

A VOLUME IN RESEARCH IN HUMAN RESOURCE MANAGEMENT



Managing Team Centricity in Modern Organizations



Brian Murray | James H. Dulebohn | Dianna L. Stone
EDITORS

Managing Team Centricity in Modern Organizations

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Managing Team Centricity in Modern Organizations

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CHAPTER 1

NEW DIRECTIONS FOR RESEARCH ON THE MANAGEMENT OF TEAMS

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ABSTRACT

This volume of *Research in Human Resource Management* showcases nine papers that examine the future of team research and management through the lenses of systems thinking; machine learning and data science; drivers of team performance; the changing nature of flexible, remote, and virtual work and its impact on teams; and the implications for diverse members of virtual teams. This introduction to the volume provides both an orientation to the chapters and an assessment of the connections among them and to the

existing team literature. We conclude that the future of team research must incorporate a systems or network perspective, studies that model and test dynamic variables and relationships that evolve over time or across contexts, research conducted at the task level, and examinations of the evolving nature and outcomes of remote, flexible, and virtual work across a diverse workforce.

Teamwork is undoubtedly an important characteristic of the contemporary workplace that offers significant management challenges. In Deloitte's 2019 Global Human Capital Trends survey, 31% of respondents reported that *most or almost all* work was done in teams and 65% reported that some work was done by cross-functional teams even though the organization was a hierarchical, functional structure (Schwartz et al., 2019). In the same survey, 74% of respondents whose organizations conducted work at least partially in cross-functional teams reported that performance improved when they shifted to teams, with 35% of respondents indicating a significant performance improvement. Hand in hand with the performance improvements, however, have been important challenges for managing the team centric organization. Schwartz et al. (2019) reported that in the Deloitte survey "only 6 percent [of respondents] rated themselves very effective at managing cross-functional teams" (para. 5). Based on subsequent evidence, Deloitte research analysts predicted that an emerging trend for teams is the growth of self-managed teams that will challenge organizations to foster involvement in creating the design of the work, to build a climate of respect, fairness, and belonging, to incorporate team member engagement measures for team effectiveness, and to provide decision-making authority and autonomy (Hiipakka, 2021).

In addition to the typical challenges of managing teams, organizations have faced a more immediate challenge, with the impact of COVID-19, of managing them virtually. Virtual teams introduce issues regarding how to collaborate using technology, monitor team progress and performance, maintain relationship characteristics including trust and empowerment, and ensure team member well-being (Deloitte, 2020). The COVID-19 virtual shift also uncovered a concern for diversity and inclusion efforts in organizations. Immediate virtualization due to remote-work requirements led to confusion and loss of clarity for teams; issues of personal life disclosure for LBGTQIA+, women, and minority team members; access limitations; and demands arising from workspace and homelife characteristics (Dolan et al., 2020).

Just as team management has become a dominant concern in organizations, teams and work groups have grown into a topic of research commanding significant attention. Published research on teams and work groups extends back almost a hundred years and has concentrated on individuals both within and compared to teams, team characteristics and dynamics, team structures and systems, and team tasks and outcomes (Mathieu, Hollenbeck, et al., 2017, Mathieu, Wolfson, & Park, 2018). Additionally,

contemporary research has focused on virtual teams (Dulebohn & Hoch, 2017), the impact of remote work (e.g., van der Lippe & Lippenyi, 2019), the methods of team research (Delice et al., 2019), and the dynamics of diversity and inclusion in work groups (Chung et al., 2020; Shore et al., 2011; Shore & Chung, 2021).

Looking to the future, prominent scholars have prioritized directions for team research based on gaps found in the literature as well as factors limiting the identification and pursuit of new directions. Mathieu and colleagues (Mathieu, Hollenbeck, et al., 2017; Mathieu, Wolfson, & Park, 2018; Mathieu et al., 2019) called for advancements in team research models and methodologies beyond the static input-process-output (IPO) model that is common in team research. They prioritized the incorporation of temporal issues and the development of network approaches. Mathieu and colleagues also presented an argument for greater attention to task characteristics, teams within multilevel dynamic systems, team composition and diversity, and team emergent states.

Dulebohn and Hoch (2017) organized research on virtual teams in the IPO framework. They presented existing and potential research streams that add information and communication technology, team member diversity, and team virtuality to the predominant variables in team studies. They also summarized a set of articles that offered conceptual development to advance virtual team research and with them prioritized research topics including communication in virtual teams, team leadership approaches and shared leadership, the interaction of culture and team virtuality, the interaction of core team dimensions and virtuality, and shared mental models within virtual teams.

Shore and colleagues (2011) reviewed diversity literature and developed a model of inclusion to guide research on work groups. They called for an examination of fairness, belongingness, and uniqueness as aspects of inclusion, inclusion climate in work groups, the theoretical development of mediating mechanisms linking inclusion to outcomes, and inclusion-driven outcomes such as creativity. Though their work has been in print for over a decade, the issues of fairness and belongingness continue to be important team topics among the emerging trends in team management (see previous reference to Hiipakka, 2021). Likewise, the contemporary issues in diversity research continue to include the need for research on the complexity of diversity, a broadening of the effects that are studied, greater emphasis and depth of study on mediating mechanisms, and the contextual generalizability of diversity models (Roberson, 2019).

The present volume of *Research in Human Resource Management* addresses the trends in team management and important research gaps in four areas. First, we present two chapters on the science of teams that consider reframing how we think about teams in a complex systems perspective

and machine learning. Second, we introduce three chapters that examine how engagement, feedback, and situated expertise relate to team outcomes. Third, we provide two chapters that examine outcomes related to flexibility in work design for team members taking into account leadership and team member shared norms for availability. Fourth, we offer two chapters addressing virtual communication technology and diversity.

THE SCIENCE OF TEAMS

The IPO framework for conceptualizing and ordering relevant team characteristics and outcomes as well as the mediating and moderating variables that influence the relationships between inputs and outcomes has served team research extremely well. There is a well-established body of knowledge and evidence about teams, team leadership, and team member characteristics as well as their relationship to performance, team, and team member outcomes. It likely will continue to serve the field well as contextual factors and other variables are studied as moderators to the IPO paths that connect its components. However, Mathieu et al. (Mathieu, Hollenbeck, et al., 2017; Mathieu, Wolfson, & Park, 2018; Mathieu et al., 2019) highlighted the weaknesses of relying solely on an IPO perspective, and there is well-founded concern that an overreliance on it may limit future advancements in team research. In the present volume, Strauss and Grand (Chapter 2) and Rosopa (Chapter 3) tackle this issue by offering an alternate perspective for conceptualization and an analytic approach for inductive research, respectively, that promise to be paradigmatic shifts in how researchers look at team dynamics and the direction they take for modeling and analysis.

Strauss and Grand (Chapter 2) address the challenge posed by Mathieu et al. (Mathieu, Hollenbeck, et al., 2017; Mathieu, Wolfson, & Park, 2018; Mathieu et al., 2019) to move beyond the IPO framework for conceptualizing and studying team dynamics by introducing readers to systems concepts. They orient readers to important characteristics distinguishing open, dynamical, and agent-based systems. They also contrast systems thinking to IPO and multilevel theory to demonstrate how conceptualization of team dynamics differs and yields new insight to what is a variable, process, or mechanism. They demonstrate that IPO and multilevel theory focus on patterns of covariance. This focus yields an understanding of the strength and direction of relationships among variables on average between teams; however, the authors conclude that the IPO framework does not inform the underlying generative mechanisms for observed covariations. In contrast, they explain that systems thinking is grounded in the actors and their actions versus a statistical covariation, that its designation of variables as independent, dependent, or mediating, or at specific levels is more fluid and less

specific, and that its processes are represented as mechanisms rather than variables. By their comparative exposition of the popular IPO framework to systems thinking, Strauss and Grand achieve their objective of raising systems awareness, demonstrating it as a conceptualizing framework, and pointing to new paths for team research.

Like Strauss and Grand, Rosopa (Chapter 3) challenges the prevailing framework and methods for conceptualizing and studying teams. He presents data science, and more specifically machine learning, as a basis for inductive research into team variables and dynamics. He frames his discussion in the complex nature of the quantity and sources of data about teams alongside the dynamic and sequential aspects of it. He proposes that commonly used statistical methods cannot adequately address these data characteristics. As a solution he proposes a machine learning approach. Rosopa orients the reader to data science and its inductive aspects in contrast to strictly deductive analytic approaches. He then presents the basic machine learning algorithms as supervised learning, unsupervised learning, and semi-supervised learning. He explains and demonstrates with examples the connections between supervised learning and neural networks and between unsupervised learning and principal components analysis. Through the examples he establishes the relevance and promise of machine learning for inductive research on teams and the examination of complex nonlinear dynamic patterns within team research data.

ENHANCING TEAM PERFORMANCE

The outcomes attributed to team characteristics and processes are many and varied including team-level variables such as productivity, efficiency, work quality, and creativity as well as member-level variables such as individual work performance, helping behaviors, absences, attitudes, and turnover intentions (Mathieu, Hollenbeck, et al., 2017). The potential drivers of these outcomes have been likewise numerous and included concerns for leadership styles, task design, team member characteristics, and collective team characteristics. Moving beyond the existing research, the emerging industry trends point to a need to better understand the design and behaviors of self-managed teams; the development of climates for respect, fairness, and belongingness; the role of engagement, and the provision of decision-making and autonomy in order to manage performance outcomes (see previous reference Hiipakka, 2021). In the present volume, authors explore and expand on these concerns: Dickey et al. (Chapter 4) focus on team engagement as the lynch pin connecting team performance management and team leader behaviors with team performance outcomes, Mockevičiūtė et al. (Chapter 5) direct attention to the driving role of

feedback in affecting team performance, and Austin (Chapter 6) draws on transactive memory systems to demonstrate how awareness of available expertise and team member actions for engaging expertise within and across team boundaries influences team effectiveness.

Dickey et al. (Chapter 4) offer three important contributions to advancing team research by developing a model of team performance built on team engagement. First, drawing from prior research, they highlight the distinctive characteristics of team engagement (Costa et al., 2012, 2014a, 2014b; Costa et al., 2017; Sharma & Bhatnagar, 2017) and propose the connection to team performance (Rahmadani et al., 2020). Second, they integrate the work of Hackman (1987) and Aguinis (2019) to present a multiphase model of performance management that they relate to team engagement. Third, they explain the role of team leadership in the performance management and engagement linkage. Transcending the bounds of their individual chapter, Dickey and colleagues' (Chapter 4) dynamic, multistage, process model reinforces the need for systems thinking (Strauss & Grand, Chapter 2) when conceptualizing and planning future team research. They expose the complexity of the interaction of full-range leadership components with the several sequenced phases of performance management and the challenges of representing them as singular constructs.

Mockevičiūtė et al. (Chapter 5) continue the conversation of performance management by digging deeply into the topic of feedback and its effect on team performance. Just as we have indicated that remote work and virtualization have changed where, when, and how teams operate as well as how team members and leaders communicate and share information, the authors recognize that the changing nature of work provides contextual elements that either are not recognized or are emerging in contemporary team research. They conducted a systematic review of contextual influences on the feedback-performance relationship and recommended avenues for future research grounded in a multilevel and spillover theory perspective. From their review, they constructed a mediated model of the feedback-performance relationship including intra-team mechanisms such as team and individual characteristics and top management team potency. They also summarized the influence of other-team performance and organizational and environmental characteristics. They expanded their model with avenues for future research by mapping the potential influence of several inter-team characteristics such as feedback exchange, conflict, and trust as well as extra-team factors including societal influences.

Austin (Chapter 6) shares Mockevičiūtė et al.'s contention that a useful future path for team research lies in the exchange between team members and extra-team environments. Austin presents an inductive, qualitative study of transactive memory systems from which he derives a set of propositions

about situated expertise and the engagement of extra-team expertise sources. Though the preponderance of team research about transactive memory systems, the identification of expertise, and the engagement of expertise is at the within-team level, Austin found that a higher impact of transactive memory system interventions existed when team members extended the principles of expertise identification and help-seeking to non-team members. Building on existing transactive memory theory, he laid out paths for future research to study team member awareness of the locations of extra-team expertise and the quality of extra-team expertise use. Of particular note is Austin's identification of the task level for analysis and its potential for informing how team boundaries are made more fluid to encourage greater extra-team expertise sharing. His call to direct attention to the task mirrors Mathieu, Hollenbeck, et al. (2017) more general call for attention to the task level for team research. Austin's presentation of transactive memory systems and his study's results are particularly relevant in today's emerging cross-functional team environment where team members are selected due to functional knowledge and reinforce the importance of considering networks and systems that Strauss and Grand (Chapter 2) emphasized.

WORK FLEXIBILITY AND THE TEAM

In contrast to the notion of the shared experiences of team members and homogeneity of work context among them, a growing phenomenon in contemporary workplaces is the customization of individuals' work into flexible work arrangements either through idiosyncratic deals (i-deals) or by job crafting. An i-deal is a negotiated agreement between an employee and supervisor that allows non-regular considerations for when, where, or how work is done in order to better fit work with the particular needs or wants of the employee. These agreements extend beyond general work policies and may or may not be available to other employees (Rousseau et al., 2006; Liao et al., 2016). Job elements that are commonly addressed by i-deals may include flexibility in workplace (flex-space) or time (flex-time), opportunities for professional development, workload reduction, job design, and financial incentives (Liao et al., 2016). Job crafting is similar to i-deals, except that the employee creates job differences without the express permission or input from the supervisor (Wrzesniewski & Dutton, 2001), and they are developed to improve the social aspects of the work and use of the employees' knowledge, skills, and abilities and to reduce stress (Hornung et al., 2014). Job crafting has been shown to relate to engagement and job performance (Lazauskaite-Zabielske & Ziedelis, 2021), and both job crafting and i-deals have been shown to positively relate to job performance, affective commitment, and intention to stay (Rofcanin et al., 2016).

The idea of job crafting has been translated to the team level. Team job crafting is a collaborative effort among team members to affect the resources, demands, and design of work to improve team processes and outcomes. It has been shown to relate positively to both engagement and team performance (Makikangas et al., 2016; Tims et al., 2013). As such, it is a promising area for team research to inform self-managed teams, autonomy, and decision-making. Especially in a virtually distanced environment between management and teams and in the face of idiosyncratic contextual factors across remote teams, between-team differences in job crafting may be particularly important for explaining team performance.

Two chapters in this volume directly address the impact of customized work arrangements. Baumgärtner and Hartner-Tiefenthaler (Chapter 7) tackle the autonomy paradox at the intersection of individual team member work flexibility and shared expectations among team members for work availability. Liao (Chapter 8) tests the impact of team member i-deals on team performance with specific reference to the role of the servant leader supervising the team.

Baumgärtner and Hartner-Tiefenthaler (Chapter 7) set the stage for understanding flexible work arrangements in a team context by recognizing the inevitability and importance of time and place flexibility in today's work environment and more specifically in answer to COVID-19 work restrictions. However, they explain that uncoordinated exercise of flexibility among team members leads to uncertainty about availability for teamwork and interaction which subsequently drives the emergence of collective norms about availability. The authors posit that those norms err toward constant availability, which has negative implications for disengagement, respite, and recovery from work. They propose interaction scripts to define commonly held expectations about availability, while recognizing implications for justice perceptions and the creation of shared mental models. They contribute to the practice of team management and shaping availability norms by describing a process of clarifying expectations, defining a reflexivity process, and implementing scripts.

On the surface, Liao (Chapter 8) takes a decidedly different perspective on customized work arrangements. In general, his arguments and data analysis suggest that more is better. He hypothesizes and demonstrates that a higher overall level of i-deals within a team is related to team potency and performance. However, his arguments and findings are presented within the context of servant leadership behaviors exhibited by the supervisor. He explains the complementarity of the servant leadership style for enacting a systematic i-deals program among team members by identifying core characteristics of the servant leader. These characteristics include attentiveness to the needs, desires, and goals of the individual, a desire to benefit stakeholders

including employees, and an intention to foster the overall effectiveness of the team while minimizing intra-team conflicts among members.

Arguably, the servant leader is the complement to the collaborative interaction script development and reflexivity processes proposed by Baumgärtner and Hartner-Tiefenthaler (Chapter 7). The former is appropriate to i-deal circumstances because the supervisor is a leading player in each negotiation and has the ability to coordinate across all customized arrangements; alternately, the latter works for job crafting situations because they are driven by the employees themselves without direction from a single leader. As a pair, these two chapters inform future team research efforts by bringing clarity to why and how the competing notions of i-deals and job crafting might work differently but achieve similar outcomes depending on context.

VIRTUAL TEAM ELECTRONIC COMMUNICATION AND DIVERSITY

The growth in geographically distributed team members as well as the move to remote and flexible work arrangements due to COVID-19 has expanded the role of electronic communication as the primary collaborating mechanism for many teams. Team researchers have established that virtual electronic communication can be a component of effective team commitment, cohesion, decision and action quality, and innovation (Gressgård, 2011; Maznevski & Chudoba, 2000). However, the use of electronic communication for one common activity, virtual meetings, raises concerns for its impact on interaction and outcomes based on gender (Dhawan et al., 2021).

In the present volume, we present two chapters that address the emerging issue of electronic communication and its implications for members of diverse groups. Canedo et al. (Chapter 9) present the use and type of electronic communication technology as a moderator of the link between diversity (i.e., variation in demographic characteristics of group members) and factors influenced by diversity (e.g., prejudice, stereotyping, status differences). This moderated relationship is positioned as a driver of virtual team processes (e.g., communication, cooperation, conflict) and ultimately team outcomes (e.g., performance, creative, team member satisfaction). Bommer and Schmidtke (Chapter 10) address the question of differences in communication behaviors in face-to-face versus virtual meeting formats as well as provide empirical evidence regarding whether there is a positive or negative behavioral difference for females.

Linking diversity to work outcomes is challenging because conceptual development and empirical evidence point to both positive and negative hypotheses as well as supporting, refuting, and nonsignificant statistical results (Hass, 2010; Roberson, 2019). Canedo, Stone, and Lukaszewski

(Chapter 9) adopt the perspective that diversity introduces challenges to team communication and coordination that are heightened in the virtual context. They review the research on diversity in virtual teams and derive an interaction model of electronic communication use in virtual teams with diversity. From their conceptual development, they offer propositions regarding the favorability of outcomes due to text-based communication technology relative to visual and auditory technology, the intervening effects on stereotyping, positive interpersonal relations, perceived status differences, diverse members' participation in virtual activities, and cross-cultural communication and conflict, and the resulting outcomes for intra-team cooperation, cohesion, conflict resolution, and communication effectiveness. Building on their review of existing research and model development, the authors offer a four-prong strategy for mitigating negative effects of virtuality for diverse teams including cross-cultural and diversity training, technology training, team-based reward systems, and team building efforts.

Bommer and Schmidtke (Chapter 10) also recognize the lack of clarity in the available evidence regarding diversity impacts on work outcomes, especially related to issues of virtual communication. They present an empirical assessment of whether the move to videoconferencing for virtual teams "levels the playing field" or heightens the problems for female team members. They conducted an assessment center comparative study of women versus men in face-to-face versus virtual meeting contexts. They measured agentic and communal behaviors and participant activity level to test for gender and modality differences.

Bommer and Schmidtke's results identified behavioral differences due to modality, but reinforced the generalizability of prior findings on gender differences in meetings. Their data provided evidence to support that videoconferencing was associated with fewer communication activities than face-to-face meetings including both fewer agentic and communal behaviors and men were associated with a greater number of participation behaviors than women including both agentic and communal behaviors. Their data did not provide evidence, however, that the videoconferencing versus face-to-face modality impacted the behaviors of men differently than women. The lack of a significant interaction effect pointed toward an inconclusive or non-effect for gender differences in the move from in-person to virtual teams relative to meeting technology. The authors proposed several avenues for future research: (a) exploration of the relationship between member behaviors and team and individual outcomes; (b) contextual determinants of "appropriate" behaviors relative to virtual versus in-person team meetings; (c) extension of the present research to include race, ethnicity, and social status; (d) the impact of technical specifications on videoconferencing effects, such as lighting, camera angle, and video quality; (e) exploration of team composition homogeneity, heterogeneity, and forms of

heterogeneity; and (f) extension of past research on face-to-face meetings to the virtual context to explore the dynamic nature of effects from initial meetings for new teams to on-going meetings for mature teams.

WHERE DO WE GO FROM HERE?

The authors and their work presented in this volume advance contemporary thinking on the management of teams, provide evidence to address some existing questions, and offer avenues for future research. Perhaps most instructive are the common threads across the chapters that tie back to existing research and studies in the team literature. From these commonalities, we suggest that the future of team research needs to prioritize (a) research from a systems or network perspective; (b) research that models and tests dynamic variables and relationships that evolve over time or across contexts; (c) research focused on the task level; and (d) research that examines the evolving nature and outcomes of remote, flexible, and virtual work for a diverse workforce.

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PART I

THE SCIENCE OF TEAMS

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CHAPTER 2

APPLYING SYSTEMS SCIENCE TO ADVANCE RESEARCH ON TEAM PHENOMENA

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ABSTRACT

The recognition of teams as complex dynamic systems was a hallmark and among the earliest considerations of research on team functioning. However, the popularization of conceptual heuristics such as the input-process-outcome (IPO) framework and the accessibility of methodological, analytical, and meta-theoretical principles from multilevel theory (MLT) have disconnected contemporary theory and empirical research from this foundational perspective. Thus, the primary motivation for the present paper is to facilitate and stimulate future research on team phenomena that embraces systems thinking. To do so, we describe key concepts, terminology, and ideas from specific branches of the systems sciences—namely open systems theory, dynamical systems, and agent-based systems—that have direct relevance for

researching team phenomena as complex systems. Additionally, a comparison between two example models of team performance that are rooted in an IPO + MLT versus a systems-oriented perspective is offered to highlight the difference in foci, applications, and inferences these approaches offer. The paper concludes with a summary of key advantages as well as potential obstacles for reintroducing systems thinking back into team science.

As the nature of work has continued progressing towards more complex tasks and operational environments, teams have increasingly become the primary unit of work for organizations (Bersin et al., 2017; Mathieu et al., 2019). Teams are also relied upon to carry out many of society's most vital functions, such as performing medical procedures, conducting humanitarian operations, and advancing scientific breakthroughs (Kozlowski & Ilgen, 2006). Understanding how to support, maintain, and facilitate high performing teams thus represents an area of critical importance. In recognition of this significance, the past 40 years of organizational science has witnessed an exponential increase in the amount of published research on work-team functioning (Mathieu et al., 2017).

In taking stock of the progress that has been made in our understanding of teams and team performance over this time span, it is informative to consider how the organizational sciences have tended to conceptualize teams and their functioning. For example, several taxonomies for classifying team properties have been proposed, such as characteristics of groups versus teams (e.g., membership, boundary permeability, entitativity; Forsyth, 2013), the types of actions teams engage in to facilitate taskwork (e.g., transition, action, and interpersonal processes; Marks et al., 2001), and differences in the context and nature of work performed by teams (e.g., action teams, decision-making teams; McGrath, 1984; Sundstrom et al., 1990). Beyond these classification schemes though, one of the earliest and foundational characterizations of teams is the recognition that they operate as *complex dynamic systems* (Allport, 1924; Lewin, 1943; Parsons, 1937; Sherif et al., 1955). That is, teams are collections of unique yet interdependent individuals who engage in behaviors and interactions with one another in a commonly experienced environment to satisfy personal goals and collectively recognized demands. Through these exchanges, unique social structures (e.g., norms, roles, cultures), affective and cognitive perceptions (e.g., trust, knowledge, cohesion), and patterns of behavior can manifest that both describe and shape how teams and their members function and perform (Arrow et al., 2000; Cronin et al., 2011; Katz & Kahn, 1978; Kozlowski & Klein, 2000; McGrath, 1991; Weick, 1979).

Given the historical precedent and widely acknowledged view of teams as complex systems, it is surprising that so little conceptual and empirical

work has accumulated on teams in the social and organizational sciences in line with this foundational perspective. A recurrent theme in contemporary reviews of the literature is the modal treatment of theories, methods, and empirics directed towards teams as static, holistic, and often anthropomorphized entities (e.g., teams “possess” personality, cognitive ability, trust, etc.; Crawford & LePine, 2013; Cronin et al., 2011; Humphrey & Aime, 2014; Kozlowski et al., 2013; Mathieu et al., 2019; Waller et al., 2016). In other words, teams have most commonly been described in ways that reify them as aggregated, homogenized, and undifferentiated “wholes” rather than rich, interactive, and dynamic systems.

A consequence of viewing “teams as wholes” versus “teams as systems” is that the former tends to promote theory, measurement, and analytic techniques that focus almost exclusively on the extent to which attributes, perceptions, behaviors, and so forth are consensually shared among team members and the extent to which that shared content correlates with other similarly formulated team-level variables at the population level (e.g., teams with higher shared perceptions of team cohesion exhibit stronger correlations with team performance on average; Dansereau et al., 1999; Klein et al., 1994; Kozlowski et al., 2013). Besides failing to capture the inherent dynamics of the team system, this focus generally neglects examinations of *how*, *why*, and *what* teams do to function effectively that could provide actionable guidance for facilitating team performance (McGrath & Tschan, 2007). We do not wish to imply that the past 4 decades of research on teams has been unfruitful or unproductive. On the contrary, the field has identified many useful constructs and accumulated valuable knowledge about teams, and we suspect that team science will continue to observe incremental improvements in understanding under the current paradigm (e.g., Mathieu et al., 2017; Waller et al., 2016). However, we posit that there is considerable potential for advancing team science by more purposefully incorporating and embracing teams as complex systems.

The primary goal of this paper is thus to provide a primer on systems thinking for the teams researcher and its utility for advancing theory and research. We first describe several key concepts and terminology from the broader domain of systems science and their relevance for representing team phenomena. Next, we highlight critical differences in the foci, applications, and inferences that can be advanced from adopting a systems approach to team functioning relative to those afforded by contemporary approaches by contrasting two example models of team performance from both perspectives. We then conclude with a summary of the strengths and likely challenges of incorporating the systems-based approach for conceptualizing and researching team phenomena.

CURRENT PARADIGM FOR STUDYING TEAMS IN THE ORGANIZATIONAL SCIENCES

Before elaborating on a systems-oriented perspective to teams research, it is useful to describe the prevailing paradigm for studying teams in the social and organizational sciences. Contemporary theory and research have arguably been most significantly shaped by two seminal perspectives: (a) the input-process-outcome (IPO) framework of team functioning (McGrath, 1964) and its derivatives (e.g., the input-mediator-outcome-input (IMOI) framework; e.g., Ilgen et al., 2005; Mathieu et al., 2008) and (b) the “meta-theoretical” principles of multilevel theory (MLT; e.g., Kozlowski & Klein, 2000).

The IPO framework has provided a useful and widely adopted heuristic for discussing factors related to team effectiveness. *Inputs* in the IPO framework refer to the attributes of members (e.g., knowledge, skills, abilities, dispositions), the team (e.g., norms, roles), and the organization/environment (e.g., resources, time demands) that constitute a team’s operational conditions. *Processes* are generally described as team members’ actions that facilitate task accomplishment and produce characteristic patterns of social interaction and structure (e.g., trust, climates, cohesion). Lastly, *outcomes* are the cumulative results of teams’ efforts and most commonly refer to performance-related outputs and affective/perceptual reactions (e.g., satisfaction, commitment). Although the IPO framework was never intended to reflect a theory or model of team functioning (McGrath, 1984), the causal chain it implies—in which a team’s inputs impact its processes which impact its outcomes—has shaped how researchers have described, studied, analyzed, and drawn inferences about teams for over half a century.

In contrast to the IPO framework’s specific focus on team functioning, MLT represents a broad collection of philosophies and methodological recommendations for considering phenomena involving collective entities (e.g., teams, multi-team systems, organizations). A fundamental tenet of MLT is that an organizational system can be characterized as a hierarchy of nested levels in which lower-level units (e.g., individuals) reside within higher-level units (e.g., teams). Two important consequents of this premise have strongly impacted the study of teams in the organizational sciences. First, substantively meaningful constructs can be conceptualized and operationalized at different levels of analysis (e.g., commitment represented as either/both an individual-level construct and a team-level construct). This proposition has inspired multiple decades of work devoted to developing conceptual frameworks, definitions, measurement approaches, and statistical indicators that capture constructs at different levels of analysis (e.g., Chan, 1998; Krasikova & LeBreton, 2019). Second, constructs residing at different levels of analysis can influence each other. This proposition

has encouraged the development of elaborate conceptual models spanning multiple organizational levels and which attempt to capture how factors at the same and different levels of analysis relate to one another (e.g., individual-level attitudes and team-level cohesion simultaneously influence individual-level commitment). Efforts to test predictions from these conceptual models have also spurred the development of improved statistical models suitable for handling nested data structures (e.g., random coefficient modeling, Gonzalez-Roma & Hernandez, 2017; multilevel structural equations modeling, Preacher et al., 2010). In short, MLT provided organizational scientists with a valuable paradigm and readily understood standards for presenting theory, designing research, and analyzing data relevant to teams and their functioning.

In conjunction, the IPO framework and principles derived from MLT have engendered an approach to describing and modeling teams in a manner consistent with what Macy and Willer (2002) describe as “factor thinking.” In factor thinking, efforts to explain and develop an understanding of team phenomena are pursued through the identification of *consistent covariation* between two (or more) variables (Bechtel & Richardson, 1993; Smith & Conrey, 2007). Thus, a factor-thinking researcher who seeks to understand team performance would pursue this goal by identifying potential predictor variables (i.e., inputs such as team cognitive ability or team cohesion, or processes such as communication or coordination), quantifying those variables at the team level (e.g., using statistical indices to determine whether members’ ability scores and ratings of cohesion can be aggregated, creating a score for a team’s overall communication quality), and then examining whether those sets of factors reliably and regularly covary with team performance. Both the IPO framework—with its emphasis on classifying variables relevant to team functioning as inputs, processes, or outcomes and establishing the intervening mediating chain—and MLT—with its emphasis on defining aggregate constructs and exploring within- and cross-level relationships—readily equip the factor-thinking teams researcher with an accessible and potent toolkit for developing conceptual models and conducting empirical research.

Although factor thinking affords several strengths for describing and studying teams, an “actor thinking” approach represents an alternative perspective less commonly embraced by the organizational sciences but which is well suited for representing teams as complex systems (Macy & Willer, 2002). In actor thinking, efforts to explain and develop understanding of phenomena are pursued through the identification of *generative mechanisms* that characterize how one (or more) ongoing processes unfold and lead to recognizable patterns (Bechtel & Richardson, 1993; Smith & Conrey, 2007). Thus, an actor-thinking researcher who seeks to understand team performance might pursue this goal by examining how, when, and why

individual members in a team engage in different activities (e.g., individuals possess multiple goals which they seek to accomplish), influence one another (e.g., task demands and individuals' unique goal pursuits create opportunities for interaction over time), and form relationships that lead to specific patterns/outcomes relevant to team performance (e.g., team members self-organize into smaller interconnected subgroups to accomplish taskwork). Through explicating and exploring these mechanisms and how they play out over time, the actor-thinking researcher seeks to describe how team performance emerges from the things that members *do* and how changes to those processes influence team outcomes, experiences, and trajectories under specific circumstances (Kozlowski et al., 2013). Actor thinking is thus directly aligned with the thesis of teams as complex dynamic systems in which collective phenomena (i.e., team performance, cohesion, conflict, trust, etc.) are conceived as continually unfolding consequences of the interactions within and between elements of a system (i.e., individuals and their actions).

We submit that factor thinking is the *de facto* and modal paradigm through which teams are considered in the contemporary organizational sciences. This perspective has been bolstered by decades of conceptual, methodological, and statistical work that have ingrained factor thinking into the cultural milieu of teams research. To reiterate, factor thinking can and does play a valuable role in summarizing basic predictions and aggregate descriptions of teams and their performance; it need not be completely abandoned. However, we believe that advancing the state of team science on topics such as team performance will require efforts to embrace and explicitly study teams in a manner more consistent with actor thinking. One of the challenges in shifting the teams research paradigm from factor to actor thinking is that many of the concepts, methods, and techniques of the latter are unfamiliar and rooted in the diffuse and disjointed domain of systems science (e.g., Epstein, 1999; Gorman et al., 2017; von Bertalanffy, 1972). In the following sections, we thus direct attention to key concepts from these areas that we believe are valuable for teams researchers interested in adopting a more actor- and systems-oriented view of team functioning.

SYSTEMS CONCEPTS FOR THE TEAM SCIENTIST

A *system* can most generally be described as a collection of independent yet interconnected and interacting *elements* (von Bertalanffy, 1972). Like teams, systems are defined with respect to their boundaries that may vary across space (e.g., physical location of members, location of team members in a workflow network), time (e.g., changes in membership or responsibilities), and purpose (e.g., shifts in team and member goals). Systems are also

commonly characterized as being embedded within an *environment* whose conditions (e.g., resources, task demands, policies) can influence and be influenced by the actions/outputs of the system and its elements. Given the breadth of applications and the interdisciplinary nature of systems science in general, several different philosophies, models, and methodological conventions exist for discussing and studying systems (social or otherwise). Although these varying perspectives share the common goal of characterizing systems as defined previously, they often draw attention to and emphasize different aspects of system functioning in their interpretations and explanations. For purposes of the present discussion, we limit our focus to three branches of systems that are particularly relevant for advancing more systems-oriented treatments of team phenomena—open systems, dynamical systems, and agent-based systems.

Open Systems

The consideration of teams and organizations as *open systems* is among the earliest and most widely recognized systems perspectives in the social and organizational sciences (e.g., Katz & Kahn, 1978; Kozlowski & Klein, 2000; Mathieu et al., 2008; Parsons, 1937; von Bertalanffy, 1972). An open system is one in which material and energy can enter and leave through exchanges between the system and its environment (von Bertalanffy, 1950). For example, teams use available equipment and information, (i.e., materials) in conjunction with the capabilities of their members to make products, services, and decisions that are subsequently distributed both within and outside the team to secure new resources. Further, teams transform these materials by continually drawing from and maintaining the affective/motivational, cognitive, and behavioral efforts of members (i.e., energy). Open systems are commonly contrasted against *closed systems* in which there is no net change in material or energy with the surrounding environment. By way of metaphor, an insulated and vacuum-sealed water bottle is a closed system as it is designed to keep its contents at the same level and temperature by preventing energy (e.g., heat) and material (e.g., water) from escaping or entering. In contrast, a cup with no lid is an open system as it is completely exposed to the environment and its contents can be influenced by the surroundings (e.g., water molecules can evaporate into the air, new substances can fall into the cup, heat is exchanged between the cup's contents and the surrounding air/surfaces). In this sense, a closed system is construed as completely isolated from its environment, whereas an open system is separate from, yet in constant exchange with, its environment.

In nature—and social systems in particular—there are few perfectly closed systems. Consequently, the significance of recognizing and treating teams as

open systems is important for at least two reasons. First, the open systems view of teams emphasizes the critical importance of integrating a team's environment into explanatory accounts of team functioning. Team's environments can be conceptualized in numerous ways and according to several facets (e.g., Meyer et al., 2019; Ostroff, 2019), including the physical environment, the task environment, and the sociocultural environment. Each of these embedding contexts reflects unique environmental facets with which teams and their members exchange material and energy. Environments also contain resources and demands that can facilitate or constrain (respectively) team functioning by placing differential value on certain member attributes, actions, and their distribution within a team (Guzzo & Shea, 1992; Mathieu et al., 2008). For example, the presence of stormy weather versus clear skies affects the criticality of attention, alertness, and communication among members in an air traffic control team to effectively carry out its tasks.

Second, an implied condition of all open systems is that they are in "perpetual motion"; that is, they engage in near continuous exchanges of material and energy with their environment. Notably, this is true even in situations where an open system is said to be "at rest" or equilibrium. Consider again the example of the sealed bottle versus the open cup. It is possible for both systems to achieve an equilibrium temperature wherein the heat of their contents does not change. However, the way in which these equilibria are reached and how they react to subsequent exchanges differs. In the closed system of the sealed bottle, an equilibrium temperature is attained once the heat contained in the air and liquid molecules trapped in the container has been equally distributed. Furthermore, this temperature will remain constant once reached unless new material/energy is added or removed from this system, at which point a qualitatively new equilibrium point should emerge (e.g., adding hot water to the bottle will raise the internal temperature of the contents to a new stable level). In contrast, the constant exchange between the open cup and its surrounding environment means that one would need to near *continuously* heat the contents of the cup to maintain its temperature at a given level. An open system can only maintain an equilibrium by continuing to import new material or energy from the environment. One can thus think of teams and their members as needing to continually generate effort—which necessitates a steady supply of support in the form of materials (equipment, information, etc.) and energy (motivational sources, capabilities, etc.)—to maintain a steady level of functioning (Katz & Kahn, 1978; von Bertalanffy, 1972).

An open system that has achieved this degree of homeostasis (i.e., rate of material/energy entering equals the rate at which material/energy is leaving) is said to be in a *stable or steady state* (von Bertalanffy, 1950). An important takeaway from the recognition of steady states in an open system is that, unlike in closed systems, it can be difficult to infer whether changes

to the material/energy of an open system produce a demonstrable change if only the system's outcomes are observed. For example, adding heat to the open cup may not raise the internal temperature of its contents if the rate at which heat dissipates from the cup also simultaneously increases. However, such changes should be evident in *how* the system is operating over time. Extending this insight to teams, changing the resources, capabilities, efforts, composition, and so forth of a team may or may not influence its observable performance if the interactions, roles, behaviors, exchanges, and so forth carried out by members adapt accordingly. Such *equifinality* (i.e., potential for any single state/outcome in a system to be achieved through different initial conditions and different processes) is common in open systems and yet another reason why focusing on how and what teams do (i.e., actor thinking) is critical for understanding team phenomena.

Dynamical Systems

In many respects, dynamical systems theory attempts to provide an overarching methodology, set of tools, and analytical frameworks for representing the behavior characterized by open systems theory (cf. Thelen & Smith, 1994). Although some in the organizational sciences have equated the application of dynamical systems theory to teams with analyzing the trajectory of team-level constructs over time (e.g., autoregressive/dual change score models of team cohesion; Cronin et al., 2011; Matusik et al., 2019), the foundations of dynamical systems theory are broader and encompass efforts to capture *global* system features/patterns and their implications for understanding *local* occurrences. In the context of dynamical systems theory, local and global refer to whether the primary explanatory lens for a phenomenon is oriented towards a system's elements or the system itself, respectively (Gorman et al., 2017). For example, a local account for team cognition might focus on the extent to which similarity and overlap among the content of individual members' knowledge exists and the individual-level processes involved in producing convergence of those outcomes (e.g., how individuals' attention, memory, and information interpretation processes operate; Dionne et al., 2010; Grand et al., 2016). In contrast, a global account of team cognition might focus on identifying sequences of behavior that occur while teams interact and the extent to which those sequences represent generalizable, stable, and predictable patterns indicative of how teams learn (e.g., identifying and categorizing sequences of communication as indicative of different team learning functions; Cooke et al., 2013; Gorman, et al., 2009; Kennedy & McComb, 2014). This latter example is consistent with the dynamical systems approach to understanding team behavior as it seeks to describe and quantify a more "macro" system-level

pattern of behavior rather than elaborate the more “micro” actions/processes carried out by specific individuals within that system.

A common technique for representing and summarizing the sorts of change dynamics represented in the dynamical systems perspective is through feedback loops (or multiple interlocking feedback loops). A *feedback loop* describes a recursive relationship among system variables in which it is possible for a variable to influence itself over time either directly or indirectly through its effect on other intervening variables (Sterman, 2000). A notable implication of representing a system’s dynamics through feedback loops is that distinctions between inputs and outputs become blurred. The circular influence structure inherent in a feedback loop means that any factor, process, or event involved in the cycle can be conceptualized as both an input and an output depending on when it is considered in the sequence of events (Cronin et al., 2011).

For example, Mathieu et al. (2015) describe an empirical study in which they examined the reciprocal relationship between team cohesion and team performance over time. In their data, team cohesion served as an input to performance at time t , but an output impacted by team performance at time $t + 1$. The authors observed that increases in team cohesion were associated with increases in team performance, which were subsequently related to increases in team cohesion. This form of recursion exemplifies a *positive or self-reinforcing feedback loop* in which a reciprocal positive relationship exists between two variables in a system (e.g., higher cohesion at time $t \rightarrow$ higher performance at time $t + 1$; higher performance at time $t + 1 \rightarrow$ higher cohesion at time $t + 2$). Positive feedback loops have the potential to compound over time and thus produce explosive patterns of exponential growth or collapse. Alternatively, a *negative or self-limiting feedback loop* is one in which changes in one variable restrict or attenuate changes in another variable over time. For example, DeShon et al. (2004) suggest that individuals working in teams regulate their efforts around accomplishing both individual- (i.e., “I need to type up my daily report”) and team-level (i.e., “Our team needs to deliver the final product by the deadline”) goals. However, in cases where these goals conflict or cannot be accomplished simultaneously, directing efforts towards one goal comes at the cost of effort and achievement relevant to the other goal that must be corrected through future actions (e.g., higher effort towards individual goal at time $t \rightarrow$ lower performance on team goal at time $t + 1$; lower performance on team goal at time $t + 1 \rightarrow$ reduced effort towards individual goal at time $t + 2$). Negative feedback loops result in asymptotic patterns in which changes in the implicated system variables eventually reach an equilibrium. Assuming unlimited time and resources, the feedback loops described by DeShon et al. (2004) would (eventually) result in team members exerting effort towards

individual and team goals such that the effort directed towards each goal proceeds at a rate equivalent to its respective desired level of achievement.

Of note, the sorts of change dynamics previously depicted can only occur if certain concepts/factors in a system are *dynamic variables* (sometimes referred to as *stocks*, Sterman, 2000). A dynamic variable is one that can maintain its state over time and thus operate as though it has a “memory” of its current state when changing over time (Vancouver & Weinhardt, 2012; Weinhardt & Vancouver, 2012). From this perspective, team cohesion would be considered a dynamic variable as it likely does not exist only at a single time point; it is presumed to exist over and through time such that its level can accumulate or dissipate from moment-to-moment as team members interact or events unfold. Recognizing that certain variables/constructs persist and ebb-and-flow in a near continuous fashion is critical to the conceptualization of teams as complex dynamic systems.

The example feedback loops presented previously were relatively simple and involved only two reciprocally related variables. However, a feedback loop may be comprised of several intervening elements. For example, Rudolph and Repenning (2002) offer a dynamical systems representation for how “performance disasters” might occur in teams (i.e., team becomes so overwhelmed with tasks that it effectively collapses). In their theory, the number of tasks a team must complete is represented as a dynamic variable such that tasks can continuously accumulate over time and are resolved at a rate equal to the team’s capabilities. The authors propose that when faced with a quota of tasks, teams formulate a perception for how quickly those demands can be resolved (number of tasks remaining → perceived resolution rate). This perceived resolution rate subsequently contributes to a team’s stress level (perceived resolution → stress), conceptualized as the ratio of a team’s perceived resolution rate to its typical resolution rate (e.g., perceiving that more needs to be done than can typically be accomplished increases stress). Lastly, stress is proposed to exhibit a nonlinear relationship with how many tasks a team resolves in a given time period such that increased stress improves performance up to a point after which it results in increasingly worse performance (stress → number of tasks remaining).

This (moderately) more complex feedback loop highlights some additional points of interest with respect to representing team phenomena from the perspective of dynamical systems. First, the passage of time is an essential and explicit feature of dynamical systems theories as it permits the transmission of influence among variables/concepts within a feedback loop(s). However, this transmission process need not occur instantaneously and therefore provides a unique way in which substantive concepts or environmental conditions can be incorporated into the representation of team dynamics. For example, including a delay between the arrival of new tasks and when a team becomes aware of those tasks in Rudolph and