, in turn, enables all component teams to effectively contribute to achieving both proximal and distal goals (e.g., Davison et al., 2012). For an MTS to perform effectively, component teams must simultaneously coordinate within the team and across the system; i.e., at two levels. Within component team coordination comprises team-level processes addressing interdependence demanding coordination of activities within the boundaries of a component team (cf., Steiner, 1972), whereas between component team coordination comprises system-level processes addressing interdependence requiring coordination of activities that span the boundaries among component teams.

The teams and MTSs literatures identify two primary means by which coordination takes place: explicitly and implicitly. Explicit coordination is based on planning and communication as coordination mechanisms used intentionally by team members to manage their multiple interdependencies (Espinosa, Lerch, & Kraut, 2004). Implicit coordination occurs when team members anticipate the actions and needs of their colleagues and the task demands, dynamically adjusting their behavior without directly planning or communicating with each other (Rico, Sánchez-Manzanares, Gil, & Gibson, 2008). Paralleling such a distinction at the MTS level, extant studies have shown that explicit coordination reflects the amount of overt communication-based efforts to align different component teams, while implicit coordination reflects the extent to which different component teams are behaviorally synchronized (DeChurch & Marks, 2006).

Implicit and explicit coordination in MTSs interact in aligning the actions occurring between and within component teams. This interaction is supported by the emergence of collective (team- and system-level) cognitive structures (Rico, Gibson, Sánchez-Manzanares, & Clark, 2009) that include component team members' mental representation of knowledge about key elements of both the multiteam system and component team's relevant task environment. As coordination processes, collective cognitive structures are bottom-up emergent constructs which summarize the pattern apparent in team members´ cognition (Kozlowski & Klein, 2000). Thus, collective cognitive structures can emerge through compositional processes in which individual cognitive structures are functionally and formally similar to their team level cognitive manifestation (e.g., team mental models; Hinsz, Tindale, & Vollrath, 1997). Additionally, collective cognitive structures can develop by means of compilational processes (e.g., transactive memory systems; Austin, 2003), whereby they present different patterns compared with the individual ones (Hinsz, 1995; Kozlowski & Klein, 2000; Mohammed, Ferzandi, & Hamilton, 2010).

Recent studies report differential relationships between forms of collective cognition and behavioral processes. Specifically, DeChurch and Mesmer-Magnus (2010) found that compilational forms of collective cognition are stronger predictors of team process than are compositional forms of cognition. These findings suggest that compilational cognitive structures enable component teams to explicitly coordinate, whereas compositional structures enable teams to coordinate implicitly.

Up to this point, we have identified the main concepts to be articulated in a series of propositions that explain how coordination processes emerge in MTS across levels (Fig. 1, Propositions 1a & 1b, 2a & 2b and 3a & 3b). Thus, we will propose how different MTS integration mechanisms (lateral versus hierarchical) moderate the impact of functional process interdependencies (sequential, reciprocal or intensive) on the explicit or implicit forms of coordination processes within and between component teams. Table 1 summarizes the predictions to be described by the categorization of different variables.

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Table 1
Summary of the moderating role of MTS integration mechanisms on the relationship of functional process interdependence on the emergence of coordination processes across levels.

		MTS integration mechanisms			
		Hierarchical		Lateral	
		Coordination processes		Coordination processes	
		Between component teams	Within component teams	Between component teams	Within component teams
MTS functional process interdependence	Sequential	Mix of explicit and implicit	Implicit	Mix of implicit and explicit	Explicit
		Proposition 1a		Proposition 1b	
	Reciprocal	Mix of explicit and implicit	Implicit	Mix of explicit and implicit	Explicit
		Proposition 2a		Proposition 2b	
	Intensive	Mix of implicit and explicit (explicit prevalence)	Explicit	Implicit	Mix of implicit and explicit (implicit prevalence)
		Proposition 3a		Proposition 3b	

2.2. Sequential functional process interdependence, MTSs integration mechanisms and coordination processes across levels.

An MTS operating with sequential functional process interdependence allows component teams to work in a relay fashion where their respective actions run relatively independently from each other. Thus, integrative mechanisms will manifest boundary spanning activities focused on the interconnection between different component teams' tasks to ensure unity of action. The way in which boundary spanning activities and coordination within and between component teams emerges may change depending on the kind of integrative mechanisms used.

On the one hand, when the system uses hierarchical integration mechanisms to align different component teams' activities there is an emphasis on reducing between component team interactions by externalizing the boundary spanning function to a higher level. This structural decision will lower the uncertainties regarding the work being done by different component teams (Mohrman et al., 1995) and increase systemic predictability about the sequence of different component teams' actions (i.e., routinization). This facilitates the development of collective compositional knowledge structures of MTS functioning (e.g., MTS mental models). Thus, implicit coordination processes will emerge between component teams. However, the externalization of the integrative function will give rise to compilational forms of team cognition that include information about which component team knows what and foster open communication and planning processes to integrate the different parts of the task performed by each component team. Accordingly, between component team coordination will require the enactment of explicit coordination processes too (DeChurch & Marks, 2006).

Within component teams, the interaction between sequential functional process interdependence and hierarchical integration mechanisms weakens perceptions of cross-boundary task interdependence while reinforcing component team feelings of operating on their own (Davison & Hollenbeck, 2012). Basically, component teams have increased capacity to concentrate on their tasks because the amount of information about the broader system needed to operate is reduced. Thus, compositional knowledge structures (e.g. mental models) will emerge, mainly including component team knowledge relevant to operate. Accordingly, it will be easier for component teams to rely on implicit coordination processes for their own functioning (Mohammed et al., 2010). Considering the former rationales, we submit that:

Proposition 1a. Under sequential functional process interdependence conditions, MTS hierarchical integration mechanisms will moderate the emergence of different coordination processes across levels. Specifically, coordination between component teams will be a mix of implicit and explicit processes, while coordination within component teams will be implicit.

On the other hand, an MTS operating with sequential functional process interdependence may be managed laterally; for example, by appointing a member of a component team to be a liaison with another team on the system (Mohrman et al., 1995). When lateral integration mechanisms are in place, they promote conditions of closer connectivity such that the work of the entire system is affected by the work occurring in each component team, even though sequential interdependence tolerates a fairly autonomous functioning of each component team.

Although lateral integration mechanisms may benefit the overall system in terms of speed and responsiveness under conditions of sequential functional process interdependence (Galbraith, 2000), lateral integration requires people in close contact with each other to facilitate the types of agreement and negotiation processes needed. As a consequence, lateral integration mechanisms increase perceptions of interdependence and the feeling that component teams' work has to fit together (Mohrman et al., 1995). Thus, the perceived need to behaviorally integrate different units to ensure success of component teams' boundary spanners will trigger additional communication efforts to incorporate compilational knowledge structures about the functioning of the different component teams in the system, which will raise explicit coordination levels both between and within component teams. In addition, and similar to when the system is integrated hierarchically, because the expected levels of functioning and corresponding performance of each component team become more relevant on the collective knowledge structures, it will ease the parallel development of compositional collective knowledge structures of MTS functioning that allow anticipation and dynamic adjustment between component teams (Rico et al., 2008). Pursuant to these rationales, we submit that:

Proposition 1b. Under sequential functional process interdependence conditions, MTS lateral integration mechanisms will moderate the emergence of different coordination processes across levels. Specifically, coordination between component teams will be a mix of implicit and explicit processes, while coordination within component teams will be explicit.

2.2.1. Reciprocal functional process interdependence, MTSs integration mechanisms and coordination processes across levels

Reciprocal functional process interdependence increases the degree of fragility and uncertainty in the system due to the cyclic and iterative nature of the different component team tasks. Unlike sequential interdependence in which a team completes its tasks before passing responsibility on to other teams in the system, reciprocal interdependence requires that work-in-process is passed back and forth between component teams; thus, component teams must react and adjust to each other as work progresses through a series of iterative steps. This, in turn, requires that the gaps between support and point component teams' (i.e., component team assuming the main work-in-progress role) tasks be minimized to the extent possible to avoid fatal breakdowns in the system. This intensifies the need for careful system integration, where planning and strategy development by component teams is key to insure that subsequent task iterations are congruent with prior task iterations. Again, system integration may be achieved either hierarchically or laterally, creating differences in the coordination processes that emerge within and between component teams.

When MTS hierarchical integration mechanisms are used, oversight of the gap between component teams is assumed by a management team empowered to specify interdependence requirements and direct the actions of the component teams (Davison et al., 2012). The lack of certainty regarding the status of tasks requires an ongoing updating of the collective knowledge structures guiding each component team's actions by correcting and adjusting activities in response to workflow variations. Therefore, coordination between component teams having reciprocal functional process interdependence and being integrated through hierarchical mechanisms will be characterized by compilational forms of team knowledge, thereby increasing explicit coordination processes (DeChurch & Mesmer-Magnus, 2010). However, by managing in a one-to-one style whereby each component team is autonomous, self-contained, and unaware of the activities of others in the system (Galbraith, 2000), a management team also develops collective compositional knowledge structures of MTS functioning that frees component team resources to concentrate on internal needs (Hoegl, Weinkauf, & Gemuenden, 2004). Accordingly, and similar to systems under sequential interdependence conditions, this will promote the use of compositional knowledge structures (e.g., mental models) within component teams, enabling the emergence of implicit coordination processes. In this regard, within component team coordination will be mainly implicit. Accordingly, we submit:

Proposition 2a. Under reciprocal functional process interdependence conditions, hierarchical MTS integration mechanisms will moderate the emergence of different coordination processes across levels. Specifically, coordination between component teams will be a mix of implicit and explicit processes, while coordination within component teams will be implicit.

When lateral integration mechanisms are used to align decisions and adjustments among component teams are necessitated by reciprocal functional interdependence, cross-component teams may be useful (Mohrman et al., 1995). The lateral integration mechanisms will initiate explicit coordination (e.g., planning) when cross-component teams record and communicate any changes between the cyclically interacting component teams. However, although the need for synchronization between component teams requires explicit coordination processes, when component teams integrate laterally, boundary spanners belonging to different component teams will frequently rely upon factual knowledge and engage in fluid communication regarding how different component teams operate and their current state. Thus, cross-component teams create opportunities to implicitly coordinate between component teams because the information to be shared is readily available in the interacting units (Rico, Salas, Burke, & Fiore, 2012).

When lateral integration mechanisms are used, there is a strong need within component teams to increase communication and ad hoc planning to better align their internal actions. Basically, each representative on the cross-component team insures that clear information is relayed to his or her respective component team about changes that affect local task processes as well as explanations of their impact on the system, and other pertinent information regarding the state of other component teams. As a result, the use of compilational collective knowledge structures peaks, which engenders explicit coordination levels within component teams. Thus, we submit that:

Proposition 2b. Under reciprocal functional process interdependence conditions, lateral MTS integration mechanisms will moderate the emergence of different coordination processes across levels. In particular, coordination between component teams will be a mix of explicit and implicit coordination processes, while coordination within component teams will be explicit.

2.2.2. Intensive functional process interdependence, MTSs integration mechanisms and coordination processes across levels

Intensive functional process interdependence requires the concerted action of different component teams (Mathieu et al., 2001) which creates an overlap between the different component teams' actions. As component teams collaboratively plan and prepare to achieve optimal synchronization, it is likely that a compositional collective knowledge structure (e.g., mental model) of the MTS will develop (Mohammed et al., 2010). Thus, implicit coordination behaviors may prevail in intensive as compared to reciprocal

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interdependence conditions. However, the kind of MTS integration mechanisms in use will moderate which coordination processes emergence across levels.

If hierarchical integration mechanisms are employed, high implicit coordination levels will be precluded. In sequential and even reciprocal interdependence MTS settings, a small task delay may be a problem for the component team in which it occurs, but it most likely has little, if any, effect on the system. However, with intensive interdependencies, even small delays may become problematic for the system as they disrupt synchronization (Galbraith, 2000). Thus, under intensive interdependence requirements and hierarchical integration mechanisms, component team interaction will rely on the exchange of large amounts of information regarding their activities, channeled through the management component team (Davison et al., 2012). This will foster the development of transactive memory systems (i.e., compilational knowledge structures) that provide access to differentiated and changing in real-time knowledge sets provided by different component teams (Hinsz & Betts, 2012). Accordingly, the prevalence of compilational collective knowledge structures causes between component team coordination to emerge in an explicit way.

Similarly, the interaction of intensive functional interdependence and hierarchical integration mechanisms will engender explicit coordination within component teams. Under other types of functional interdependencies, management component teams have capacity to enact information integration and monitoring thereby allowing component teams to focus efforts on their own needs (which increase implicit coordination levels within component teams). Under intensive functional interdependence, however, the intense needs of concerted action require extra effort for information exchange across the component teams–management component team interface. This, in turn, will demand additional iterations to integrate and exchange that information among the component teams (Davison et al., 2012), promoting explicit coordination processes within component teams. Accordingly, we submit that:

Proposition 3a. Under intensive functional process interdependence conditions, MTS hierarchical integration mechanisms will moderate the emergence of different coordination processes across levels. Specifically, coordination between component teams will be explicit, while coordination within component teams will be a mix of implicit and explicit processes, with explicit being more prevalent.

Alternatively, if lateral integration mechanism is in place, cognitive compositional structures will be readily used by different component teams to anticipate and dynamically adjust to other component team's actions (Hinsz, Wallace, & Ladbury, 2009). For example, overlapping membership arrangements among component teams will accelerate knowledge sharing process at the MTS level (Mohrman et al., 1995). Thus, the primary use of compositional knowledge structures will create conditions for between component team coordination to occur implicitly, for the most part.

Multilevel theorizing regarding the pervasiveness of top-down effects compared with bottom-up effects (Kozlowski & Klein, 2000) points to a prevalence of implicit coordination behaviors within component teams too. This prevalence doesn't mean that coordination will be exclusively implicit when MTS lateral integration mechanisms are used because component teams will need to dynamically integrate information from other component teams. To achieve the close alignment that intensive interdependence requires, overlapping membership is a clear option (Mohrman et al., 1995). Although lateral integration arrangements with intensive forms of interdependence will ease the convergence and sharing of different knowledge and the development of compositional structures (i.e., mental models), the need for information integration will also demand some degree of explicit monitoring and backup behaviors from boundary spanners. This, in turn, will slightly increase explicit coordination processes when coordination occurs within component teams. Therefore, we argue:

Proposition 3b. Under intensive functional process interdependence conditions, MTS lateral integration mechanisms will moderate the emergence of different coordination processes across levels. Specifically, coordination between component teams will be mainly implicit, while coordination within component teams will be a mix of implicit and explicit processes, with implicit being more prevalent.

The former hypotheses reveal the role that upper level characteristics play on the differences in the way explicit and implicit coordination emerges across MTS levels. Such differences may very well explain why the effects of coordination within component teams do not directly translate into the same effects between teams. In the following section, we propose which combinations of functional process interdependencies and MTS integration mechanisms will make coordination processes produce either countervailing or confluent consequences for MTS performance (Fig. 1, Propositions 4, 5a, 5b & 5c).

2.3. Countervailing and confluent effects of MTS coordination processes on MTS performance

Extant literature consistently suggests that implicit coordination processes are related with higher component team and MTS performance (DeChurch & Marks, 2006; de Vries et al., 2016; Entin & Serfaty, 1999; Stachowski, Kaplan, & Waller, 2009). This greater performance is particularly likely in dynamic situations prototypically handled by MTSs because within component team coordination will have more resources available for component team learning about the task environment and have greater capability to determine if any adjustments are needed to cope with the situation at hand or potential changes to it (Rico, Gibson, Clark & Sánchez-Manzanares, under review). Accordingly, MTSs will easily align and structure different component team's contributions by providing increased awareness of the different component teams' activities and smoother interaction processes between them (de Vries et al., 2016). Thus, high levels of within and between component team implicit coordination when MTSs are performing is a more efficient way of mobilizing component team resources resulting in higher system effectiveness.

Explicit coordination will also contribute to MTS goal attainment when MTSs perform tasks. Explicit coordination, both within and between component teams, requires a controlled way of functioning. Operating in a controlled instead of an automatic fashion requires extensive communication, planning and evaluation processes that will demand substantial time and negotiation between component team member across the system. These increased efforts at control will slow operations while simultaneously increasing the resources needed to insure adequate functioning of the whole system. That is, explicit coordination is resource intensive and time consuming. However, in some situations, this intensive processing effort in the system is needed. For example, when the MTS is unable to handle the complexities of the task to be performed, or when the situation in which the system is operating is dynamic and procedurally unclear, component teams increase explicit coordination by engaging in open communication and overt planning resulting in greater adaptation by component teams and MTSs (Bergström, Dahlström, Henriqson, & Dekker, 2010; Bienefeld & Grote, 2014; LePine, 2003). Thus, although MTS' effective performance may be reached only through explicit coordination mechanisms, it is usually reached by a combination of both coordination types. However, to gain the advantages derived from the enhanced capacity to mobilize component teams and MTS' resources to better deal with complex tasks, an emphasis on implicit coordination will yield higher system efficiency (Rico et al., under review). Accordingly, we propose that:

Proposition 4. A performing MTS is more efficient as the prevalence of implicit coordination processes increases across levels (within and between component teams).

Recognizing that the prevalence of implicit coordination process across levels will improve the system performance is insufficient to address the coordination complexities we revealed in prior sections. To enhance MTS management and system performance, consideration should be given to the moderating effect that integration mechanisms exert over the causal chain that links functional process interdependence to coordination processes. This moderating effect could impact how different combinations of coordination processes across MTS levels may enhance countervailing or reduce confluent effects on MTS performance.

2.3.1. Coordination effects on MTS performance in sequential functional process interdependencies and MTS integration mechanisms

Considering our previous developments, we submit that sequential interdependence requirements create a chain pattern between different component teams on the system. Consequently, component teams may operate rather independently from each other. If MTSs are integrated through hierarchical integration mechanisms (e.g., management component team; Sinha & Van de Ven, 2005) implicit coordination will be promoted within teams (Mohammed et al., 2010) with the consequential enhanced capacity to perform. Although hierarchical integration will slightly increase explicit coordination between component teams to obtain and exchange relevant information in the whole system, the predictable flow of work allows the management component team to give timely support to different component teams and keep implicit coordination levels between component teams at the level required. Thus, confluent effects of coordination on MTS performance are expected in this case, as implicit coordination processes prevail on the system.

In contrast, using lateral integration mechanisms (e.g., overlapping membership; Mohrman et al., 1995) will maximize explicit coordination levels within component teams, and cumbersome interactions will characterize the way in which component teams will integrate their efforts (de Vries et al., 2016). Although lateral integration will increase implicit coordination between component teams, according to recent research, it won't be enough to compensate for the redundant communication efforts and high explicit coordination levels within component teams (Davison et al., 2012). The net result being countervailing effects of coordination processes on MTS performance when the system is integrated laterally. In sum, the former rationales suggest that:

Proposition 5a. Under sequential interdependence, when the system is integrated hierarchically, the effects of coordination processes on MTS performance will be confluent because higher implicit coordination levels across levels will be promoted; on the contrary, when the system is integrated laterally, higher explicit coordination levels will appear across levels and the effects of coordination processes on MTS performance will be countervailing.

2.3.2. Coordination effects on MTS performance in reciprocal functional process interdependence and MTS integration mechanisms

We discussed previously how the bonds between cyclically interacting component teams should be tightened to maximize MTS performance under reciprocal interdependence requirements. When hierarchical integration mechanisms are in place, the management team could utilize the explicit coordination between component teams to better predict each component team's actions and maximize the integration of component team activities (Davison et al., 2012), and leverage this to take advantage of the implicit coordination processes occurring between component teams. Consistent with recent findings, this mix of explicit and implicit coordination at the system level will strengthen the connection of implicit coordination within component teams with MTS performance (Lanaj et al., 2013; de Vries et al., 2016). Consequently, confluent effects of coordination on MTS performance are expected when MTSs performing under reciprocal process interdependence are hierarchically integrated.

Lateral integration mechanism (e.g., a cross-component team; Mohrman et al., 1995) may also mix implicit and explicit coordination levels between component teams because resources are directed toward awareness of the demands of other teams. However, in contrast with a system integrated hierarchically, lateral integration maintains high levels of explicit coordination mechanisms within teams. In this case, component teams will be required to increase communication and planning efforts to account for other component team's needs (Joshi, Pandey, & Han, 2009), and the information flowing from the cross-component team will overload the system with an unnecessary amount of communication, reducing MTS performance (DeChurch & Zaccaro, 2013). Thus, countervailing effects of coordination processes on MTS performance are expected when a reciprocal interdependent system is integrated laterally, as explicit coordination levels will prevail in the system. Hence, we submit that:

Proposition 5b. Under reciprocal interdependence, when the system is integrated hierarchically, the effects of coordination processes on MTS performance will be confluent because higher implicit coordination levels across levels will be promoted; on the contrary, when the system is integrated laterally, higher explicit coordination levels will appear across levels and the effects of coordination processes on MTS performance will be countervailing.

2.3.3. Coordination effects on MTS performance in intensive functional process interdependence and MTS integration mechanisms

Intensive interdependence requirements place high demands on component teams because they need to be operating simultaneously and in concert on the task to perform properly. Such interdependence will homogenize the temporal distribution of component teams' tasks, requiring smooth coordination processes that provide the necessary capacity to the whole system to move nimbly and synchronously. If the system is integrated through hierarchical mechanisms (e.g., a management component team) under intensive interdependence requirements, high explicit coordination levels both between and within component teams will jeopardize MTS capacity to respond in unison to task demands. MTS performance is going to be limited by a communication overload across levels and duplicated planning efforts that will slow down the system functioning because of misunderstandings and awkward interactions between component teams (de Vries et al., 2016). Thus, countervailing effects of coordination processes on MTS performance are expected when an intensive interdependent system is integrated hierarchically.

In contrast, when the system is integrated laterally (e.g., a representative integrating component teams; Mohrman et al., 1995) implicit coordination levels both within and between component teams will be prevalent, freeing up component team capacities to adaptively respond to the needs of other component teams, task changes and to anticipate potentially unforeseen events (Rico et al., under review). Instead of having an overwhelmed management team trying to convey and circulate all the information to every single component team and dampening system functioning, the intensive interdependency requirements will be better addressed through the mutual adjustment capabilities provided by lateral integration mechanisms (Galbraith, 2000). In this regard, shared compositional knowledge structures (i.e., shared mental models) enable anticipation and dynamic adjustment capabilities crucial to MTS performance (DeChurch & Marks, 2006). Ultimately, because implicit coordination processes prevail in the system, confluent effects of coordination on MTS performance are expected when MTSs performing under intensive process interdependence are laterally integrated. Collectively, this set of arguments suggests:

Proposition 5c. Under intensive functional process interdependence, when the system is integrated laterally, the effects of coordination processes on MTS performance will be confluent because higher implicit coordination levels across levels will be promoted; on the contrary, when the system is integrated hierarchically, higher explicit coordination levels will appear across levels and the effects of coordination processes on MTS performance will be countervailing.

Overall, the preceding propositions offer a fine-grained view of the way that functional process interdependence and integration mechanisms shape the impact of explicit and implicit coordination processes within and between component teams and their influence on MTS performance. Consequently, when MTSs are designed and managed taking the structural variables our propositions identified into account, a solid foundation will exist for minimizing the potential countervailing consequences of coordination processes across levels, benefitting overall multiteam system performance.

3. Discussion

Employing a multilevel perspective, this paper describes a model that reveals how the type of functional process interdependence (i.e., sequential, reciprocal or intensive) and the kind of integration mechanisms employed in the system (i.e., lateral or hierarchical) shape coordination process emergence (i.e., implicit or explicit) differentially across MTS levels. In so doing, it explains the potential countervailing or confluent effects of coordination processes on MTS performance. All in all, this framework has implications for both theory and practice that deserve consideration.

3.1. Implications for theory

The framework proposed herein advances MTS theory by detailing how top-down influences exerted by system level variables (i.e., functional process interdependencies and integration mechanisms) shape the bottom-up emergence of coordination processes (i.e., implicit and explicit) in MTSs. Specifically, the model shows how different combinations of functional process interdependencies (i.e., sequential, reciprocal and intensive; Mathieu et al., 2001) and MTS integration mechanisms (i.e., hierarchical and lateral; Mohrman et al., 1995) lead to the emergence of either more implicit or explicit coordination processes both within component teams and between component teams. By adopting a multilevel approach to the development of differential predictions regarding how interdependence requirements combine with integration mechanisms to produce coordination processes, a more complete and clear explanation of the way coordination processes form both within and between teams is provided (Kozlowski & Klein, 2000). Such differences in emergence allow us to understand that the countervailing or confluent consequences of a MTS process also affect the way the process itself emerges, not just the process outcome. This is also an important contribution beyond the

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countervailing/confluent perspective (DeChurch & Zaccaro, 2013) because it shows how the interplay of relevant higher-level characteristics that mold MTS's emergent process are of paramount importance to understand their consequences.

The proposed framework provides further theoretical support for the recent work from de Vries et al. (2016) who integrate micro and macro perspectives on coordination in MTSs. In this vein, our framework illustrates the value of integrating the micro-level approach of team cognition and related constructs in broadening our comprehension of key MTS processes, such as between component team coordination, as key predictor of MTS performance (Marks et al., 2005). Up to now, the team cognition and coordination literatures have generally ignored the way in which macro-level variables (e.g. MTS integration mechanisms) affect emergence and shape effects on performance across levels. Moreover, from a macro-level perspective, we offer value by modeling the role of integration in changing coordination process effects on MTS performance (Mohrman et al., 1995; Galbraith, 1994). Thus, although hierarchical and lateral approaches to integrating component teams' activities may seem equivalent ways of facilitating communication and planning in the system, we offer compelling arguments that show the differential effect of these mechanisms for coordination both within and between component teams.

The proposed framework not only advances theory for understanding MTSs and their performance, but in partnership with the recent surge of theoretical developments for the conceptualization of MTS processes related to performance (Luciano et al., 2015; Mathieu et al., 2017; Rico et al., 2017), it may also inspire additional theoretical efforts. Moreover, de Vries et al. (2016) suggest micro and macro approaches that might be considered. It is clear that multilevel theoretical approaches will offer much to advance our understanding; however, other approaches might also make contributions. For example, by adopting a multiphasic approach to system functioning (Marks, Mathieu, & Zaccaro, 2001) we could identify how the system activities vary as MTSs go through different transition and action phases while they perform. Each phase includes different tasks; transition phases prepare the whole system and its component teams for their tasks through evaluation and/or planning activities, while action phases are characterized by performing tasks conductive to goal accomplishment (Marks et al., 2001). Because of the differences in the activities enacted during the transition and action phases, the attributes that make coordination processes effective may not be the same across these temporal phases.

Therefore, the countervailing or confluent consequences of coordination process may also change across time during task execution. Specifically, implicit coordination should benefit MTS performance the most during action phases while the benefits of explicit coordination will arise mostly during transition phases. This claim may advance MTS theory development by suggesting that the consequences of MTS processes should not be considered fixed across time; rather, theory development must take temporal aspects into account. Thus, similar to the reasoning regarding coordination, the countervailing or confluent consequences of many key MTSs processes such as trust or leadership may very well change with time, especially if they are not attuned to the different requirements that each phase of performance imposes (Marks et al., 2001). Accordingly, we join other scholars in highlighting the importance of adopting a multiphasic approach to exploring MTSs coordination processes (e.g., Davison & Hollenbeck, 2012; de Vries et al., 2016; Faraj & Yan, 2009; Mathieu et al., 2001; Marks et al., 2005).

We envision numerous theoretical benefits of employing the multilevel and the multiphasic perspective to coordination for MTS performance. By combining such perspectives, we can reveal explanatory mechanisms by which coordination, as a key driver of MTS performance (Davison et al., 2012), results in countervailing or confluent consequences across levels (DeChurch & Zaccaro, 2013). This would be an important addition to the science of MTSs that helps further our understanding of how, why, and when the same process either improves or degrades performance.

Finally, multiteam systems can be considered to be a set of subgroups that are subsumed under a larger group (Hinsz & Ladbury, 2012). Consequently, the work on subgroups in work groups (Carton & Cummings, 2012) can highlight other questions and issues that might attract greater attention (e.g., faultlines, conflict, intergroup relations). Likewise, regulatory systems approaches to teams (e.g., Hinsz et al., 2009) would stimulate consideration of how component team's focus of attention or decision making strategies might contribute to overall multiteam system effectiveness, as well as the effectiveness of the component teams. Because these selected processes could happen with and between component teams, these approaches could supplement the guidance provided by a multilevel perspective to facilitate more discoveries of the compelling relationships in multiteam systems.

3.2. Research implications

A framework such as described in this paper provides a conceptualization upon which a number of research and measurement implications can be derived. By clarifying the emergence of coordination processes that foster MTS performance, new avenues for research can be explored. Moreover, the multilevel perspective employed in the framework paves the way for future initiatives in the important and expanding field of MTSs research. Some research and measurement implications of the proposed framework are identified below.

Our approach can promote further research efforts that adopt a perspective which posits that MTS functional interdependencies change over the course of performance (e.g., spaceflight MTSs change interdependencies during the launch, exploration, and return stages of a mission). Thus, some component teams in the system might intensively and synchronously work together early in a performance episode, after which they might work in a more independent fashion before integrating their efforts at some later moment or stop being an active participant altogether. Such dynamics point to key research questions about the extent to which boundary-spanning roles fluctuate and are continuously redefined, and how critical linkages between component teams may be managed by combinations of hierarchical and lateral integration mechanisms in response to the changes that component teams will face over time. Although extant research points to certain enabling conditions for managing changes in Long-Lifespan team-based systems

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(e.g., role definition clarity, strong process orientation, role change training; Mohrman et al., 1995) the importance of effectively managing functional interdependence transitions in MTSs deserves future attention.

In furtherance of the former idea, our framework may appear to suggest that MTSs just operate in one of the three interdependence conditions whereby all component teams function with the same amount of interdependence. However, MTSs may also vary in the extent that the different interdependencies of component teams may be occurring simultaneously. Accordingly, some teams may have sequential relationships that feed into more reciprocal or intensive interdependencies for other teams, all occurring at the same or very similar timeframes. In this regard, our framework may very well be useful for further research exploring the possibility that a system function simultaneously with different integration mechanisms. In so doing, further theoretical and empirical developments shall embrace the idea of congruent interdependence-integration mechanisms combinations that allow the system to satisfactorily reach their goals. In this vein, recent empirical findings offer promising results by showing how MTSs effectively function with different coordination processes simultaneously (de Vries et al., 2016).

Another issue is how virtual interactions could impact potential boundary roles in the coordination–MTS performance link. During the last decade team and organizational virtuality have been a matter of intensive research (Martins, Gilson, & Maynard, 2004). Information and communication technologies bring an enormous potential either for facilitating or impairing information sharing and coordination at critical moments for MTSs goal accomplishments (DeChurch et al., 2011; Reddy et al., 2009). Implicit coordination between different component teams based on shared knowledge structures may be especially useful for teams with high virtuality since they are faced with the challenge of successfully integrating their common actions under restricted communication conditions (Rico et al., 2008). Future research could examine how different combinations of explicit and implicit coordination behaviors will manifest in MTSs with different degrees of virtuality, and the implications of these behaviors for team performance. Addressing any of these research questions would contribute to existing theory and provide empirical evidence that expands our understanding of the role of virtuality in MTSs.

Another thrust could target additional performance boundary conditions, such as the degree of predictability of the tasks that MTSs undertake. This connects extant literatures on team adaptation (e.g., Maynard, Kennedy, & Sommer, 2015) with some of the issues related to MTS development. Regarding MTS adaptation, extant theoretical and empirical literature at the team level has called our attention to team knowledge structures, role adjustments, and other task-related changes and coordination processes that help teams to adapt to changes in their task environment (Burke, Stagl, Salas, Pierce, & Kendall, 2006; DeRue, Hollenbeck, Johnson, Ilgen, & Jundt, 2008; LePine, 2003; Rico et al., 2009). In terms of responsiveness and adaptability, this area is set to produce important research in the years to come. In this regard, some of the propositions we developed to understand differential coordination demands during MTSs performance could be related to the capacity of the system and its component teams to cope with unexpected events.

There are also important implications of our framework for process and outcomes measurements in MTSs. Regarding the assessment of coordination and team knowledge structures referenced in our framework, there is a need to consider at least two key issues: (1) explicit and implicit coordination measures have been developed in the field using both self-report and also externally rated behavioral markers (Mohammed, Hamilton, Sánchez-Manzanares, & Rico, 2017); and (2) team cognition researchers have developed different measures for stable and dynamic knowledge structures (Mohammed et al., 2010; Cooke, Salas, Kiekel, & Bell, 2004). Thus, it may be possible to leverage existing measures in some cases. However, considering how highly context dependent team mental model actions and performance are (DeChurch et al., 2011; Hinsz & Ladbury, 2013), recent theoretical and methodological work in macrocognition should be considered to insure that cognitive processes of teams interacting in highly collaborative complex environments are accurately measured (Fiore et al., 2010; Wallace & Hinsz, 2010).

3.3. Implications for practice

The focus of our framework and propositions is mainly on theory and research development. However, an important goal of our approach is to provide advice and guidance that is useful for practice. Thus, what follows are our thoughts on creating conditions for maximizing MTS performance through leveraging coordination processes within and between component teams. Building upon the countervailing-confluent consequences perspective, we suggest that managers will need to adopt a multilevel, system-wide approach when designing and operating MTSs.

Between team coordination processes are inseparably intertwined with coordination processes within teams, and isomorphic coordination effects across levels cannot be assumed (DeChurch & Zaccaro, 2013). Thus, the integration mechanisms aimed at connecting component teams need to be carefully chosen to address different coordination needs across levels as well as between transition and action phases. The former reasoning also applies when there is the option to choose between different ways in which MTS duties are to be organized (i.e., division of labor, workflow design). Organizing work to proceed sequentially creates different coordination demands both within and between component teams than does organizing work to proceed concurrently. Our propositions offer guidelines that practitioners can use to help them prescribe how best to address coordination needs. In this way, managers will be able to enhance confluent consequences of coordination processes at the component team and MTS levels by having a response to the question: What will be the right combination of integration mechanisms and functional process interdependence requirements?

We posit that under sequential conditions a hierarchical integration would be preferred. However, because the high predictability of the task fosters coordination between component teams, there probably won't be much of a difference between the use of hierarchical or lateral integration mechanisms for increasing MTS effectiveness. This is consistent with the organizational literature that identified both mechanisms as the simplest ways of coordinating between different units in highly predictable situations

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(Galbraith, 1994). However, when interdependence is reciprocal, the findings of Davison et al. (2012) suggest that the use of lateral integration mechanisms will impair between component team coordination. In contrast, hierarchical integration mechanisms will help the team manage the uncertainty related to the potential back and forth of the linking actions from different teams, in this way reducing the risk of component teams having mismatched actions. Finally, if we consider intensive interdependence requirements, then lateral integration mechanisms will reduce coordination complexity by situating adaptation and information resources between component teams such that the action takes place in the system.

Another practical question that arises is what is the relationship between functional process interdependencies and the goal structure of the system? The multilevel nature of our framework points to augmented consequences for key component team processes that MTS goal structure characteristics will have compared with other interventions applied at the individual level of analysis (Chen & Kanfer, 2006). Thus, MTS managers should pay close attention to the design of the goal structure of the system, guaranteeing both horizontal and vertical compatibility of the different component team and MTS goals. This will also ensure that interdependence requirements and their corresponding integration mechanisms follow a predictable pattern in the system. Further, the priority of different goals in the hierarchy should be clear and understood by component teams in a way that implicit coordination processes across levels enhance MTSs performance (Rico et al., 2017).

If the propositions put forth within our framework hold up under empirical scrutiny, they offer several practical implications for training. Managers could consider systematic training that includes all the component teams in the system acting together. This whole system training could be especially useful when intensive forms of functional process interdependence are required for the MTS to operate. In addition, cross-training strategies in which component teams´ members are provided with exposure to and practice with the roles of other MTS component team's members may also be warranted. Moreover, metacognitive training at the MTS level could provide a higher level of knowledge and understanding. This metacognitive training could include semi-structured discussions among different component team members, visualization and common analysis of audio or video recorded performance episodes, and reflective activities about the MTS's interaction and performance. Managers must consider how these training initiatives can increase component team members´ awareness and understanding of their knowledge structures as well as how their ability to regulate them could improve the ability of the whole system to coordinate effectively under dynamic circumstances (e.g., Day, Gronn, & Salas, 2004; Rico et al., 2008).

Technology may also aid managers in making MTSs more effective. Managers could use communication technologies and collaborative teamware to implement regular leader debriefings and updated information from the evolving task setting. These technological aids could facilitate development of accurate and easy to share team knowledge structures (e.g., Cooke et al., 2004; Day et al., 2004). Collaborative teamware, such as the GPS devices described by DeChurch and Mathieu (2009) for the firefighting crews, can also provide greater awareness of, and attention to, a team's own and other component team's processes. This greater within and between team awareness may help teams identify situations where perfectly logical actions at the component team level, result in incompatible and potentially tragic consequences at the MTS level.

Finally, multiple membership and frequent team composition changes will be a norm in many if not most MTSs (O'Leary, Woolley, & Mortensen, 2012). Research has shown that there are important performance and information processing consequences of member turnover in teams (Levine, Moreland, & Choi, 2001; Lewis, Belliveau, Herndon, & Keller, 2007). If some degree of stability in the team membership can be maintained, then members' experience working together may also enable the swift formation of shared knowledge structures that will help when implicitly coordinating component team efforts (Levine & Choi, 2004). It is important to note that the lateral and hierarchical integration mechanisms discussed earlier (e.g., liaisons; multiple team memberships) are examples from the framework that are identified which can be used by managers as a way to intervene in MTSs that are expected to have frequent changes in their membership.

3.4 Conclusion

Our work contributes to the science and practice of multiteam systems by showing how the interplay of functional process interdependence and system integration mechanisms from a multilevel perspective offer a fine-grained view of explicit and implicit coordination in MTS and its performance consequences. We believe our approach will be useful in promoting further research and theoretical development, and a better grounding for managers in their endeavor to understand and coordinate multiteam systems.

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