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Processes and Performance in Technology-Enabled Teams: The Mediating Role of Team Ambidexterity

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Abstract

Information systems (IS) usage by team members within organizational teams is crucial to organizational work. Research shows that in addition to IS use, teams work through a number of processes (e.g., coordination, communication, conflict management, knowledge sharing) and develop emergent states (e.g., cohesion, ambidexterity) that influence their effectiveness. This research theoretically explores the distinction between team processes and emergent states and how they affect team outcomes. Specifically, it focuses on how the emergent state of team ambidexterity mediates the relationship between the team processes of IS usage and coordination and team performance. We conducted an observational study and a quantitative study with 106 team members in 33 teams in an organization. The findings indicate that team ambidexterity mediates the relationship between team IS usage and performance, as well as team coordination and performance. This research contributes to a better understanding of the construct of team ambidexterity and the concepts of team processes and emergent states and their relative roles in affecting team performance in technology-enabled work. We discuss the theoretical implications and contributions of our work and provide avenues for future research.

Keywords: Team Performance, Team Processes, Team Emergent States, Team Ambidexterity, Team Coordination, Team IS Usage, Alignment, Adaptability

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1 Introduction

For the past several decades, organizations have been increasingly making use of teams as a structure to perform work tasks. Teams have synergy and complementary capabilities that allow them to achieve beyond what is possible with individual work. Work teams (teams henceforth) are collections of two or more individuals that interact, perform organizational tasks, have some level of interdependency, share some common goals, and possibly have different roles and responsibilities within an organizational boundary (Salas et al., 2000). The study of teams and teamwork in IS research has taken many forms; for example, studying group decision support systems (e.g., Dennis et al., 2001), computer-mediated work (e.g., Satzinger & Olfman, 1995), virtual teams (e.g., Majchrzak et al., 2000), and team telework (e.g., Bélanger & Allport, 2008).

In technology-enabled teams, teamwork goes beyond the collection of team members' behaviors to also include the team goals, group norms (Feldman, 1984), team processes, and team emergent states (Ilgen et al., 2005; Kozlowski & Ilgen, 2006). We briefly define both concepts below, but in the next section, we will provide a more detailed theoretical discussion of both *team* *processes* and *team emergent states*, and explain how they can affect each other, what differentiates them, and how they may impact team outcomes differently.

Team processes are the activities that "team members engage in, combining their resources to resolve (or fail to resolve) task demands" (Kozlowski & Ilgen, 2006, p. 79). In organizational contexts, IS use is embedded in the team's work. In fact, IS use is often mandatory, such that team members cannot complete their work tasks without using at least some IS features (Brown et al., 2002). Research has shown that IS use in organizations is a collective phenomenon emerging from individuals to collectives (e.g., groups, teams, business units, etc.), based on refined interdependencies in use between the team members (Burton-Jones & Gallivan, 2007). Consequently, in technology-enabled teams, IS use becomes a mandatory process developed through the assimilation of organizational policies, procedures, and practices (Jasperson et al., 2005). IS usage can be considered a team process given that it requires a series of activities or steps that team members must perform to achieve a common goal.

Team emergent states are the "properties of the team that are typically dynamic in nature and vary as a function of team context, inputs, processes, and outcomes" (Marks et al., 2001, p. 357). The team emergent state of interest in this research is team ambidexterity. Contextual team ambidexterity represents the team's set of simultaneous capabilities, specifically its alignment and adaptability capabilities, at a point in time (Gibson & Birkinshaw, 2004). Ambidextrous teams can call upon both capabilities given the specific context in which the team is embedded (Gibson & Birkinshaw, 2004; Han et al., 2022; Jansen et al., 2016; Zhang et al., 2022). Team alignment capability, which focuses on efficiency (Han et al., 2022), refers to consistency in the way team activities are performed to solve the team's work tasks while team members work together toward the same goals (Gibson & Birkinshaw, 2004). The alignment can occur through the type and diversity of team members (Lix et al., 2022) or through the use of technology (Bjørn & Ngwenyama, 2009). Team adaptability is focused on innovation (Han et al., 2022) and refers to the team's capability to reconfigure activities so that the team can rapidly adjust to changes in the environment that result from disruptions or other external triggers (Gibson & Birkinshaw, 2004). Team ambidexterity develops over time, with expected positive impacts on performance (Han et al., 2022; Kostopoulos & Bozionelos, 2011). Furthermore, "the contextual perspective of ambidexterity suggests that teams establish a context that allows members to make their own choices about how to best divide their time between these two efforts" (Han et al., 2022, p. 176). We argue that team ambidexterity is an emergent state (property of the team, per Marks et al., 2001) that is developed through the team's work, including technology-enabled work (Mathieu et al., 2008). In technology-enabled teams, alignment and adaptability are key to the team's success. However, when teamwork requires the use of an IS (i.e., mandatory), this dependency on IS use can affect a team's ability to be aligned and adaptable.

To understand the role of team ambidexterity on team performance in technology-enabled teams, we build on prior extensive reviews of team processes and emergent states. More specifically, we ground our work on the review and theoretical framework proposed by Kozlowski and Ilgen (2006), who highlight the effects of team processes and team emergent states on team effectiveness and suggest that "technology-based work systems" might substantially affect the relationships among these constructs (p. 102). We draw on Kozlowski and Ilgen's (2006) framework to propose a conceptual model, which we tested using data collected from teams who are required to use an IS to coordinate and perform their work tasks in a Western European organization. Before surveying those teams, we first observed the behaviors and interactions of members of two teams in that organization. Building on these insights, our theoretical foundation, and existing research, we developed surveys that were administered to team members and their managers. The data analysis indicates that team ambidexterity mediates the relationships between team IS usage and team coordination and performance.

Our research contributes to the literature in several major ways. First, we further the understanding of team processes and team emergent states in technology-enabled teams. Second, we introduce and operationalize team ambidexterity as an emergent team state in technology-enabled work contexts. Third, we also advance knowledge of emergent states by theoretically arguing for and empirically examining the mediating role of team ambidexterity as a mediator in the relationship between team processes and team performance. Fourth, we explain how focusing on team processes such as IS usage or coordination without considering the mediating role of team emergent states (i.e., team ambidexterity) provides an incomplete understanding of team performance. Fifth, we offer a comprehensive nomological network for team performance. Our findings have additional implications for practitioners, providing insights into the ways in which team performance can be enhanced by fostering team IS usage, coordination, and ambidexterity in organizational settings where IS usage of individuals and teams cannot be considered in isolation.

2 Theoretical Background

The digitalization of work and the workforce has led to increased opportunities to study the role of technology in teams, particularly regarding how IS can make them more effective. With the abundant research about teams and team effectiveness, several large-scale reviews have been conducted to explore antecedents to team effectiveness (e.g., Ilgen et al., 2005; Mathieu et al., 2008, 2017). They reveal that as team members work together, the processes that teams use to conduct their work tasks tend to stabilize to such an extent that at a specific point in time, emergent states develop in teams, influencing the team's effectiveness (Ilgen et al., 2005). As an outcome, team effectiveness can be measured in multiple ways, including through team performance, satisfaction, or viability (Hackman, 1987). Our research explores one facet of team effectiveness: team performance.

Kozlowski and Ilgen (2006) argued that teams are dynamic and that they evolve as team members work together and interact with each other. However, most studies on dynamic team processes rely on static assessments, using instruments that only capture processes at a single point in time. Therefore, according to Marks et al. (2001), it is more accurate to refer to these static measurements as emergent states. Additionally, Mathieu et al. (2008) reviewed team processes and emergent states as different categories of mediators to effectiveness, addressing team processes as actions and team emergent states as team properties (e.g., Hitt et al., 2007; Marks et al., 2001; Mathieu et al., 2008). In our study, we follow this view and build on Marks et al. (2001)'s conceptualization of team processes as the activities performed by teams to accomplish their work tasks to achieve team goals, and where team attributes (e.g., team abilities, team properties) evolve into emergent states. This research considers team processes that are directly related to the use of technology by team members: team IS usage and technology-enabled coordination. Similarly, it considers team ambidexterity as a team emergent state that reflects capabilities of the team that can be called upon depending on context.

2.1 Contextual Team Ambidexterity

Both alignment and adaptability capabilities can coexist in organizations because they are non-substitutable and interdependent (Gibson & Birkinshaw, 2004). Ambidexterity refers to an entity being able to simultaneously make use of its alignment and adaptability capabilities, which can be developed within a structural configuration (Benner & Tushman, 2003; Simsek, 2009) or contextually framed (Gibson & Birkinshaw, 2004). In organizational-level ambidexterity research, structural ambidexterity is often the concept of interest, as some business units can be focused on exploration tasks while others can be focused on exploitation tasks (Benner & Tushman, 2003; O'Reilly & Tushman, 2013). At the team level, however, ambidexterity is more context-driven than structurally designed, such that both alignment and adaptability capabilities can emerge over time as team members work together (Han et al., 2022). Teams develop capabilities, such as ambidexterity, based on the skills and characteristics of their members, which can be refined through interdependencies among the members and its leadership, as well as the processes used by the team (Bledow et al., 2009; Han et al., 2022; Zhang et al., 2022). These capabilities can be called upon if the context requires it.

As previously discussed, contextual team ambidexterity allows teams to maintain consistency while executing the activities necessary to complete their tasks and achieve their goals (i.e., alignment); however, they are also able to reconfigure activities in response to changes in their work environment (i.e., adaptability). Teams exhibiting contextual ambidexterity have both capabilities, and their team members can allocate and balance their time between tasks related to alignment and those related to adaptability (Han et al., 2022). However, tensions may arise between alignment and adaptability in dynamic environments as the demands of the work context evolve. Some teams may operate in more stable business units, while others may frequently need to switch between conflicting contextual demands, as some teams are more exposed to changes than others. Consequently, different teams may exhibit different levels of ambidexterity at different points in time. Technology-enabled teams, in particular, may face greater exposure to dynamic contextual changes as technology changes and/or members continue to use their existing technologies.

Since ambidexterity emerges as a state that develops in teams over time, supported by a set of processes and mechanisms that team members rely on to align with and adapt to their current task and context, we propose that some teams will be ambidextrous, some will only be alignment capable, others will only be adaptability capable, and some may have none of those capabilities (at a given point in time). As discussed above, ambidextrous teams will exhibit both alignment and adaptability capabilities, and team members are capable of both performing routine tasks and identifying new potential opportunities and synergies, enacting multiple roles and discovering new collaborations in the environment in which they operate (Papachroni & Heracleous, 2020; Raisch et al., 2009). For example, agile software teams need to maintain efficient methods and procedures to build software that meets requirements, while also having the flexibility to adapt their practices as needed (Fontana et al., 2015).

Alignment-capable teams have an alignment capability but lack the capability to adapt to contextual demands. These teams can work coherently within organizational policies, complete work tasks effectively in stable environments, and be well-coordinated when facing conflicting goals and tasks (Gibson & Birkinshaw, 2004). When teams operate in contexts with low internal or external stimuli that do not demand significant adaptability, they can focus on processes that enable contextual alignment. This alignment capability leads to consistent teamwork, including practices such as using IS to manage service loads, adhering to organizational processes, employing standard channels for project management and communication, and conducting regular team meetings. Research suggests that achieving task requirements through alignment capability not only involves team processes or tasks but also requires alignment in team functioning. This includes adjustments for member diversity (Lix et al., 2022) and alignment with the available technology (Bjørn & Ngwenyama, 2009). Examples of such teams are service teams like technical support or customer service, which must strictly follow established organizational guidelines to ensure the consistent delivery of services and effectively resolve customer issues (Wirtz & Jerger, 2016).

Conversely, adaptability-capable teams demonstrate a high level of adaptability but lack the capability to align. This allows them to challenge established practices, be flexible, and rapidly evolve in response to changes in task requirements and priorities (Gibson & Birkinshaw, 2004). In technology-enabled teams, adaptability can lead to the development of new methodologies, foster collaborations within and between teams, and promote innovative uses of technology. Teams that are highly adaptable to dynamic environments can discover innovative ways to respond to rapid shifts in the market, environment, or organizational context, and quickly adjust their efforts to effectively meet new challenges. For example, teams in industries where customer preferences change quickly, such as online streaming companies, must be able to constantly adapt their content offerings to follow evolving viewer preferences and market trends (Wu et al., 2024). Similarly, research and development (R&D) teams, which are required to solve novel problems in real time, typically develop a strong adaptability capability but may struggle to align with standard processes.

It is possible for teams to have neither the capability of alignment nor that of adaptability, indicating that they are non-ambidextrous. The formation of emergent states and their effects takes time. Research shows that in newly formed teams, there may be either individual or reciprocal relationships between emergent states (e.g., cohesion) and performance, with these relationships strengthening or weakening as the team develops (Braun et al., 2020). Non-ambidextrous teams can either be newly established teams that may not yet have had the time for the development of either capability or teams with low interdependence between team members (Barrick et al., 2007). These teams often experience stagnation, leading to suboptimal outcomes. This stagnation is typically characterized by inertia in learning and experience, causing a reliance on established practices and previous experiences (Lee & Chen, 2024). Such teams generally rely on familiar methods and knowledge, making it difficult for them to adapt to new circumstances or align with context demands.

2.2 Mediating Role of Team Emergent States

Team processes represent the activities of team members in performing work tasks (Kozlowski & Ilgen, 2006) while team emergent states are the capabilities a team possesses, developed from team members' attitudes, values, cognitions, and motivations, which the team can use when needed to achieve outcomes (Marks et al., 2001). Team emergent states are dynamic in that they continue to evolve over time. However, they do not represent team members' interactions or actions of the team; instead, they are the properties that teams have developed from working together. Emergent states can be measured at a given point in time, representing the level of that emergent state at that point. For example, as a new team is put together, it may have low cohesion, but over time, the team may develop higher levels of cohesion (Braun et al., 2020). Measuring the level of cohesion at a given point in time reflects, among other things, how long the team has been together and team experiences, but also the team composition that led to that level of cohesion at that point in time.

Prior research has shown that both team processes and team emergent states influence team outcomes. There is an interrelationship between team processes and team emergent states that is necessary for teams to achieve team effectiveness (Jansen et al., 2016; Mathieu et al., 2000). Based on Kozlowski and Ilgen's framework and the extant literature, we argue in this section that team emergent states represent a mediating mechanism between team processes and team effectiveness. This is consistent with the fact that team processes require mediating mechanisms, such as cognitive, motivational, or affective team states, for team processes to affect team performance (Ilgen et al., 2005). Furthermore, prior research suggests that mediation can help researchers gain a better understanding of how factors are related, as an alternative path in theory building (MacKinnon, 2008), particularly when studying the effects of context-specific factors (Hong et al., 2014).

Research refers to how organizations and teams deal with the tensions between the capability to adapt and the capability to align as the ambidexterity hypothesis (Tushman & O'Reilly, 1996). The development of contextual ambidexterity in technology-enabled teams is therefore a response to the complexity of the context in which they operate. In other words, contextual ambidexterity mediates the relationship between context and performance (Gibson & Birkinshaw, 2004). In the context of technology-enabled work, there is a dynamic interaction between the IS, team members, and their tasks (Burton-Jones & Straub, 2006), resulting in team processes that can be complex or more time-consuming. As such, team members may see the implementation of such processes as obstacles to the performance of the team. Therefore, team processes shape the team and, over time, teams develop a variety of emergent states, including the capabilities that represent team ambidexterity, allowing them to achieve superior performance. Additionally, team-related research suggests that in newly formed (non-technology-enabled) teams, there is a reciprocal relationship between emergent states (e.g., team cohesion) and team performance (Braun et al., 2020), although their relative roles are not clear. In teams, emergent states, such as team confidence, cohesion, trust, shared mental models, and contextual ambidexterity, develop over time and significantly influence how team members interact within the team (Mathieu et al., 2008). These states shape the team climate and can enhance or hinder team processes, acting as a mediation mechanism to team performance.

2.2.1 Team IS Usage

Team IS usage comprises the IS, the team members using it, their work tasks, and the interdependencies in use (e.g., Burton-Jones & Gallivan, 2007; Burton-Jones & Straub, 2006; Nan, 2011). The shift from individual IS use to collective use is a bottom-up process shaped by different configurations and interdependencies between the elements noted above and the context in which they occur. When teams use an IS to perform work, they use these resources to complete their assigned tasks. When IS usage is infused into work practices, it can help improve efficiency and reduce risk, providing numerous benefits for organizations. As team members work together, they develop similar work practices and IS uses, which become embodied in the team through repeated team member IS use behaviors until they are refined and institutionalized by the team (Orlikowski, 2000). As team members become aware of how other team members' actions affect their own usage, they adjust their use behavior by communicating and sharing relevant information needed to work together (Karsten, 2003). In summary, team IS usage is established by the repetition of usage practices, recognizable patterns of action, and interdependent actions toward usage among team members (Feldman & Pentland, 2003). It is a collective phenomenon that emerges from the integration of team members' use behaviors and the interdependencies in use of team members.

The use of an IS helps to define what a technology-enabled team is, typically for task management or to facilitate team processes. When it is mandatory to use the IS for most tasks, team members must cope with the use of the IS, but may do so distinctly from each other. As such, tensions in the team can be created or amplified if the mandatory usage undermines the achievement of team goals. Team members must then use some coping mechanisms, which vary between engagement, compliance, reluctance, or deviation with IS use (Bhattacherjee et al., 2018).

IS usage as a team process results from team members' efforts to integrate and work with other team members to achieve team goals (Salas et al., 2000). These interactions reflect the definition of team processes (Marks et al., 2001, p. 357), as "members' interdependent acts convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals." According to the taxonomy proposed by Marks et al. (2001), IS use may be characterized as an action process, which refers to processes related to executing activities that influence the accomplishment of a team goal, affecting the team's performance. However, higher levels of IS usage alone do not imply improved team performance. The effectiveness of IS usage depends on how well the team integrates and adapts these systems to the context. Technology-enabled teams that are better at appropriating and seeking fit with the IS for their tasks achieve higher performance; teams with poor technology fit can overcome this by innovating and adapting their IS usage (Fuller & Dennis, 2009). Team ambidexterity allows teams to balance the need to perform routine tasks (alignment) with the capability to innovate and respond to changes (adaptability) when using the IS to achieve higher levels of team performance (Luo et al., 2015). As a result, we posit that team ambidexterity mediates the relationship between team IS usage and team performance:

H1: The effect of team IS usage on team performance is mediated by team ambidexterity.

2.2.2 Team Coordination

Coordination is one of the most often-cited technology-enabled team processes that affects how team members work together (Kozlowski & Ilgen, 2006). Teams have interdependent work that must be coordinated to meet the demands of other members. Effective teams share a common vision, with each team member being motivated to work towards a common goal (Salas et al., 2000). Team coordination is the "process by which team resources, activities, and responses are organized to ensure that tasks are integrated, synchronized, and completed within established temporal constraints" (Salas et al., 2000, p. 342). As such, team coordination allows for the integration of individual actions, knowledge, and objectives in a team to adapt to situational demands in order to complete tasks successfully. Teams can coordinate teamwork by using standardization mechanisms, such as checklists, methodologies, and codes of practice with formalized documentation (e.g., e-schedules, plans), and by adjusting interactions through formal and informal mechanisms (Sabherwal, 2003).

While prior research links coordination to team performance, the question is whether this direct effect is also mediated by the emergent state of team ambidexterity in technology-enabled work. Coordination is a fundamental process to manage team issues, such as geographical distance or time zone differences in virtual teams (Massey et al., 2003) or cultural and language diversity (Montoya-

Weiss et al., 2001). However, team coordination can be affected by multiple factors, such as uncertainty from lack of information, changing coordination mechanisms, or team diversity (Sabherwal, 2003).

The existence of informal and formal coordination mechanisms among team members determines their engagement in both alignment and adaptability activities (Jansen et al., 2006). Connectedness between team members is a form of informal coordination that is important in predicting team ambidexterity since the density of the relations between team members affects its ambidexterity (Jansen et al., 2006). This is because team members can manage potential tensions related to team ambidexterity and combine distinctive learning activities with coordination, supporting both alignment and adaptability activities. Teams that can manage internal work efforts while challenging standard work practices to quickly respond to external challenges are more likely to achieve their goals. Thus, team ambidexterity that promotes team members' integration of work practices to improve existing skills and knowledge, resulting in the team simultaneously improving extant practices and searching for and experimenting with new ones, can lead to greater team performance. Hence, we hypothesize:

H2: The effect of team coordination on team performance is mediated by team ambidexterity.

Both H1 and H2 suggest that team processes affect team performance through the mediation of an emergent state, team ambidexterity. Various team emergent states have been studied in the literature to explain team effectiveness (Rapp et al., 2021), but not as a mediator. Yet, the inclusion of mediating variables can assist in understanding delayed effects, studying the process of change, refining theories, etc. (Hong et al., 2014). Some research supports a direct link between ambidexterity and performance at the team level (Han et al., 2022); for example, team ambidexterity in project teams affects project performance (Liu & Leitner, 2012). Thus, we expect that at a given point in time, team ambidexterity will positively influence team performance. Therefore, we hypothesize:

H3: Team ambidexterity is positively related to team performance.

Figure 1 shows the research model to be tested.

3 Observational Study

To better examine the possible relative roles of team processes and emergent states, we first performed an observational study where one of the co-authors was able to observe two of the teams in the study organization (ITM as a pseudonym). This allowed us to develop an in-depth understanding of the context of the study, an important step in conducting research (Hong et al., 2014). We examined team processes and emergent states related to system usage, team operations, work task resolution, and the organizational context. We also examined collaborative practices among team members and team actions related to ambidexterity. Team members did not know that they were participating in a research study (only top management did). The preliminary observations showed that it was possible to measure team processes and emergent states in ITM's work teams. It also allowed us to examine the exhibition of ambidexterity by the teams in context.

ITM is a technology company offering shared services to other firms. It has over 50 work teams with over 280 team members. To ensure that IS use had emerged at the team level, we requested access to employees with more than two years of tenure. We also needed teams with different functions and configurations in terms of members (homogeneous or heterogeneous), environmental contexts (intense/complex or stable),[1] and tenure (Mathieu et al., 2008). ITM requires the use of a service management system (SMS) for employees to manage work requests between business units and service teams, but SMS can also be used as a collaborative tool. Since all employees had experience with the tool, the emergence of IS usage at the team level and the development of norms of usage had thus already occurred.

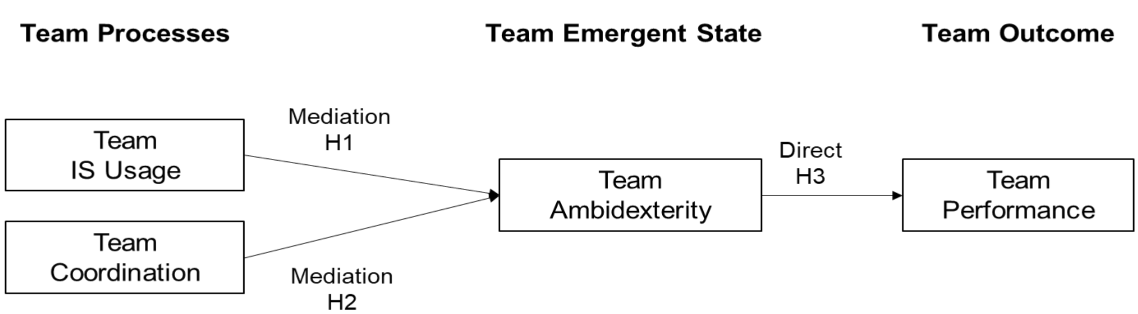


Figure 1. Research Model

[1] Intense and complex environments are characterized by rapid changes, high levels of uncertainty, and multiple interacting factors that require adaptive strategies and quick decision-making. Stable environments are characterized by consistency and predictability (Mathieu et al., 2008).

Team Support	Team Dev
1. *All elements use [SMS] very easily as part of daily routine work. Perform almost all work tasks in [SMS]. They get used to it.*	1. *I saw J and D together in front of J's monitor to create a work request together. They tested several ways to do the task. When they finish it, they said to each other that in the next request they will try it another way.*
2. *Saw X and Y talking in the cafeteria about going to a concert together.*	2. *They claim a lot that using [SMS] is hard; they say performing the task via [SMS] delays the normal work.*
3. *Y and W argue a lot about a certain request that was incorrectly created, and Y went to the requester to teach him how to do it and to correct.*	3. *When each needs to open a request calls for the other, they talk and discuss the process of requesting services.*
4. *I found X with another team teaching them to reconfigure [SMS] so that the work order lists appear different to make it easier to check.*	4. *When they are alone, they open often the requests for the other.*
5. *C went to the team (that did not use [SMS] before) that she was responsible for to resolve requests to teach them to open requests that better fit the way she works.*	5. *The team manager said to them that using [SMS] was a very easy task for these two.*
	6. *C came to ask for D's support to open a request.*
	7. *J claimed that the service team closed the request without solving it because it was wrongly addressed, so J invited D and they went to the service team to teach them how.*

Figure 2. Sample Field Notes (One Visit)

3.1 Observation of the Teams

ITM gave us access to two teams for observational purposes, including a team of developers (Team Dev) and a business support team (Team Support). One researcher observed both teams at their workplaces, including in conference rooms when they had meetings and in more informal settings, such as the cafeteria. She took brief notes of all the events she observed at the end of each visit, including how team members used SMS to perform work tasks, their collaboration via SMS, their interactions with SMS, and the features of SMS. As we reviewed her field notes, we refined some of the concepts to further consider for our study and made suggestions regarding what she should focus on during subsequent observations. She sometimes asked team members probing questions to better understand or clarify her observations. Examples of such field notes are shown in Figure 2.

3.1.1 Team Support

Team Support has had seven members working together for more than 15 years. This team functions as a proxy between organizational teams by redistributing technical support requests between service and information technology (IT) teams. Each team member seeks to meet individual goals only, which are measured by the number of requests they handle and the time it takes to complete them. The team's goals depend on the combined performance of all team members. This indicates that resolving service requests, which is the primary task of this team, is performed independently by each team member. Although team members have different individual goals, their collective efforts contribute to achieving the team's objectives. This dynamic creates a strong interdependence between the team members; although they do not share the same individual goals, their contributions collectively support the team objectives.

The tasks assigned to this team include different IS usage such as checking for new requests, analyzing requests, identifying which service team should solve the request, and reassigning the request to a responding team. If the request is complex, it requires coordination among team members, with the request being further analyzed by several team members or the team's manager.

SMS has served as the main work information system for this team for many years. Over time, system use has been refined and adjusted to meet team members' needs. Initially, team members experimented with SMS, trying new forms of usage, and exploring alternative ways of using the system until they felt it met their work needs. When a team member discovers a novel method or a beneficial customization of functionalities that better suits their needs, they share it with the other team members. As these new practices are adopted by other team members, they become standard usage practices. Furthermore, members of this team often help service requesters in creating and changing requests, effectively transferring their usage behavior to users of other teams.

Team Support members have developed strong relationships with each other over the years, such that work is now assigned almost automatically, as each member knows what requests they should select to fulfill. This shows that the team members' coordination process is implicit. In situations of unexpectedly high workloads or requests with new characteristics, the manager and team members explicitly coordinate work distribution among themselves to optimize the workload and complete the requests as soon as possible.

Over the years, team members have consistently used SMS because their shared and continuous use practices have proven to be effective, and the team manager has encouraged team members to refine their SMS usage. This shows the importance of SMS usage in enabling the team to align and adapt their work according to the current demands and context. Given the nature of its role, this team has exhibited high alignment capability with well-established work processes that are in line with organizational policies. Additionally, their work processes allow them to quickly respond to changes in task requirements or priority shifts, demonstrating high contextual adaptability. According to the context-driven definition of ambidexterity, Team Support is clearly an ambidextrous team.

3.1.2 Team Dev

Team Dev is a smaller and younger team comprising two senior software engineers and a manager that have been working together for two years. Both engineers perform project management, system analysis and design, and software development. They have developed independent and reusable modules of code, processes, and functions, which they can apply to various projects. While there is some overlap of work functions, there are differences in goals and tasks. Therefore, task assignment is explicit and agreed upon between team members and the team manager, such that there is an explicit coordination of work tasks. Although the goals are assigned individually, when both individuals perform tasks in the same application, they can work together, learning from one another. This team only uses SMS as a client of other business units (to request that work tasks be performed by other organizational units)—for example, for service requests to IT teams for application deployment, execution of database scripts, or the configuration of communication facilities.

Initially, this team used the SMS in a standard way, systematically following the user's manual. As team members continued using the system, they started to explore new forms of use that enabled them to reduce the time spent on certain tasks, making them better prepared for new challenges and changing contexts. Whenever team members found new ways to use SMS features, they would share them with the other team members. Our observations of Team Dev suggest that the team has the capability of being adaptable to changing or urgent demands. Although the team follows organizational policies through compliance with existing processes, which gives it some alignment capability, Team Dev clearly has a higher adaptability capability. As a result, Team Dev is assigned to critical projects and is often approached by other teams seeking better ways of using SMS.

In summary, our observational study revealed that both IS usage and coordination can facilitate routine operations (Team Support) and the exploration of new methods (Team Dev), which are pivotal in supporting task efficiency and innovative practices when applicable. In their own ways, each team exhibits ambidexterity and both are considered well-performing teams. However, we consider Team Dev to be less balanced, with a higher adaptability capability compared to its alignment capability. This indicates that contextual team ambidexterity can lead to high team performance, as long as both capabilities are available in the team when needed.

4 Quantitative Study

This study was conducted by surveying team members and their managers in ITM. We performed the analyses in multiple stages to ensure instrument, construct, and data reliability and validity before hypothesis testing.

4.1 Instrument Development

The main data collection involved a large-scale quantitative survey of teams and team managers within ITM. All measures on the survey instruments (i.e., one for team members and one for managers) were adapted from existing scales. Team IS usage was adapted from Li et al. (2013). We surveyed team members about their team IS usage using the referent-shift model, which changed the referent of the original construct from individuals to the collective, resulting in a conceptually distinct construct (Chan, 1998; van Mierlo et al., 2009). Thus, informants were asked to answer for the collective to which they belonged, reflecting the informants' perceptions about the collective. We measured coordination by adapting the coordination scale from Chiocchio et al. (2012), and surveyed team managers about team performance and team ambidexterity. Team performance was adapted from Lewis (2004). Based on previous research, we used a two-step approach to develop the measure of team ambidexterity (Gibson & Birkinshaw, 2004; Jansen et al., 2016). First, we measured team alignment and team adaptability, and then we computed the additive measure of team ambidexterity. The process is described in Appendix A, together with the survey development procedures, items, and scale validations. Additionally, we controlled for several variables that could have confounded our results: team size, longevity, communication, and team innovativeness.

4.2 Participants and Data Collection

The organization had 41 of 52 available teams meeting our research requirements. We sent 176 survey requests by email to employees and 41 to their managers. As an incentive to increase the response rate, we donated 0.50€ to a non-governmental institution sponsored by ITM as part of their social responsibility actions for each completed response. We also sent three follow-up emails. We received 111 employee and 36 team manager responses. However, we had to discard two partially incomplete employee responses and two manager responses that had no corresponding team member responses, as well as one outlier data point (corresponding to one team with three members). Consequently, the final sample size comprised 106 employees and 33 managers for a final response rate of 60% and 80% for employees and team managers, respectively. The mean team members' response rate in teams was 75%. Of the 33 teams, 15 were in information systems (analysis and development), eight were in information technology (databases, networks, etc.), three were in client support, three were in organizational services (legal, governance, etc.), two were in procurement, and two were in shared services. Team sizes varied from 2 to 20. Most teams had mixed gender representation, although a few had only men or women. The average ages varied from 29 to 58 years old. The average experience with SMS varied from 2 to 4 on a scale from 1 = *none* to 4 = *a lot* (Anderson & West, 1998), with most teams being at 3 or 4. The same was true for experience with the task, with team ratings of 2 to 4 on the same scale—again, most teams were at 3 or 4. Finally, the frequency of use within each team varied from 2 to 7 on a scale of 1 = *do not use at all* to 7 = *use several times each day* (Venkatesh et al., 2008) with the following distribution 2 (n = 6), 3 (n = 7), 4 (n = 3), 5 (n = 1), 6 (n = 9), and 7 (n = 8).

4.3 Measurement Model Validation

Before model testing, we conducted in-depth analyses of the collected data measured at both the individual and team levels to ensure their validity and reliability. These detailed tests, provided in Appendix B, included skewness, multicollinearity, and convergent and discriminant validity, as well as common method bias. All tests indicated that the measurement model was appropriate for pursuing model testing and that common method bias was not a concern. Two team-level constructs were measured from individual team members' perceptions (i.e., team referent-shift constructs); to evaluate their validity, we performed computations suggested for the measurement of shared constructs. This included measuring interrater agreement and intraclass correlation to evaluate the homogeneity of team members' perceptions regarding team IS usage and coordination (i.e., team variables measured as referent-shift constructs). Appendix C provides a detailed description of the aggregation process and validation of the aggregations performed. Appendix D presents descriptive statistics and correlations of the variables in the model.

5 Quantitative Study Results

5.1 Hypothesis Testing

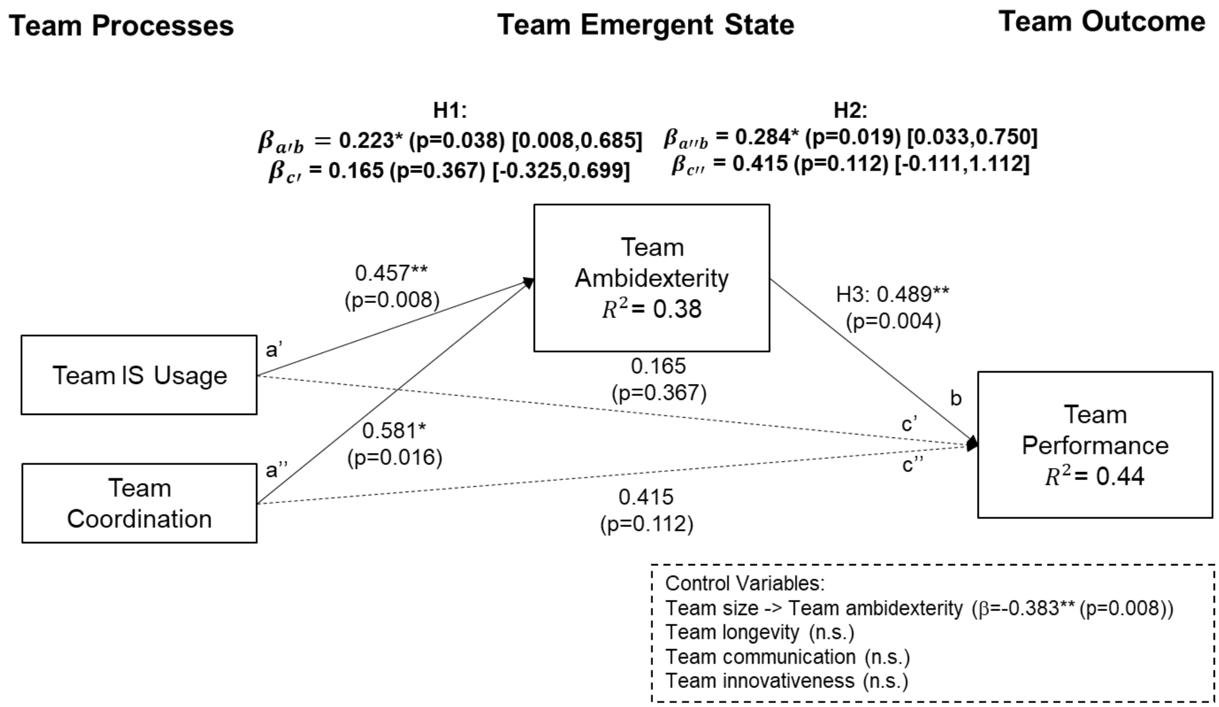
We tested hypotheses H1, H2, and H3 with covariance-based structural equation modeling (CB-SEM) as implemented in IBM SPSS Amos 28.0. Since the first two hypotheses involved mediation, we conducted a mediation analysis using the bootstrapping method (Hayes, 2009), an approach that offers great statistical power, allows for the direct measurement of "indirect effects", and does not assume a normal distribution. To use this method, we resampled the original sample with replacement 5,000 times (Hayes, 2009) to estimate the indirect effects in the resample, assuming a standard 95% confidence interval (CI) for the upper and lower bounds (MacKinnon, 2008). The results are shown in Figure 3.

The indirect effect between team IS usage and team performance mediated by team ambidexterity was significant ($\beta_{a'b}$= 0.223, p = 0.038), and the 95% CI did not include zero. Similarly, the indirect effect between team coordination and team performance mediated by team ambidexterity was also significant ($\beta_{a''b}$=0.284, p=0.019). The mediation effect existed if the indirect effect, i.e., the coefficient of the ab mediation path was significant and its CI did not include zero; i.e., the indirect effect had to be significant (Zhao et al., 2010). Both $\beta_{a'b}$ and $\beta_{a''b}$ were significant, indicating that team ambidexterity was a mediator in the relationship between both team use and coordination and team performance, supporting H1 and H2. As shown in Figure 3, the test for the direct effect of team ambidexterity on team performance was significant, also providing a high level of explained variance in team performance, thus supporting H3.

We also tested for several control variables, including team size, team longevity, team communication, and team innovativeness. The results show that team size had a negative significant effect on team ambidexterity. This is in line with other research in technology-enabled teams, such as agile development teams, suggesting that team members of smaller teams are more satisfied and more easily create bonds with each other (Venkatesh et al., 2023). However, the results indicate no significant relationship between team longevity, communication, and team innovativeness to team performance. For communication, we explain this result by the high correlation between communication and coordination, which is in the model. For longevity, we believe that since team ambidexterity is developed over time, longevity is already reflected in the measured level of ambidexterity that the teams exhibited at the time of data collection. Finally, for team innovativeness, the mandatory use of the IS might explain the lack of effect for this control variable.

5.2 Post Hoc Analysis

To gain additional insights, we conducted a series of post hoc analyses. First, to ensure the robustness of our measurement for team ambidexterity, we replicated the analyses using an alternative measure by computing the product of alignment and adaptability. The results are consistent with those obtained from the additive measure, confirming the robustness of our findings.



Note: * < 0.05; ** < 0.01; *** < 0.001. Bold numbers represent coefficients and confidence intervals of the mediation effects obtained using the bootstrap method with 5,000 samples. a'b and a''b represent the mediation paths between team IS usage and team coordination, team ambidexterity, and team performance, respectively. c' and c'' represent the direct paths between team IS usage and team coordination with team performance, respectively.

Figure 3. Results of Hypothesis Testing

Table 1. Bootstrapped Confidence Interval Tests for Mediation Model (Indirect Effects)

Relationship	β	p-value	95% lower bound	95% upper bound	Zero?
USE → ALI & ADA → PERF	0.245	0.179	-0.158	0.718	Yes
COO → ALI & ADA → PERF	0.501	**0.009***	0.118	1.025	**No**
Note: USE: team IS usage; COO: team coordination; PERF: team performance; ALI: alignment capability; ADA: adaptability; * *p* < 0.05					

Table 2. Direct Effects Testing for Mediated Relationships

Relationship	β	*p*-value	95% lower bound	95% upper bound	Zero?
USE → PERF	0.056	0.598	-0.182	0.315	Yes
COO → PERF	0.041	0.691	-0.226	0.418	Yes
USE → ALI	0.450	0.095	-0.115	0.909	Yes
USE → ADA	0.431	0.072	-0.042	0.923	Yes
COO → ALI	0.730	**0.003***	0.250	1.287	**No**
COO → ADA	0.464	0.090	-0.083	0.995	Yes
ALI → PERF	0.968	**0.002***	0.667	1.176	**No**
ADA → PERF	-0.444	0.062	-0.695	0.022	Yes
Note: USE: team IS usage; COO: team coordination; PERF: team performance; ALI: alignment capability; ADA: adaptability; * *p* < 0.05					

Additionally, to further ensure that team ambidexterity is an emergent state that cannot be substituted by alignment and adaptability capabilities separately, we tested our research model, substituting team ambidexterity with its subconstructs. Tables 1 and 2 show the results of these analyses, where the capabilities are tested as possible mediators.

For model comparison, we used Akaike's information criterion (AIC), which best balances the trade-off between goodness of fit and model complexity. Our research model AIC ($AIC_{ambidexterity}$ = 72.0) is smaller than for the model with alignment and adaptability ($AIC_{alignment\ and\ adaptability}$ = 113.7) indicating that our research model is a better model

(Boomsma, 2000). The results indicate that the indirect effect of coordination on performance, mediated by alignment, is significant. However, team IS usage showed no significant relationship with performance when considering both capabilities separately (but it did when using ambidexterity as the mediator). This suggests that ambidexterity does play a crucial role in how team processes impact performance, although it is sometimes more dependent on one of the capabilities, as in the case of coordination.

Our theoretical reasoning led us to identify different levels of contextual ambidexterity, i.e., specific levels of adaptability and alignment capabilities in a team at a specific point in time. This is in line with previous research that has discussed how different levels of ambidexterity in business units can result in differences in performance (Gibson & Birkinshaw, 2004). Despite the possible conceptual differences between team and business unit capabilities, we considered the possibility that different levels of team ambidexterity might affect performance differently.[2] Thus, we performed a cluster analysis in our sample of ambidextrous teams to identify groups of teams with different levels of ambidexterity at the time of the data collection. We conducted a two-step cluster analysis to identify distinct groups within the data. The optimal number of clusters was determined using the AIC. The model with the lowest AIC value (14.78) was selected as the final clustering solution. The final solution identified three clusters, which explained 87.6% of the total variance. The cluster analysis results differentiate teams with high, medium, and low levels of ambidexterity. Table 3 shows the ambidexterity (cluster centroids), alignment, and adaptability mean scores for each of the three clusters.

We then examined performance differences both between groups (between the three clusters of teams with distinct levels of ambidexterity) using ANOVA and within groups (between the teams in each cluster) using the regression-based SD analysis. We compared the mean values of performance weighted by team size between the groups. The results of the ANOVA are shown in Tables 4 and 5.

The ANOVA F-test was not significant ($F = 0.509$, $p = 0.608$), indicating that we could not reject the hypothesis that the groups had the same performance level. In other words, no significant performance differences were found between the three clusters of ambidextrous teams. Following He and Wong (2004), we then regressed the three standard-deviation values against the three mean performance values weighted by group size. The results of the regression-based standard deviation analysis are shown in Table 6.

The actual standard deviations of all groups of ambidextrous teams were within the 95% CI and very close to the predicted standard deviation, implying normal intragroup (between teams of each cluster) variation in the three groups of ambidexterity levels, confirming that all ambidextrous teams exhibited the same relationship between ambidexterity and performance.

Table 3. Cluster Centers Mean Scores

Ambidexterity level	*N*	Ambidexterity	Alignment	Adaptability
High	5	12.00	5.08	6.92
Medium	16	10.57	4.55	6.02
Low	4	9.11	4.17	4.94

Table 4. Descriptive Statistics

Ambidexterity level	*N*	Mean	*SD*	*SD*/mean
High	5	4.33	0.56	0.13
Medium	16	4.22	0.32	0.08
Low	4	4.08	0.05	0.01

Note: Levene statistic for homogeneity of variances = 3.079 ($p = 0.066$); equal variances assumption is not rejected.

Table 5. ANOVA for Team Performance

Performance	Sum of squares	*df*	Mean square	*F*	Sig.
Between groups	0.128	2	0.064	0.509	0.608
Within groups	2.776	22	0.126		
Total	2.904	24			

[2] We wish to thank the review team for the suggestion to further analyze the structure of the different levels of ambidexterity in the study and their relation to performance.

Table 6. Regression-Based SD Analysis

Ambidexterity level	Weight	Mean	*SD*	Predicted *SD*	Lower bound of 95% CI	Upper bound of 95% CI
High	5	4.33	0.56	0.55	0.53	0.57
Medium	16	4.22	0.32	0.33	0.31	0.34
Low	4	4.08	0.05	0.04	0.02	0.06
Note: Regression equation: $y_i = \beta_0 + \beta_1 w_i x_i + \varepsilon$, *i* = 1...3 (ambidexterity levels: high, medium, low); y_i = standard deviation of performance for *i*; x_i = mean performance values of *i*; w_i = weight of *i*, i.e., *i* group size.						

6 Discussion

Our research seeks to explain how two technology-enabled team processes (coordination and IS usage) and a team emergent state (ambidexterity) affect performance in technology-enabled teams. We define team ambidexterity as an emergent state that represents the alignment and adaptability capabilities of the team, which cannot be substituted for by either of these capabilities separately. In this paper, we show that team ambidexterity mediates the relationship between team IS usage and performance, as well as the relationship between team coordination and performance. These overall findings have numerous implications, which we discuss next.

6.1 Team Processes and Team Emergent States

Prior research has highlighted the roles of team processes and team emergent states in affecting team performance. However, it has not clearly untangled their relative roles, often lumping them together as undifferentiated determinants of team performance. In this study, we distinguish between team processes and team emergent states in technology-enabled work teams and clarify their roles in affecting team outcomes.

There are potentially several other team emergent states in technology-enabled work that require further research. As a first step, studies could consider contexts in which IS usage is not mandatory, because when IS use is mandatory, team members may react with different behaviors; team members can be deviant, reluctant, compliant, or engaged within the same team (Bhattacherjee et al., 2018). Deviant team members believe that using the IS is an additional challenge to their work and autonomy, exhibiting opposition to using it; reluctant users have low expectations about the IS, feeling disengaged and using it only to comply with mandates; compliant users see the IS as necessary, using it with a routine way to perform work tasks; and, engaged users feel enthusiastic about IS use, using the IS beyond required uses by exploring and customizing the IS (Bhattacherjee et al., 2018). The findings from our observational study suggest that in one of the ambidextrous teams (i.e., Team Support), team members had embedded SMS use completely in their work routines, such that they were compliant with organizational use guidelines. Conversely, in the other ambidextrous team (i.e., Team Dev), team members were late adopters of SMS because they felt it was not useful for performing their tasks, but given its mandatory usage, they explored ways to use the system differently to better serve their needs. Further research should study how negative emotions or behaviors related to IS use emerge at the team level and how they can affect other team processes and outcomes. It would also be interesting to explore the role of the mandatoriness of other technology-enabled team processes (e.g., communication, knowledge sharing, etc.) and its impacts on team emergent states and outcomes.

Another emergent state that could be further explored is the capability of the team to learn in the context of technology-enabled work, which could be labeled learning culture or team absorptive capacity (Lee et al., 2021; Roberts et al., 2012). Team absorptive capacity can be defined as the "team's self-learning capabilities in terms of acquiring, assimilating, transforming and exploiting knowledge to generate new knowledge to better respond to environmental changes within a project" (Lee et al., 2021, p. 123). In technology-enabled contexts, where teamwork requires team usage of IS within a dynamic environment created by the constant evolution of technology, the emergent state of team absorptive capacity may be required for teams to perform or to continue to perform well. In fact, a team's capability to dynamically learn and share knowledge among team members has been recognized as a collective ability (Roberts et al., 2012; Tiwana & McLean, 2005). Additionally, a team's absorptive capacity can promote an environment where team members encourage each other to learn, increasing all team members' willingness to learn about the technologies available for completing their work tasks. For organizations that make extensive use of technology-enabled teams, our research opens avenues to think about how they should promote the development of their teams' emergent states to improve team performance.

Distinguishing between team processes and team emergent states enables a deeper understanding of teams' performance in technology-enabled environments, as both impact performance differently. By untangling these roles, this study provides a clearer framework for analyzing how specific team interactions (processes) and dynamic properties (emergent states) influence team outcomes. This can be valuable for researchers investigating a variety of other team outcomes that may also be impacted differently by team processes and emergent states.

We showed one situation where the effects of the team process (i.e., IS usage) on performance are amplified by the team's emergent state. Future research is needed to explore the role of technology in facilitating (or inhibiting) the emergence of the team's emergent state and how teams adapt and learn in dynamic technological contexts to promote a culture of continuous improvement and innovation. For example, are there situations where technology functions as a constraint rather than an enabler of such emergence? Under what conditions and context might this happen?

6.2 Team Ambidexterity as an Emergent State

Prior research has indicated that firms may demonstrate different levels of organizational ambidexterity (Napier et al., 2011). In that research, an organization can achieve structural ambidexterity by dividing work between different organizational units, such that some are alignment capable and others are adaptability capable. For example, R&D departments are often focused solely on innovation (Bledow et al., 2009), while accounting departments focus mainly on operational processes. Our work, however, considers work teams where contextual ambidexterity does not concern the division of work but rather the team's ability to develop both capabilities and become ambidextrous. Our findings contribute to the conceptualization of team-level ambidexterity in technology-enabled teams, which is important because prior research has examined team ambidexterity much less than organizational ambidexterity. The few exceptions include research that addresses team ambidexterity as the notion of team members being able to simultaneously engage in exploratory and exploitative learning and work activities (Jansen et al., 2016; Jørgensen & Becker, 2017; Zhang et al., 2022). By leveraging but also extending these concepts, our study defines team ambidexterity as an emergent team state in technology-enabled work contexts that reflects the ability of teams to respond to contextual demands through their capabilities to align and adapt to the context.

In our observational study, we noticed that contextual work demands influenced the team's development of alignment and/or adaptability capabilities. Therefore, we can argue that in technology-enabled teams, the capabilities of alignment and adaptability can be developed over time depending on the context in which the teams are embedded. We can then measure team ambidexterity as an emergent state reflecting those capabilities at a given point in time. The findings reinforce the importance of team ambidexterity as a powerful emergent state resulting in the joint capabilities of alignment and adaptability, which teams can make use of depending on the contextual conditions. Importantly, the mediating effect of team ambidexterity cannot be replaced by alignment or adaptability separately for at least some processes (i.e., IS usage). We found that, unlike IS usage, when the two capabilities are considered separately, the effect of coordination on performance is mediated by the alignment capability. Interestingly, this finding suggests that the mediation effect varies depending on the specific team process, with one capability sometimes playing a more dominant role than the other. Marks et al. (2001) proposed a taxonomy of team processes that emphasizes their differences, which could potentially serve as a foundation to explore how the mediation effect of emergent states differs. In addition, we encourage further research focused on the complex structure and form of team emergent states in distinct technology-driven scenarios and further examination of their mediating role for other team processes.

6.3 The Mediating Role of Team Ambidexterity as an Emergent State

The input-mediator-outcome team effectiveness framework includes both team processes and team emergent states that serve as mediators for effectiveness by aligning team resources for task resolution (Kozlowski & Ilgen, 2006; Mathieu et al., 2008), but does not distinguish between processes and emergent states. In this study, we provide new insights into the role of team emergent states as mediators to achieve higher levels of team performance (Rapp et al., 2021).

To further interpret the mediating role of ambidexterity, we used Zhao et al.'s (2010) extension of Baron and Kenny (1986). Accordingly, to identify the type of mediation, we tested the direct effects of team IS usage and coordination on team performance. If the direct effect, i.e., the coefficient of the direct path is significant, then complementary (positive sign) or competitive (negative sign) mediation can occur, indicating the possibility of omitted mediators in the model. On the other hand, if the direct path's coefficient is non-significant, it indicates indirect-only mediation, suggesting that the mediator is consistent with the hypothesized theoretical framework (Zhao et al., 2010). Our results show that the direct paths between team IS usage and coordination to team performance are non-significant, revealing indirect-only mediation of team ambidexterity, confirming that there are no omitted mediators in our hypothesized model. This is a key finding, as the amplifying effect of the team emergent state (as team ambidexterity) could be overlooked if researchers focus solely on the impact of processes like coordination and communication on team performance without fully understanding the dynamics at play.

6.4 Team IS Usage as a Collective Process

Our research also validates team IS usage as a collective construct representing a team process in technology-enabled work contexts. The emergence of team IS usage through a shift from individual IS use to team IS use is possible when team members perform similar tasks and have some degree of interdependence that compels them to redirect their efforts into regulation, sharing, and adjustment of practices for their collective use (Wageman, 1995). The team's expectations regarding task resolution and system use have been established, which simplifies the expected usage behavior of team members. Even if team membership changes, these previous team use practices are transferred to new team members to promote the continuance of the established usage behavior so that the goals continue to be achieved. While much research has looked at the effects of team IS usage on team performance, the consideration of team IS usage as a process helps to improve the understanding of how usage practices in the team affect team outcomes. Research has developed theories such as media synchronicity theory (Dennis et al., 2008) and communication mode repertoires (Watson-Manheim & Bélanger, 2007) to improve the understanding of the concurrent use of multiple information systems. Defining system use as a process that evolves over time and leads to emergent states enables a clearer perspective on how the use of concurrent technologies among group members impacts team outcomes (Easley et al., 2003; Kang et al., 2012).

Similarly, a large body of research exists on virtual teams' use of technologies to perform their work (Majchrzak et al., 2000; Shirish et al., 2023), and a process view can further explain how this usage affects performance through the development of emergent states, such as cohesion (or lack thereof) in remote teams. Rapp et al. (2021) arguef that the increased virtuality of organizations might affect team emergent states. In our study, all team members had to use technology to perform their work and to communicate and coordinate their work with each other. However, they were not remotely located and were likely able to have conversations about problematic situations. But what happens when work becomes almost exclusively IT-enabled? How does the use of an IS to perform all work affect team emergent states, such as team ambidexterity or team cohesion? As organizations sent employees home during the pandemic and suddenly those employees all needed to make use of technology to perform their tasks, which employees fared better? Was there a link between more successful transitions and those who had been working for longer in their teams? Many collaborative tools were available (e.g., Zoom, Teams, Google Meet), but were the technologies sufficient to promote continued team cohesion? This is particularly important now, as the rise of remote work and digital nomads is putting pressure on organizations to improve their management of geographically dispersed teams (He et al., 2022).

6.5 Team Performance and Its Nomological Network

Our findings confirm the mediating role of team ambidexterity when team members exhibit alignment and adaptability capabilities that can be used, depending on the current context (Han et al., 2022). Our results thus offer insights into ways to enhance team performance by fostering team IS usage, coordination, and ambidexterity. Since higher levels of team IS usage and coordination affect team performance via team ambidexterity, it is important for organizations to promote the use of the available IS for work tasks and coordination with their teams. This study confirms that focusing only on team IS usage or on team coordination without accounting for the mediating role of team emergent states does not provide a full picture of how team processes lead to team performance. Therefore, future research should not only distinguish between team processes and team emergent states but also consider the specific mediating role of the emergent states on the relationship between other team processes and team performance.

In considering the broader picture of how team processes, team emergent states, team outcomes, team characteristics, and external factors interact, we sketched a nomological network in Figure 4 that integrates various suggestions for future research that were presented in this paper, our findings, and relationships established in prior work. At a high level, various team processes can affect outcomes, either directly or mediated, via team emergent states. Several external factors may affect both team processes (i.e., use of IS and the mandatoriness of such use in our study) and team emergent states (factors that may change over time, affecting the emergence of team emergent states). Finally, numerous covariates could affect team outcomes, including not only team characteristics like diversity in gender, age, and ethnicity, but also the size and longevity of the team, as was measured in this study. In the nomological network, solid lines reflect relationships that were specifically tested in this study and the effect of technology-enablement as the context of this study; dashed lines indicate possible relationships that have either been tested in other research or are theoretically suggested in our discussions (for example, there is abundant work on the effect of team size on team communication). Some of the possible research areas that can be derived from the proposed nomological network shown in Figure 4 are summarized in Table 7.

Before concluding this paper, we note some limitations. Regarding our sample, we had a limited number of teams with complete data. While our power analyses showed that this was sufficient, future research should be conducted with more individuals and groups to validate our findings. Since our study's research design is cross-sectional, emergent states were measured at one point in time; longitudinal research is needed to enhance our understanding of the relationships between team processes, emergent states, and outcomes over time. While using survey methods can result in common method bias, we took steps to overcome these concerns, including measuring variables at two levels of analysis (employees and managers) and having multiple respondents within each team. Additionally, our tests revealed that common method bias was likely not an issue in our study. We measured team performance as a perception, but future research should use objective measures for this construct if possible. Following previous research, we used two subconstructs to measure team ambidexterity and used the additive measure of both. While this was theoretically supported and confirmed by our robustness tests, further research could develop a single-construct measurement of ambidexterity. Finally, since coordination and communication were highly correlated, the latter was used as a control variable only. Future studies could find different measures of team communication to integrate it as an antecedent to team ambidexterity and performance.

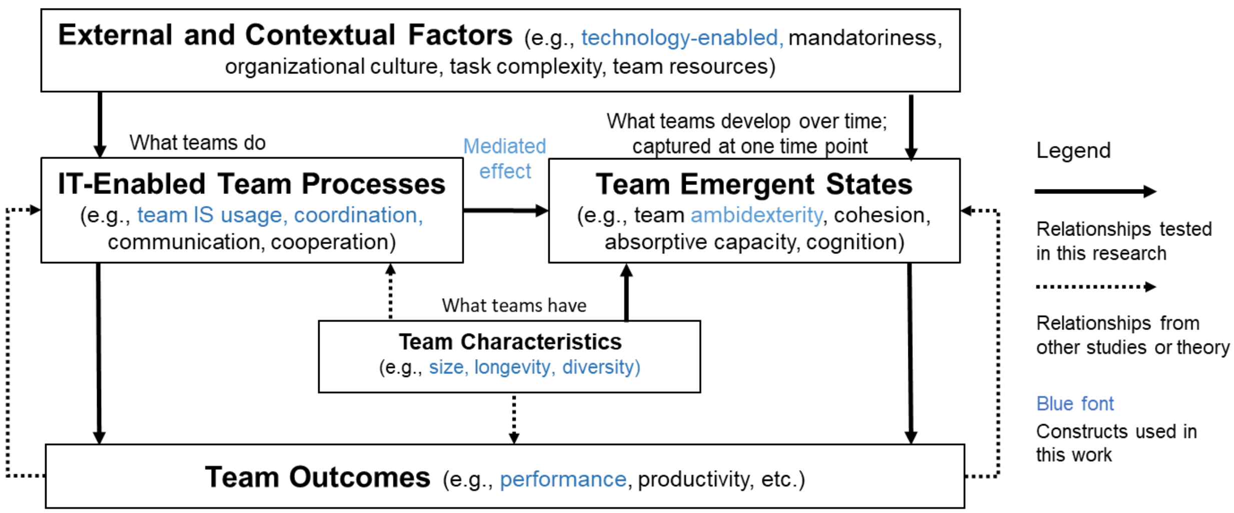


Figure 4. A Nomological Network of Team Processes, Emergent States and Outcomes

Table 7. Future Research Ideas

Concept	Research idea	Sample research questions
Team emergent states	Study the mediating role of team ambidexterity on other relationships between team processes and outcomes.	• Since team ambidexterity reflects adaptability and alignment, how does it mediate the relationships between other transition, action, and interpersonal team processes, such as communication or leadership enactment or interpersonal trust, and outcomes such as team attitudes or information processing or team innovation? • What are the temporal patterns of team ambidexterity mediation between team processes and outcomes? • How is team ambidexterity mediation between team processes and team performance affected by the processes of different levels (e.g., organizational, individual, etc.)? • Does team ambidexterity mediate cross-level relationships between team processes and outcomes?
	Study other possible team emergent states	• Team cohesion: How does team cohesion affect the relationship between team processes and team performance or productivity? And other outcomes? • Team absorptive capacity: How does team absorptive capacity affect the relationship between team processes and team performance or productivity? And other outcomes? • What emergent states are more important for technology-enabled teams to perform well?

	Study the development and refinement of emergent states in teams	• How long does it take for teams to develop various levels for different emergent states? • How does this time for the development of emergent states vary across emergent states? • How dynamic are emergent states and what affects their development and refinement? • How do team composition changes (i.e., new members) affect a team's ambidexterity? • What is the effect of team composition changes on other existing emergent states in the team? • What group norms are essential for and which ones are associated with the development of each team emergent state or categories of emergent states? • How do non-human agents (i.e., AI agents) in teams affect the development of team emergent states? • Can non-human agents in teams replace the need for teams to develop team emergent states, or are they tools for refinement?
	Explore the role of technology on emergent states	• Are there situations where technology, rather than being an enabler, is a constraint for the emergence of team emergent states? • Under what conditions and context would this happen? • How can the complexity of the structure and form of team emergent states be defined in distinct technology-driven scenarios? • How do the underlying processes or stages of ambidexterity develop in technology-enabled teams?
Team processes	Explore the emergence of team processes	• What other team processes develop through homogeneous emergence of usage from individuals to teams besides team IS usage? • What happens to the emergence of team processes if they do not emerge homogeneously? • How do team emergent states relate to configural processes (processes that do not emerge homogeneously)?
	Study other team processes that can affect team performance	• As coordination and communication are highly correlated, what are alternative measures of team communication that can be used as antecedents to ambidexterity and performance?
Team IS usage	Explore the role of team IS usage in other relationships to team performance	• At what point does the process of IS usage lead to the emergence of team emergent states? • What is the role of mandatoriness in facilitating the development of team emergent states? • What happens if usage is non-mandatory and individuals could bypass the use of the technology for coordination and handling service requests? • Does the mandatoriness of IS usage for new members allow them to align with the team's emergent states more quickly? • What other emergent states would develop when use is mandatory? • What happens to emergent states when system usage is not mandatory?
Combining team processes, emergent states, and outcomes	Explore the interrelationships between team emergent states, processes, and outcomes	• As usage behaviors and contextual variables change over time, how do the relationships between team processes, emergent states, and outcomes evolve over time? • What is the effect of configural team processes on team emergent states and their impact on team performance? • Our study's theoretical background suggests possible moderation effects of emergent states, which need to be addressed in a different research design (Carte & Russell, 2003), leading to the question: How do emergent states affect the strength of the relationship between processes and outcomes? If these effects exist, are they permanent or context-driven?
	Explore how other team emergent states mediate other relationships in teams between processes and outcomes.	• What other emergent states could serve as mediators between team processes and outcomes? • Can the relationship between team processes and team emergent states change direction? What are the conditions that teams face in which their emergent states affect their processes and teamwork instead of the other way around?

7 Conclusion

This research highlights the relative roles of team processes and team emergent states in the context of technology-enabled work. Using rigorous multilevel methods like measuring variables at multiple levels, we found that team ambidexterity as a team emergent state is a mediator between team IS usage and coordination to performance. Mediation is the mechanism that explains the positive relationship between team IS usage and coordination and performance. The study offers an operationalization of an emergent state. Emergent states occur after teams have used various processes to perform their common goals. The clarification of the relative roles of team processes and emergent states offers an avenue to consider how to study technology-enabled work teams and their evolution towards alignment and adaptation, which can lead to enhanced performance. Finally, our study reinforces the idea that IS usage in teams is multilevel, emerging from individuals to teams such that usage constructs are part of teams' dynamic environments composed of technologies, people, processes, and emergent states that together impact the team's effectiveness. Overall, the results of the study help advance the field's knowledge about the importance of the mediating role of emergent states in the relationships between team processes and outcomes. While our discussion highlighted numerous implications for research and practice, it also revealed several questions that remain unanswered and require further research.

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Appendix A: Survey Development, Items and Scale Validation

The survey was developed using existing items where possible. We first created the questionnaires (managers/employees) in English. They were then reviewed for content validity by English-speaking IS academics. A bilingual IS academic (fluent in both English and Portuguese) translated the questionnaires into Portuguese. A different bilingual IS academic back-translated the questionnaires to English. Additionally, we repeated the process with an English professional translator. A third person compared both translated versions with the original ones. The differences were analyzed to achieve the best wording or terminology for translation, ensuring vocabulary and content equivalence for the native language version of the questionnaires (Sekaran & Bougie, 2016). This back-translation process is standard in academic research.

Pilot Test

The instruments were pilot tested with students in workgroups and their respective professors representing the individual and team levels of analysis, respectively. Student groups had to develop a prototype of an IS (e.g., hotel booking, restaurant orders) using MS Access. Participation was voluntary, and we obtained student-professor pair responses from 138 students in 35 groups. The assessment of the individual- and team-level questionnaires showed overall acceptable values on all assessment criteria, except for the originally reversed items of the alignment and adaptability scales at the team level. Because those original reversed items performed badly, we decided to change those items to non-reversed versions. The resulting alignment scale showed that all items loaded on a single factor having an eigenvalue of 2.15 and accounting for 72% of the construct's variance ($\alpha = 0.79$); for adaptability, all items loaded on a single factor having an eigenvalue of 1.91 and accounting for 64% of the construct's variance ($\alpha = 0.67$).

Pre-Test

Before the main data collection, we pretested the questionnaires with five IS/IT experts from the study organization. These experts annotated issues they identified, which we thoroughly reviewed and corrected. One change was related to adapting the surveys to the context of our sample of participants while keeping the original meaning of the constructs intact. The final version of the scales used is shown in Table A1.

Measuring Team Ambidexterity

To measure team ambidexterity, we combined team alignment and adaptability dimensions, as described here. First, team managers assessed their team's alignment and adaptability using an adapted version of Gibson and Birkinshaw's (2004) scales. Given that alignment and adaptability are orthogonal (interdependent, non-substitutable, and complementary), we were able to compute the additive measure of team ambidexterity by adding the measures for team alignment and team adaptability (Cao et al., 2010; Jansen et al., 2016). According to previous research on ambidexterity, the loss of information associated with combining multiple measures into a single one is lower for additive measures (Jansen et al., 2006; Lubatkin, 2006); thus, this approach is recommended.

Table A1. Scale Items

Construct	Items	Informant	Source
Team coordination (7-pt. Likert-type scale; adapted from 5-pt. scale; COO)	My teammates and I can foresee each other's needs without having to express them.	Team members	Chiocchio et al. (2012)
	My teammates and I instinctively reorganize our tasks when changes are required.	Team members	
	My teammates and I have an implicit understanding of the assigned tasks.	Team members	
	My teammates and I make progress reports.	Team members	
	My teammates and I exchange information on 'who does what.'	Team members	
	My teammates and I discuss work deadlines with each other.	Team members	
Team IS usage (7-pt. Likert-type scale; adapted to team level (referent-shift); USE)	The use of [SMS] has been incorporated into the team members regular work practices.	Team members	Li et al. (2013)
	The use of [SMS] is pretty much integrated as part of the team's normal work routines.	Team members	
	The use of [SMS] is now a normal part of the team member's work.	Team members	
	Team members use [SMS] according to the standard practices.	Team members	

Team performance (7-pt. scale; PERF)	The team's deliverables were of excellent quality.	Team manager	Lewis (2004)
	The team managed time effectively.	Team manager	
	The team met important deadlines on time.	Team manager	
	The team did a good job meeting the task requirements.	Team manager	
Team communication (7-pt. Likert-type scale; adapted from 5-pt. scale; COM)	My teammates and I provide each other with useful information that makes work progress.	Team members	Chiocchio et al. (2012)
	My teammates and I share knowledge that promotes work progress.	Team members	
	My teammates and I understand each other when we talk about the work to be done.	Team members	
	My teammates and I share resources that help perform tasks.	Team members	
	My teammates and I communicate our ideas to each other about the work to be done.	Team members	
Team innovativeness (7-pt. Likert-type scale; adapted to team level (referent-shift); INN)	Team members discovered new uses of [SMS] to improve the quality of task performance.	Team members	Li et al. (2013)
	This team gives very importance to new and alternative methods and procedures of [SMS] use, for doing their task.	Team members	
	Team members often produce new ways to use [SMS].	Team members	
	This is an innovative team regarding [SMS] usage.	Team members	
Team ambidexterity variables:			
Team alignment (7-pt. Likert-type scale; ALI)	This team works coherently to achieve the overall objectives of a task to perform.	Team manager	Gibson and Birkinshaw (2004)
	This team does not waste time in unproductive activities.	Team manager	
	When facing conflicting objectives, this team still works well-coordinating.	Team manager	
Team adaptability (7-pt. scale; ADA)	This team challenges standard practices when performing tasks.	Team manager	Gibson and Birkinshaw (2004)
	This team is flexible enough to respond quickly to changes in task requirements (resolve unexpected problems).	Team manager	
	This team evolves rapidly in response to shifts in task priorities.	Team manager	

Appendix B: Data Validation

Prior to model and hypothesis testing, we conducted several pre-analyses using IBM SPSS 26.0 and IBM SPSS Amos 26.0 to ensure the instruments were reliable and valid. We conceptualized team usage, team coordination, team communication, and team innovativeness as shared collective constructs measured at the individual level (employees) and aggregated them to the team level. Team ambidexterity and team performance are global constructs measured at the team level (managers). Thus, we validated the data measured at the level at which they were collected.

Data Validation for Variables Measured at the Individual Level

All data were first checked for skewness. The highest absolute skewness result was 1.48 for COM5, definitely meeting the rule of +/-2.2. Tests for multicollinearity were conducted using variance inflation factors (VIFs). The recommended levels for VIFs are < 5.0 for reflective constructs (Cenfetelli & Bassellier, 2009; Peng & Lai, 2012). A VIF > 5.0 is indicative of moderate multicollinearity, and > 10.0 is indicative of severe multicollinearity problems (Larose & Larose, 2015). Except for USE items with VIF values between 5.23 and 8.52 (moderate multicollinearity), and INN items with one indicator higher than 10, all other items had VIF values lower than 5, indicating that multicollinearity was not an issue. We then conducted a confirmatory factor analysis to test the measurement. For convergent validity, we examined factor loadings based on the confirmatory model specifications that include all items. The standardized regression weights are shown in Table B1, together with the significance level for each item. All factor loadings were significant and above 0.70 except for COO1, with a weight of 0.594. We therefore deleted that from the analysis. The CFA analyses resulted in acceptable to excellent fit, as shown in Table B2. We also examined the average variance extracted (AVE), which must be greater than or equal to 0.50 (Fornell & Larcker, 1981; Hair et al., 2006). Table B3 shows that all AVEs for our scales were greater than 0.50, further indicating convergent validity.

The next step in testing discriminant validity involved comparing the square root of each construct's AVE with the inter-construct correlations. Table B3 shows the square roots of the AVEs along the diagonal and the correlations among the latent variables. The square root of the AVE for a latent variable should be higher than any of the correlations of that latent variable and any other (Fornell & Larcker, 1981; Staples et al., 1999). Since this condition was met for all latent variables in our model, we argue that the data exhibit both discriminant and convergent validity. Finally, we confirmed the reliability of the scales via the composite reliabilities, which were all greater than 0.70 (Fornell & Larcker, 1981; Gefen & Straub, 2005).

Table B1. Item Loadings and Significance for Variables Measured at the Individual Level

Construct	Item	Weight	*p*-value
Team usage	USE1	.955	***
	USE2	.934	***
	USE3	.911	***
	USE4	.901	***
Team coordination	COO2	.745	***
	COO3	.715	***
	COO4	.769	***
	COO5	.836	***
	COO6	.701	***
Team communication	COM1	.825	***
	COM2	.891	***
	COM3	.810	***
	COM4	.769	***
	COM5	.882	***
Team innovativeness	INN1	.896	***
	INN2	.853	***
	INN3	.990	***
	INN4	.930	***

Table B2. CFA Fit Indices for Variables Measured at the Individual Level

Fit index	Recommended values*		Results	Fit
	Acceptable	Excellent		
χ^2/df	≤ 5	≤ 3	1.508	Excellent
Comparative fit index (CFI)	≥ .90	≥ .95	.963	Excellent
Root mean square error of approx. (RMSEA)	≤ .08	≤ .05	.070	Acceptable
Standardized root mean square residual (SRMR)	<.10	<.08	.056	Excellent
P-close	>.01	>.05	.064	Excellent
Note: *Hu and Bentler (1999); computed with Gaskin and Lim (2016)				

Table B3. Measurement Model Quality Criteria for Variables Measured at the Individual Level

	CR	Alpha	AVE	MSV	USE	COO	COM	INN
Team usage (USE)	.96	.96	.86	.35	**.93**			
Team coordination (COO)	.87	.86	.57	.57	.10	**.76**		
Team communication (COM)	.92	.93	.70	.57	.15	.76***	**.84**	
Team innovativeness (INN)	.96	.94	.84	.35	.59***	.19†	.06	**.92**
Note: Average variance extracted (AVE); maximum shared variance (MSV). Significance of correlations: † $p < 0.100$, * $p < 0.50$, ** $p < 0.010$, *** $p < 0.001$								

Data Validation for Variables Measured at the Team Level

Data were checked for skewness. The highest absolute skewness result was 1.30 for PERF4, meeting the rule of +/- 2.2. All items except for PERF4 had VIFs lower than 5 (PERF4: VIF = 5.63; moderate collinearity), indicating multicollinearity was not an issue. We conducted a confirmatory factor analysis to establish convergent validity, shown in Table B4. The fit indices showed acceptable to excellent fit. However, the standardized regression weight for "Team Adaptability" ADA1 item was not significant. We thus removed it from further analyses and reran the convergent validity tests, shown in Table B4. This resulted in all significant loadings, suggesting convergent validity, as well as acceptable to excellent fit, as shown in Table B5. We then tested for discriminant validity by comparing the square root of each construct's AVE with the interconstruct correlations. Table B6 shows the square roots of the AVEs along the diagonal and the correlations among the latent variables. The square roots of the AVE for all latent variables are higher than any of the correlations of each latent variable with the others, suggesting that the data exhibits both discriminant and convergent validity. We also confirmed the reliability of the scales via the composite reliabilities, which were greater than 0.70 (Fornell & Larcker, 1981; Gefen & Straub, 2005).

Table B4. Item Loadings and Significance for Variables Measured at the Team Level

Construct	Item	ADA1 removed	
		Weights	*p*-value
Team performance	PERF1	.789	***
	PERF2	.696	***
	PERF3	.747	***
	PERF4	.966	***
	ADA2	.716	***
	ADA3	.963	***
Team alignment	ALI1	.784	***
	ALI2	.672	***
	ALI3	.808	***

Table B5. CFA Fit Indices for Variables Measured at the Team Level

Fit index	Recommended values*		Results	Fit
	Acceptable	Excellent		
χ^2/df	≤ 5	≤ 3	1.514	Excellent
Comparative fit index (CFI)	≥ .90	≥ .95	.975	Excellent
Root mean square error of approx. (RMSEA)	≤ .08	≤ .05	.069	Acceptable
Standardized root mean square residual (SRMR)	<.10	<.08	.094	Acceptable
P-close	>.01	>.05	.372	Excellent

Note: *Hu and Bentler (1999); computed with Gaskin and Lim (2016)

Table B6. Measurement Model Quality Criteria for Variables Measured at the Team Level

	CR	Alpha	AVE	MSV	PERF	ADA	ALI
Team performance (PERF)	.88	.86	.65	.51	**.81**		
Team adaptability (ADA)	.83	.82	.72	.57	.40†	**.85**	
Team alignment (ALI)	.80	.80	.57	.57	.72*	.76***	**.76**

Note: Critical value (CR), average variance extracted (AVE), maximum shared variance (MSV). Significance of correlations: † $p < 0.100$, * $p < 0.50$, ** $p < 0.010$, *** $p < 0.001$

2.3 Common Method Bias Assessment

We tested for the possibility of common method bias with two different procedures. First, we applied Harman's single-factor test (Podsakoff et al., 2003) to assess whether a single factor was able to explain at least 50% of the total variance of the data, suggesting the presence of common method bias. Additionally, we conducted the marker variable test. We added a theoretically uncorrelated latent variable to our research models as a latent factor (a common factor including all indicators of the model). If this value is below the cut-off of 0.50, we can conclude that common method bias is not a problem in our data. In the variables measured at the individual level, in Harman's single-factor test, the largest variance explained by one factor was 36.67%. Then, we added a theoretically uncorrelated latent variable (task motivation), and the common latent factor produced a value of 0.64, corresponding to a common method variance of 0.41. According to these tests, it is unlikely that common method bias influenced the research results. In the variables measured at the team level, in Harman's single-factor test, the largest variance explained by one factor was 43.22%. The results of the marker variable test yielded a value of 0.31 for the common latent factor corresponding to a common method variance of 0.10. According to these tests, it is unlikely that common method bias influenced the research results.

Appendix C: Aggregation Assessment

We measured team usage, team coordination, team communication, and team innovativeness from individuals and aggregated individual scores to the team level. Then, we assessed reliability and validity for the aggregation. The within-group interrater agreement ($r^*_{wg(J)}$) was used to assess agreement among team members, capturing the extent to which ratings from different team members were interchangeable (Dixon & Cunningham, 2006). The intraclass coefficient ICC(1) is an estimate of the proportion of total variance of a measure that can be explained by group membership (Bliese, 2000). Aggregation of participants within groups is considered satisfied if the F-test for ICC(1) values is significant (Klein & Kozlowski, 2000). ICC(2) is a measure of the reliability of the group mean based on all assessments within a group; that is to say, it is a function of ICC(1) corrected for group size (Bliese, 2000; Klein & Kozlowski, 2000). ICC(2) is dependent on the group size; the larger the group size, the larger ICC(2) value (Klein & Kozlowski, 2000). In the organizational literature, a median ICC(1) value of 0.12 has been reported (James, 1982), with a recommended ICC(2) cut-off value of 0.60 (Glick, 1985). The results of $r^*_{wg(J)}$, ICC(1), and ICC(2) shown in Table C1 indicate that the teams in our sample had enough within-group agreement and reliability and between-group variability. With the measures and aggregation process validated, we aggregated the variables at the team level by computing the unit means of the items for each construct and then using them as construct scores for hypothesis testing, which is a standard procedure used in multilevel research (Klein & Kozlowski, 2000).

Table C1. Results of $r^*_{wg(J)}$, ICC(1), and ICC(2)

	$r^*_{wg(J)}$		Intraclass correlations	
	$r^*_{wg(J)}$	% of teams with rwg value > 0.70	ICC(1)	ICC(2)
Team usage	.939	100	.412	.692
Team coordination	.916	87.88	.216	.469
Team communication	.923	90.91	.217	.471
Team innovativeness	.919	87.88	.452	.726

Appendix D: Descriptive Statistics and Correlations

Table D1. Descriptive Statistics and Correlations

Variable	Mean	*SD*	1	2	3	4	5	6	7	8
1. Team usage	3.08	.78								
2. Team coordination	4.78	.69	-.15							
3. Team ambidexterity	9.94	1.57	.27	.19						
4. Team performance	4.05	.51	.19	.05	.57**					
5. Team size	6.30	4.22	-.11	.16	-.39*	-.26				
6. Team longevity	58.84	103.52	.02	-.39*	-.23	.08	.11			
7. Team communication	5.27	.69	-.10	.77**	.06	-.15	.13	-.36*		
8. Team innovativeness	2.28	.87	.53**	.01	.01	.01	-.02	.04	-.21	

Note: $*p < 0.05$; $** p < 0.01$; $*** p < 0.001$

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