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ABSTRACT

When organizations face paradoxical tensions, such as when they must simultaneously meet scientific and commercial objectives, individuals within the organization also experience tensions. How individuals' responses to these tensions inform the collective organizational response remains a theoretical and empirical challenge. We address this challenge by introducing a social network perspective. In a two-stage mixed-method study of a research institute in Taiwan, we examined how individuals' social networks facilitated the organization's response to a science-commerce paradox. Our results demonstrated that the level of heterogeneity in each individual's social network influenced how each individual contributed to the organization's collective response. Specifically, individuals with heterogeneous instrumental networks were more likely to contribute to the organization-wide consensus response, whereas individuals with homogeneous expressive networks were more likely to contribute to a polarized subgroup response. Our findings suggest that individuals' roles in shaping a collective organizational response to paradoxes depends on who they seek advice from and who they befriend.

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INTRODUCTION

Organizations often face paradoxical demands. They must explore new knowledge while exploiting existing knowledge (Andriopoulos and Lewis, 2009; Raisch and Birkinshaw, 2008), earn profits while adhering to a social mission (Smith and Besharov, 2017; Smith et al., 2013; Jay, 2013), or cooperate with other organizations while competing in the same market (Bengtsson and Raza-Ullah, 2016; Jarzabkowski and Bednarek, 2017). These paradoxical demands that occur at the organizational-level trigger tensions that are experienced by individuals within the organization (Jarzabkowski et al., 2013; Miron-Spektor et al., 2018), such as individuals experiencing performing paradoxes associated with executing contradictory activities in their work roles (Bednarek et al., 2017), or individuals experiencing belonging paradoxes associated with holding contradictory identities (Sheep et al., 2017b).

A growing number of scholars recognize that paradoxes are inherent to organizing yet only become salient when triggered by individuals' thoughts and feelings (e.g., Lewis, 2000; Schad et al., 2016; Smith and Lewis, 2011), which has led to an increase in attention to how individuals respond to organizational paradoxes (e.g., Miron-Spektor et al., 2011; Miron-Spektor et al., 2018; Smith, 2014; Zhang et al., 2015). Making inferences about how organizations respond to paradoxes based on insights from how individuals respond to paradoxes, however, requires aggregation, and we cannot assume that the experience of one individual applies to the entire organization (Schad et al., 2016). Organizations are composed of multiple actors with varying experiences and perspectives, including top managers (Smith, 2014), middle managers (Lüscher and Lewis, 2008; Knight and Paroutis, 2017), and frontline employees (Smets et al., 2015). Consequently, the same organizational paradox may not be perceived by all actors in the same way (Schad and Bansal, 2018). Compounding this issue is the fact that individuals' responses to paradoxes do not occur in

isolation but are co-constructed with others through social interactions (Jarzabkowski and Lê, 2017; Dameron and Torset, 2014; Sheep et al., 2017a; Bednarek et al., 2017; Putnam et al., 2016). As a result, individuals' responses to paradoxes do not only depend on *where* they are situated within the organization but *who* they interact with. Variance in social interactions may create variance in how individuals contribute to the organization's overall response to paradoxes.

To address how individual responses to organizational paradoxes aggregate to the organizational-level in a way that considers variance in both individuals' perspectives and social interactions, we integrate paradox theory with social network theory. Social network theory stipulates that the composition of social interactions that individuals engage with on a day-to-day basis impacts their exposure to and mutual influence on dis(similar) ideas, opinions and perspectives (Reagans and McEvily, 2003; Rodan and Galunic, 2004) and, thus, contributes to the individual's influence on organizational outcomes. Some individuals will more likely than others interact with people who share similar knowledge (Rivera et al., 2010) or hold a similar identity (Gibbons and Olk, 2003; Ibarra, 1992), establishing varying levels of heterogeneity in the type of people that individuals interact with (McPherson et al., 2001; Casciaro and Lobo, 2008).

Our paper integrates social network theory with paradox theory by examining the relationship between individuals' network composition and their role in facilitating the collective's overall response to organizational paradoxes. We support our theoretical framework empirically by drawing from a two-stage study of researchers at a quasi-governmental research institute in Taiwan that had recently merged its basic science and applied science divisions. As a science organization that must simultaneously address scientific and commercial objectives, the organization represented a prototypical case of an organization facing paradoxical demands (Bednarek et al., 2017; Sauermann and Stephan, 2013). We used cultural consensus theory (CCT)

as a methodological approach to examine the cross-level association between individuals' network composition and the collective's response to the paradox (Anders and Batchelder, 2012; Batchelder and Anders, 2012). This involved conducting a qualitative study to surface a range of individual responses to the organizational paradox, and conducting a quantitative study to aggregate individuals' responses and to analyze the relationship between individuals' social network composition and their alignment with the aggregate response. The result is a multi-stage way of determining how individuals' social networks facilitate an organization-level response.

Through our theoretical and empirical approach to aggregating individual responses to organizational paradoxes, our study contributes to the organizational paradox literature in three critical ways. First, we answer calls for further examinations into the microfoundations of paradox (e.g., Schad et al., 2016). We build on recent insights that recognize that individuals' responses to organizational paradoxes vary (e.g., Keller et al., 2017; Miron-Spektor et al., 2018; Zhang et al., forthcoming; Zhang et al., 2015), while also building on insights on how individuals co-produce their response through social interactions with others (e.g., Putnam et al., 2016; Sheep et al., 2017a). We complement both of these approaches by demonstrating how patterned interactions (as opposed to "in-the-moment interactions") shape individuals' responses to organizational paradoxes in varying ways, and how the variance is associated with their role in shaping the organization's collective response. Second, we build on a central tenet of organizational paradox theory that proclaims that paradoxes are both inherent in systems and socially constructed (e.g., Clegg et al., 2002; Smith and Lewis, 2011; Schad and Bansal, 2018; Schad et al., 2016). Rather than focusing on how cognition transforms individuals' awareness and response to the latent tensions that are inherent in systems and structures (Miron-Spektor et al., 2018; Smith, 2014; Sharma and Good, 2013), we focus on how social structures transform individuals' cognition.

Third, we answer calls to extend the boundaries of organizational paradox theory through the integration of other theories (Schad et al., 2018), incorporating social network theory as a theoretical framework and CCT as an empirical framework for aggregating individual responses.

HETEROGENEITY OR HOMOGENEITY OF SOCIAL NETWORKS

Our theoretical framework is based on the premise that individuals in organizations are embedded in instrumental and expressive social networks (Lincoln and Miller, 1979; Podolny and Baron, 1997). Instrumental networks (or otherwise referred to as "advice networks") follow formal task interdependencies and formal lines of communication. They are primary conduits for the exchange of task-related knowledge in pursuit of work goals within the organization. Instrumental networks provide individuals with outlets to learn and share knowledge about task-related information, ideas and opinions. This does not only provide individuals with insight on how to perform their own tasks but insight on how various activities, structures and systems within the organization facilitate the overall instrumental goals of the organization (Podolny and Baron, 1997). Instrumental networks are therefore likely to serve as conduits for exchanging knowledge on performing paradoxes, which are contradictory yet interrelated goals and objectives (Smith and Lewis, 2011). Expressive networks (or otherwise referred to as "friendship networks") are primary conduits for the exchange of personal knowledge, which provides intimacy and self-disclosure on values and preferences (Chua et al., 2008; Marsden, 1988). As individuals learn about others' values and emotions, they acquire a sense of a shared identity (Umphress et al., 2003). In the process, they do not only learn and share knowledge about the various social identities within the organization, but how the engagement in various activities, structures and systems strengthens or weakens their identity (Nelson, 1989; Ely, 1994). Expressive networks are therefore likely to serve

as conduits for exchanging knowledge on belonging paradoxes, which are contradictory yet interrelated identities within the organization (Smith and Lewis, 2011).

We contend that how individuals respond to organizational paradoxes depends on the level of heterogeneity in individuals' instrumental and expressive network composition, which refers to the extent to which the background of individuals' network contacts vary (Reagans and McEvily, 2003; Rodan and Galunic, 2004). Whereas individuals with homogenous instrumental networks seek advice from colleagues with similar backgrounds, individuals with heterogeneous instrumental networks seek advice from colleagues with different backgrounds (LePine et al., 2012). Similarly, whereas individuals with homogeneous expressive networks befriend colleagues with similar backgrounds, individuals with heterogeneous expressive networks befriend colleagues with different backgrounds (Flynn et al., 2010; Klein et al., 2004).

Relative heterogeneity of each individual's instrumental or expressive network will likely play a particularly salient role in determining whether the individuals' social interactions shift or reaffirm their pre-existing approach to the paradox. We base our assertion on the premise that individuals' pre-existing approach to paradoxes are shaped by membership in organizational subgroups, as each subgroup has a different set of logics, practices, and identities that predisposes them to emphasize one pole over another when interpreting paradoxes (Besharov and Smith, 2014; Smith and Besharov, 2017). For example, science organizations conduct both research and commercialization (Bednarek et al., 2017). While basic research requires flexible and independent processes, commercial activities require controlled and interdependent processes. To ensure that both processes are incorporated into the organization, organizations establish differentiated structures with basic scientists in one subgroup and applied scientists in another. Because each subgroup brings to the organization contrasting views of how to organize (Bikard et al., 2015;

Murray, 2010), members of each subgroup are predisposed to approach tensions from one of two opposing poles (e.g., flexibility and independent processes versus controlled and interdependent processes). The extent to which individuals' instrumental and expressive networks are heterogeneous will have an influence on whether the people they interact with are predisposed to also approach paradoxes from the same end or a different end of the pole.

Whether others are predisposed to view paradoxes from the same end or a different end of the pole should influence how the individual contributes to the organization's collective response to paradoxes because social interactions facilitate a co-created response to tensions (Jarzabkowski and Lê, 2017; Dameron and Torset, 2014; Sheep et al., 2017a; Bednarek et al., 2017; Putnam et al., 2016). Social interactions can reinforce each individual's defensive response (Lewis, 2000), such as the suppressing of one pole or the separating of two poles (Smith and Lewis, 2011; Jarzabkowski et al., 2013), or can reinforce proactive responses (Lewis, 2000), such as the acceptance and transcendence of both poles (Smith and Lewis, 2011; Jarzabkowski et al., 2013). When individuals have a similar predisposition, a shared defensive response is likely to reaffirm both parties' emphasis on one end of the pole. For example, basic scientists are more likely to reaffirm their emphasis on independence when communicating their defensive responses to tensions between independence and interdependence with other basic scientists. When individuals have a different predisposition, however, their proactive responses are more likely to shift both parties' emphasis towards the complementarity of poles (Birkinshaw et al., 2016). For example, basic scientists are more likely to shift their emphasis towards the complementarity between independence and interdependence when communicating their proactive responses with engineers.

The accumulation of defensive and proactive responses across series of social interactions are likely to create aggregate responses to organizational paradoxes that follow particular patterns,

as each individual is influenced by the people they interact with, and influence the people they interact with over the course of their organizational experience. For individuals with homogeneous networks, their social interactions are more likely to reinforce polar approaches to organizational paradoxes, as they will more likely to be convinced by others to share a polar approach, and they will more likely convince others to share a polar approach. As a result, individuals with homogeneous networks are more likely to contribute to a polar subgroup response that emphasizes one pole over the other. Their approach to organizational paradoxes will therefore be more congruent with a polar subgroup response, and less congruent with an organization-wide consensus response that integrates the two poles. For individuals with heterogeneous networks, on the other hand, their social interactions are more likely to shift multiple parties' approaches to organizational paradoxes towards an organization-wide consensus approach that integrates the two poles. They are more likely to be convinced by others to shift, and will more likely convince others to shift. Their approach to organizational paradoxes will therefore be more congruent with an organization-wide consensus response, and less congruent with a polar subgroup response. Therefore, individuals' role in the formation of an aggregate response to organizational paradoxes will depend on whether their networks are homogeneous or heterogeneous. It will depend on whether they typically seek advice from or befriend others who share their predisposed polar view or have an alternative perspective.

H1: Individuals with heterogeneous instrumental social networks will have more congruence with the consensus in their approach to organizational paradoxes.

H2: Individuals with heterogeneous expressive social networks will have more congruence with the consensus in their approach to organizational paradoxes.

H3: Individuals with heterogeneous instrumental social networks will have less congruence with a polar subgroup in their approach to organizational paradoxes.

H4: Individuals with heterogeneous expressive social networks will have less congruence with a polar subgroup in their approach to organizational paradoxes.

CULTURAL CONSENSUS THEORY

To examine the relationship between individuals' network composition and their congruence with aggregate responses to organizational paradoxes, we adopted cultural consensus theory (CCT) as an empirical guide (Borgatti and Carboni, 2007; Weller, 2007; Bernard, 2011). CCT was originally developed by anthropologists as a theory with associated methods for determining what is "culturally true" across multiple informants (Romney et al., 1986). CCT is not a statistical tool used to test whether there is agreement at the aggregate-level on a generalizable construct (e.g., job satisfaction), as found in traditional management research (e.g., intraclass correlation (ICC); Woehr et al., 2015). CCT is a comprehensive approach for determining aggregate patterns of socially constructed knowledge and the individual-level factors associated with aggregate patterns (Keller and Loewenstein, 2011; Weller, 2007). CCT typically involves qualitative and quantitative stages of data collection. This mixed-method approach does not use a qualitative stage to develop theory and a quantitative study to test theory (e.g., Sonenshein et al., 2014; Martens et al., 2007). Instead, the first stage involves the use of qualitative methods to surface perceptions and the second stage involves the use of quantitative methods to determine the aggregate distribution of perceptions (e.g., areas of consensus and subgroup polarization) and the individual-level factors associated with aggregate patterns (Batchelder and Anders, 2012), including social network composition (e.g., Hopkins, 2011).

We adopted CCT as our empirical approach because CCT enables us to integrate epistemological and ontological approaches to the study of paradox, which are both integral to paradox theory yet are traditionally studied in isolation (Schad and Bansal, 2018). By using qualitative data to surface individuals' responses to paradoxes, we recognize that individual responses to paradoxes are socially constructed and hence best examined through individuals' own epistemological lens (Sheep et al., 2017a; Jarzabkowski and Lê, 2017; Putnam et al., 2016). At the same time, by using quantitative data to examine individuals' network structure, we can simultaneously hold an underlying assumption that network structure reflects an externally observable ontological reality (Emirbayer and Goodwin, 1994). CCT enables us to examine the relationship between an epistemological reality that individuals perceive, and an ontological reality that we as researchers observe by disentangling the content of individuals' perceptions from the aggregate distribution of perceptions across a population. This allows us to examine how network structures contribute to the aggregation of constructed responses. Accordingly, instead of separating inductive and deductive aspects of our study into two stages, we simultaneously use an inductive approach to examining individuals' perceptions and a deductive approach to examining how social networks shape the collective's perceptions.

EMPIRICAL CONTEXT

The context of our study is a Taiwan-based quasi-governmental research institute that had recently merged two divisions. The merger was spurred by a change in government policy that was motivated by a desire to reduce the institute's reliance on government funding while maintaining its mission of simultaneously advancing research and aiding commercialization efforts. In the past, the research institute would take funding from the government to conduct core R&D work and then transfer knowledge derived from the work to private companies who would

then commercialize the technologies. The new policy was to promote the active engagement of the institute in direct commercialization activities, which presented both a threat of losing government support and an opportunity for gaining revenue. One of the divisions to be merged that was composed of predominantly applied scientists (e.g., engineering) and non-scientists (e.g., marketing) was already active in commercialization efforts. Another division that was composed of predominantly basic scientists (e.g., biological science) was focused on research. The goal of the merger was to encourage members of both divisions to simultaneously pursue both.

We purposefully chose an empirical context where, from an observer's perspective, the organization was facing a set of interrelated paradoxical tensions, with a high potential for tensions to be experienced by individuals within the organization (Lewis et al., 2014). As a science-based organization that was wrestling with how to simultaneously meet scientific and commercial objectives, the institute represented a prototypical case of an organization facing performing paradoxes around satisfying multiple external demands (e.g., Bednarek et al., 2017), as they were required to produce research and earn money simultaneously (Murray, 2010). In addition, nested within this tension was a learning tension associated with exploring new knowledge for the sake of research while harnessing existing knowledge for the sake of commercialization (Lüscher and Lewis, 2008). Finally, because serving both commercial and scientific objectives required combining different types of employees with different competencies and perspectives, the institute faced an organizing tension around how to integrate and differentiate the scientific and commercial aspects of the organization's activities (Milosevic et al., 2018).

We also selected this case because the institute included both basic and applied scientists who were influenced by divergent logics (Sauermann and Stephan, 2013; Bikard et al., 2015; Murray, 2010; Leahey, 2016; Leahey et al., 2016), and hence individuals within the institute were

likely to be predisposed towards emphasizing one pole over another when responding to the organizational paradox. The basic scientists were more likely to emphasize the scientific objectives, whereas applied scientists were more likely to emphasize commercial objectives. Differences between science and commerce logics influenced not only general views about the key objectives of the institute, but specific ways of thinking about how to organize in order to meet the objectives (Sauermann and Stephan 2013). In addition, contrasting views on the objectives of the institute also reflected how each member perceived their professional identity (Gioia et al., 2010; Collinson, 2004; Boussebaa and Brown, 2017), as a scientific objective is a key part of a basic scientist's identity and a commercial objective is a key part of an applied scientist's identity (Murray, 2010). The institute therefore presents an environment where individuals are likely to be wrestling between disciplinary and organizational identities (Jarzabkowski et al., 2013).

OVERVIEW OF STUDY

Our study involved two stages. We began with a qualitative stage that included interviews, observations and archival data. The goal of the qualitative stage was not to generate theory, but to examine how various actors experienced paradox, their own response to the paradox, and how their own disciplinary background may have contributed to their response. The data from the qualitative stage was also used for the design of the questionnaire on individuals' responses to the paradox. As in all CCT studies, connecting the qualitative to the quantitative data was essential for ensuring that the quantitative study captured an aggregate pattern of responses that was grounded in the empirical context (Weller, 2007).

We then used a quantitative study to examine the aggregate patterns of responses and to test our hypotheses that heterogeneous networks facilitate an integrative consensus response and

homogeneous networks facilitate polar responses. The quantitative study involved a survey of all members of the same institute. The first component was a set of questions on views about the institute's activities, systems and structures to derive aggregate responses grounded in the organizational context. The second component was a set of questions about the individual's instrumental and expressive network ties, using a list of members of the institute to ensure that the responses were accurate. Our data collection began within a year after the institute merged basic science and applied science functions in order to capture individuals' response to the paradox when the paradox was still salient.

QUALITATIVE STAGE OF STUDY

Interview Sample and Protocol

One co-author of the paper conducted semi-structured interviews with 16 members of the institute, with two other co-authors participating in seven of those interviews. Since the goal of our study was to extrapolate a range of perspectives, the interview participants included two top leaders, six division managers and eight front-line employees, with at least three members representing each type of disciplinary background, position of formal authority, and experience within the organization. All interviews were conducted in Mandarin Chinese. The interviews served two goals. The first goal was to assess various actors' general views on the merging of the basic science and applied science functions, the contradictions they saw in the organization's objectives, and the organization's response. This enabled us to gain a holistic understanding of the context and the paradoxical tensions that permeated the organization. The second goal was to surface specific views on how the organization should respond, including the activities, systems and structures that epitomized their overall views on how the organization should respond to the

paradox. Surfacing specific, concrete examples is critical for CCT research, as it enables researchers to precisely identify areas of consensus and disagreement when aggregating perspectives (Weller, 2007). For example, most interviewees mentioned the importance of breakthrough research, but many disagreed on the specific level of importance. We therefore followed up each general question with specific questions such as "what activities are you engaged in"; "what are current issues facing the institute's innovation efforts,"; "what current activities at the institute are being conducted that are helping or harming the institute's innovation efforts"; "how are current key performance indicators (KPIs) helping or hurting the innovation process"; and "how is the way the current institute is structured helping or hurting the innovation process?"

Additional Data Collection

As in previous paradox literature (e.g., Bednarek et al., 2017; Jay, 2013), we also collected secondary data from internal documents that demonstrated how the organization was structured and how the institute was changing structures and objectives in response to government policy changes. This helped us to reinforce our understanding of the paradoxes that the research institute was facing from an observer's perspective. One co-author also spent time as an observer, confirming that employees did engage in formal and informal forms of communication with each other. For example, besides formal meetings, many employees also ate lunch together.

Data Analysis

The interview data was transcribed and then coded separately by two coauthors and an independent researcher with no knowledge of the theoretical goals of the study. Following Miles and Huberman (1994), we engaged in multiple rounds of analyses to ensure that we capture the main topics covered and the full range of activities, systems and structures. We analyzed our data

in two phases. In the first phase, we examined how the interviewees perceived the underlying paradox the organization was facing and the way each interviewee framed the paradox, as conducted in previous qualitative paradox studies (e.g., Jay, 2013; Smith, 2014). In the second phase, we coded for examples of specific activities, systems and structures that were referenced when individuals discussed how they believed the organization should respond to the paradox.

Findings

Identifying paradoxes. In accordance with prior findings in paradox research (e.g., Sheep et al., 2017a), we found that the paradoxical tensions expressed by the individuals were qualitatively different from those we observed as researchers at the organizational-level, as performing and belonging tensions were considered to be the most salient. Our interviews confirmed that individuals across the institute believed that the organization was facing tensions attributed to simultaneously addressing scientific and commercial objectives, and they saw such tensions in their own work. Our findings therefore replicated previous findings on paradoxes in science organizations that found organizational-level performing paradoxes manifested as work-related tensions associated with balancing scientific and commercial concerns in day-to-day practice (Bednarek et al., 2017). In addition, we also found that individuals were experiencing belonging tensions, and these belonging tensions focused on the tension between their own disciplinary identity and the identity of the larger organization. Our findings therefore also replicated previous findings that found that organizations facing restructuring trigger individuals' concerns over relationships between their affiliation with a subgroup and the organization as a whole (Lüscher and Lewis, 2008; Jarzabkowski et al., 2013). We found evidence of individuals experiencing these paradoxes among both basic scientists and applied scientists.

Identifying general responses to paradoxes. As in prior research, we also found evidence that individuals responded to the paradoxes with a range of proactive and defensive responses (Jarzabkowski et al., 2013; Jarzabkowski and Lê, 2016). However, there were key differences in responses to performing and belonging paradoxes. When discussing performing paradoxes, the individuals were more likely to use a *proactive* response (e.g., integrating) and focus attention on the *organization*. For example, an engineer stated that "directly meeting the needs of hospitals and doctors is the right path for [research institute] because the problems facing hospitals are both industrial and scientific." However, when discussing belonging paradoxes, the individuals were more likely to use a *defensive* response (e.g., suppressing or opposing) and focused on the impact on *subgroups*. For example, a manager with a basic science background stated that: "Different people speak different languages. If you put different types of people together, nobody accomplishes anything." Meanwhile, an engineer asked rhetorically: "we are not academia, so how can we define ourselves as doing basic research?" In some cases, responses to performing paradoxes triggered tensions associated with belonging tensions. For example, according to a basic scientist, "before integration, [research institute] employees were proud of their performance, but now previous performance indicators are overshadowed by the organization and policy direction." We also found that interviewees' responses to belonging paradoxes were more emotionally-laden, as evident from their elevated tones when discussing the topic. These results therefore suggested that social interactions that discussed exclusively performing paradoxes and social interactions that also discussed belonging tensions elicited different types of responses.

Identifying views on specific organizational responses. We paid special attention to individuals' perceptions of specific organizational issues and their proposed responses, as surfacing concrete understandings of individuals' views was necessary for surfacing variance in

views across the organization. This is critical for examining aggregate responses, as individuals may hold similar abstract views but hold radically different views in practice (Keller and Loewenstein, 2011). For example, individuals throughout the institute may agree, in the abstract, that there needs to be some level of integration and differentiation of basic and applied research, but they may disagree on the specific ways of integrating and differentiating, thereby triggering different responses in practice. We found evidence that individuals were concerned with a broad range of specific issues, encompassing organizational activities, systems and structures. Individuals' were concerned with the extent to which the organizational activities supported scientific or commercial objectives and whether they enabled individuals to engage in activities that coincided with their disciplinary identity. This included, for example, issues pertaining the amount of time that individuals had to work on long-term projects with no immediate commercial value. Individuals were also concerned with the incentive systems that the institute put into place to reward individuals. This included, for example, issues pertaining whether key performance indicators (KPIs) should include output that enhanced the individuals' scientific reputation (e.g., academic papers) or provided tangible evidence of satisfying commercial goals (e.g., revenue). Finally, individuals were also concerned with how the institute was structured. This included, for example, issues pertaining whether project teams needed to include both scientists and non-scientists to simultaneously address scientific and commercial objectives or should separate the two types of teams in order to ensure that each objective was met. We found evidence that individuals were actively concerned with how activities, systems and structures facilitated a collective response to the tensions the individuals within the organization were facing. We also found evidence that individuals had varying views on how the organization should respond.

QUANTITATIVE STAGE OF STUDY

The main objective of quantitative stage of the study was to examine aggregate patterns of consensus and polar views on the organization's response to paradoxes, and to test our hypotheses about the association between individuals' instrumental and expressive networks and their alignment with consensus and/or polar views.

Questionnaire design

Following prior work on using qualitative data as part of CCT analysis (Weller, 2007), two coauthors and an independent researcher with no knowledge of the theoretical goals of the study coded for specific examples of individuals' views on the optimal range of specific activities, systems and structures that constituted the organization's response to ongoing tensions. This coding formed the basis for the generation of items to be used to measure aggregate responses and each individual's congruence to the aggregate patterns. To ensure that no alternative views were missing (cf. Battilana and Dorado, 2010), an independent researcher also conducted a confirmatory analysis of terms relating to activities, systems and structures, using Maxqda and added codes accordingly. After initial coding revealed a Cohen's kappa of .73 (Landis and Koch, 1977), the coders deliberated and reconciled a coding scheme.

We identified 14 specific responses pertaining organizational activities, systems and structures, mentioned by at least two interviewees and based on 146 overall comments. A complete list of responses, including the number of participants mentioning each issue and the total number of comments, are displayed in Table 1. The first four responses pertained to the proportion of time and effort spent on various activities aimed at achieving scientific or commercial goals. The next five responses related to the incentive systems as found in the key performance indicators (KPIs)

that are associated with rewarding the achievement of scientific or commercial goals. Finally, five responses pertained to structures associated with serving scientific or commercial goals.

Insert Table 1 about here

Based on the 14 responses, we developed an online questionnaire that included 25 items on activities, systems and structures, used to measure aggregate responses (consensus and polar views) and each participant's alignment with the aggregate responses. We presented the items to two representatives of the institute to confirm that the items are ecologically valid. Answers are transposed into a set of 25 dichotomous answers used for the CCT analysis. Details on the process for generating item content are presented in Appendix 1.

Participants and procedures

A link to the online questionnaire was sent to all employees within the institute. This questionnaire included measures to capture employees' views on activities, systems and structures; instrumental and expressive social networks; and demographic characteristics. Of 345 employees within the organization, 172 responded to the questionnaire (90 basic scientists and 82 applied scientists), giving us a response rate of 50%. Among respondents, 62% were male and the average age was 40. We conducted one-way ANOVA tests to examine if nonrespondents differed significantly from respondents in key demographic characteristics, and found no significant differences between the two groups in rank, professional tenure, and disciplinary background.

Congruence measures for consensus and polar approaches

To measure the consensus and polar aggregate views, we followed prior CCT research and generated a pairwise agreement matrix for all 25 "1" and "-1" answers (Weller, 2007). We then measured the proportions of matching responses (the "match" method; Weller and Mann, 1997), and then corrected for chance responding. The corrected-for-chance agreement matrix was then submitted to a minimum residual factor analysis without rotation. The first factor loading score from the factor analysis measured *congruence to consensus*, as the score measures the extent to which an individual's scores across items match areas of consensus across the sample. The second factor loading score from the factor analysis measured congruence with one polar view over the other. We then took the absolute value to indicate *congruence with polar approach*, as the score measures the extent to which an individual's scores are aligned with one subgroup over a second subgroup (regardless of which subgroup).

Measures for network composition

We measured the instrumental and expressive network compositions by using Krackhardt and Kilduff's (1990) and Ibarra's (1993) sociometric questions on advice and friendship ties. Specifically, we tapped at individuals' instrumental ties by asking respondents the following questions: "Consider the people who are important sources of professional advice to you. Over the past year, please indicate whom you approach if you have a work-related problem or when you want advice on a decision you have to make." Expressive friendship ties were measured by asking respondents the following questions: "Consider the people in your social network with whom you like to spend your free time. Who are very good friends of yours: people whom you see socially outside of work?" An online roster of names was provided for respondents to select their contacts. Ten drop-down boxes, which contained the names of the employees filtered by departmental

affiliation, were provided for each social network question so that respondents could select up to ten contacts each for instrumental and expressive contacts.

To measure *instrumental network heterogeneity*, we computed the number of advice contacts of respondents across three disciplinary backgrounds: science, engineering and management. Using information of employees' demographic characteristics obtained from the human resource department, we derived respondents' disciplinary background through coding their field of specialty in their education. Then we applied the Blau's (1977) heterogeneity index to compute each respondent's instrumental network heterogeneity (e.g., Wong and Boh, 2010). The same procedure was used to measure *expressive network heterogeneity*.

Control variables

We also included several control variables to ensure that other individual-level factors did not drive individuals' propensity to align with consensus and/or polar views. We controlled for individual disciplinary background, rank, and occupational identity, in particular, since these demographic variables could influence their views on paradoxes in fundamental ways. Description of these control measures are presented in Appendix 2.

Results for Aggregate Responses

To assess aggregate patterns of consensus and polar approaches, we submitted the pairwise agreement matrix across all 25 items to an unrotated, minimum residuals factor analysis (Weller, 2007). Results revealed a first factor eigenvalue of 28.3 and a second factor eigenvalue of 19.2, which corresponds to an average of 35% of each individual's views attributed to the organization's consensus views, 24% of each individual's views attributed to views shared exclusively by

members of each of the two polar subgroups, and the remaining 41% of each individual's views attributed to idiosyncratic factors not found in the analysis.

We then analyzed the content of the consensus views by computing standardized mean scores for the whole sample weighed by first factor loadings (consensus), and we analyzed the polar views by separating two subgroups based on whether they had positive or negative second factor loadings (see Keller & Loewenstein, 2011). Results are presented in Table 2. For the consensus views, we found a slight preference for engaging in more breakthrough research than incremental research, conducting research over servicing industry, conducting internal research over outsourcing, not using academic papers or patents as a core component of KPIs, not using team-based KPIs, and neither complete separation nor major integration of functions in teams. Therefore, while preferences on activities emphasized more basic research, preferences for KPIs emphasized more commercialization. This suggests that the consensus response to the organization's paradoxes was to focus slightly more time on scientific objectives and to focus slightly more effort at incentivizing commercial objectives. Therefore, the consensus response was not a complete compromise between commercial and scientific approaches, but a tendency to integrate through emphasizing different aspects of commercial and scientific approaches. Unsurprisingly, we found that respondents who were ranked higher had more congruent views with the consensus ($r = .165$, $p \leqslant .03$), suggesting that those with positions closest to the top had views that reflected the views of the entire organization.

For polar views, one subgroup (based on second factor loadings) had a strong preference for scientific pursuits, as exemplified by a preference for breakthrough research over incremental research, high risk over low risk research, research over servicing industry, internal over outsourced research, patents and not revenue as KPIs, complete separation of functions and hiring,

and hiring team members with depth of knowledge over breadth. The other subgroup had a strong preference for commercial pursuits, with a strong preference for low risk research, servicing industry over research, outsourcing research, revenue and no patents as KPIs, minor integration of functions, and hiring team members with breadth of knowledge over depth. This suggests that polarization between subgroups permeated beliefs about all activities, systems and structures. Unsurprisingly, these polar views were tied to disciplinary backgrounds and identities, as congruence to the first subgroup (which emphasized breakthrough research and patents as KPIs) over the second subgroup (which emphasized incremental research and revenue as KPIs) was correlated with a field of specialty in basic science ($r = .166$, $p \leqslant .05$) and identification as a basic scientist ($r = .229$, $p \leqslant .01$).

Insert Table 2 about here

Results for Individuals' Congruence to Consensus and Polarization

We then analyzed individual-level results, including the relationship between individuals' network composition and their alignment with consensus and polar views. Descriptive results and correlations are displayed on Table 3.

Insert Table 3 about here

To test our hypotheses, we conducted ordinary least squares regression analyses. Results of the regression analyses are reported in Tables 4 and 5. As found in Table 4, we found support for Hypothesis 1, as instrumental network heterogeneity was found to be significantly and

positively associated with congruence with the consensus (β=.217, p ⩽ .05), even when controlling for expressive network heterogeneity (β=.206, p ⩽ .05). However, we did not find support for Hypothesis 2, as expressive network heterogeneity was found not to be significant (β=.103, p = *ns*). We found an opposite pattern for Hypotheses 3 and 4. As found in Table 5, we found support for Hypothesis 4, as expressive network heterogeneity was found to be significantly and negatively associated with congruence with a polar subgroup (β=-.297, p ⩽ .05). The result remained marginally significant when controlling for instrumental network heterogeneity (β=-.280, p = .052). However, we did not find support for Hypothesis 3, as instrumental network heterogeneity was found not to be significant (β=-.132, p = *ns*).

Insert Tables 4 and 5 about here

Discussion of Quantitative Results

Our findings revealed that individuals' heterogeneous networks facilitated consensus and reduced polarization in the aggregate response to organizational paradoxes. However, our mixed findings also suggest that instrumental and expressive networks play different roles, as we found that only heterogeneous instrumental networks were associated with consensus and only homogeneous expressive networks were associated with polarization. Considering that consensus and polarization appear as opposing processes, the results appear themselves to be paradoxical. One potential reason for the qualitatively different effects is that the factors that drive consensus and polarization are independent of each other, as there can simultaneously be some views that are shared across a sample and some views that are specific to a subgroup (Batchelder and Anders,

2012). In the case of our study, this distinction centered on a consensus view about spending slightly more time on basic research but with polarized views on how to reward the research.

Because employees who shared the consensus view were more likely to have heterogeneous instrumental ties (and not necessarily heterogeneous expressive ties), our results suggest that the consensus-building process occurred during task-related discussions between employees with different backgrounds. This further suggests that heterogeneous instrumental networks facilitated a consensus response to the organization's performing paradox, as task-related discussions are more likely to address the shared objectives of members of the organization. For example, through a heterogeneous exchange, a basic scientist learns how research serves the commercial aspects of the organization's objectives and an engineer learns how research serves the scientific aspects of the organization's objectives. Our results suggest that homogeneous instrumental ties, on the other hand, will not necessarily lead to polarization, as working on the same task with others who share the same perspective on the task may not necessarily shift their views from where they are already predisposed. One potential reason is that individuals are unlikely to confide in others about their feelings of insecurity or anxiety about their identity when focused on the task at hand, even when they are engaged in a task with others who share the same feelings. As a result, any defensive reaction to a belonging paradox is unlikely to be reinforced in task-based interactions.

The relationship between homogeneous expressive ties (and not necessarily homogeneous instrumental ties) and polarization, on the other hand, suggest that the polarization process occurred during informal settings among friends who shared the same identity. This suggests that homogeneous expressive networks helped form polar responses to disciplinary-based belonging paradoxes. Belonging paradoxes are more likely to be discussed in informal settings among friends.

A basic scientist meets with other friends who share a basic science identity and discusses how their jobs impact their identity as scientists. They learn more about how the various activities, systems and structures impact their shared identity and coalesce around a co-constructed view of how the organization should respond to help reinforce their identity. Our results suggest that individuals' social interactions with friends who share a disciplinary identity do not only surface belonging tensions between their subgroup identity and an organizational identity, but co-construct polar, opposing views on how the organization should respond. Heterogeneous expressive networks, however, did not facilitate consensus. This suggests that having friends from different backgrounds may enable individuals to accept an organizational identity, but shifting views on the organization's response to performing paradoxes requires knowledge of how to integrate activities, which more likely comes from task-based interactions with others of different backgrounds.

GENERAL DISCUSSION

Previous literature has long suggested that individual responses to organizational paradoxes can shape the organization's response to paradoxes (e.g., Smith, 2014), yet questions have arisen over how individual responses aggregate to the collective level (Schad et al., 2016). We examined the question of aggregation by conducting a two-stage qualitative and quantitative study that incorporated social network theory as a theoretical lens and cultural consensus theory as an empirical guide. We studied a research institute that had recently merged a division that emphasized scientific objectives with a division that emphasized commercial objectives, and had adopted a mission to paradoxically integrate the objectives. Using qualitative interview data, we found that members of the institute perceived both performing and belonging tensions and were actively concerned with how the organization should address the activities, systems and structures that serve as responses to these tensions. Using survey data, we then found multiple aggregate

responses to these tensions, including a consensus response that emphasized integration and two polar responses tied to disciplinary identities. We found that variance in the relative heterogeneity of individuals' networks was associated with how individuals' views were aligned with others across the organization. Individuals with heterogeneous instrumental ties had views congruent to the organization's consensus response, whereas individuals with homogeneous expressive ties had views congruent to a polar subgroup's response.

Our findings suggest that individual views proactively shift toward a shared organizational response that addresses both scientific and commercial goals when they interact in heterogeneous instrumental networks. In instrumental networks, task-related concerns from different perspectives can be reframed to clearly recognize the interdependence in performing paradoxes, which then engenders the broadening of approaches that are more accepting of both poles of the paradox. However, experiences of tension arising from belonging paradoxes may not be fully expressed in instrumental task-based networks of interactions. Emotional responses that are stirred up from contradictions between the disciplinary identity and work role may find more open expression and dialogue in expressive networks with peers who share a common identity. Thus, negative emotional responses to belonging paradoxes are amplified with homogenous friends who also "support" their disciplinary identity.

Our findings support recent insights on organizational paradoxes that emphasize the dynamic interplay between paradoxes at multiple levels of analyses (e.g., Smith and Lewis, 2011; Schad et al., 2016; Sheep et al., 2017a; Jarzabkowski et al., 2013). Paradoxes of performing, learning and organizing observed at the organizational-level was experienced subjectively by individuals as performing and belonging paradoxes, which informed multiple aggregate responses involving different approaches to organizational activities, systems and structures. Our results also

support previous insights on organizational paradoxes that emphasize that organizational conditions shape individual responses to paradoxes (e.g., Knight and Paroutis, 2017; Miron-Spektor et al., 2018). We found that different types of social network structures influenced how aggregate responses are formed, coinciding with different emphases on performing and belonging paradoxes. Because organizations can influence how individuals' access social networks by creating varying opportunities for interactions (Feld, 1981), our results point to a new form of organizational response to paradoxical tensions centered on network structures. For instance, the impact of heterogeneous instrumental networks on the consensus response suggests that formal network structures that foster task-based social interactions will influence the formation of a consensus response, whereas the impact of homogeneous expressive networks on polarization suggests that informal network structures that encourage friendship-based social interactions will influence the formation of polar responses. By demonstrating how social networks contribute to the aggregation of individuals' responses to organizational paradoxes, our results therefore demonstrate how structures within the organization do not only contribute to how individuals respond to paradoxical tensions, but how these tensions inform the collective response.

Theoretical contributions

By demonstrating how individuals' network composition shapes the organization's collective response to organizational paradoxes, our study contributes to research on organizational paradoxes in three major ways. First and foremost, we answer calls for further examinations into the microfoundations of paradox (e.g., Schad et al., 2016). We provided a theoretical framework and empirical account of how individuals' patterned interactions shape collective response in different ways, contributing to our understanding of how individuals' responses to organizational paradoxes shape the organization's response (Schad et al., 2016). Our

results complement prior findings that focus on "in-the-moment" communication in accounting for individuals' response to organizational paradoxes (e.g., Jarzabkowski and Lê, 2017; Bednarek et al., 2017; Sheep et al., 2017a), by demonstrating that individuals' pattern of social interactions with homogeneous or heterogeneous others, manifested as instrumental and expressive social networks, also influence how individuals contribute to the organization's response. Our findings therefore contribute to microfoundational approaches that emphasize individual differences (e.g., Miron-Spektor et al., 2018) and social interactions (Putnam et al., 2016), as we demonstrate that both factors matter.

Second, we build on a central tenet of organizational paradox theory that proclaims that paradoxes are both inherent in systems and socially constructed (e.g., Clegg et al., 2002; Smith and Lewis, 2011; Schad and Bansal, 2018; Schad et al., 2016). While prior research has focused on how cognition transforms individuals' awareness and response to the latent tensions that are inherent in material structures (Miron-Spektor et al., 2018; Smith, 2014; Sharma and Good, 2013), we demonstrate that social structures can also transform individuals' cognition in dynamic ways. Prior literature has found that individuals' embeddedness within groups that acquire particular logics predispose them to a particular pole when responding to paradoxes (Jay, 2013; Smith and Besharov, 2017). We find that this predisposition is transformed through social interactions with others from different backgrounds, as individuals who seek advice from others with different backgrounds or befriend others with different backgrounds are less likely to follow the conventional beliefs of the disciplinary culture.

Third, we answer calls to extend the boundaries of organizational paradox theory through the integration of other theories (Schad et al., 2018). Our incorporation of social network theory extends our understanding of paradoxes by building on research on micro-level social interactions

(Jarzabkowski and Lê, 2016). Our social network theoretical approach and our incorporation of cultural consensus theory as an empirical guide extends our capacity to connect individual-level to organizational-level responses to paradoxes, as it provides a framework for examining cross-level data in a way that integrates epistemological and ontological approaches to paradox (Schad and Bansal, 2018). By incorporating these approaches, we do not only provide evidence of how individuals' social interactions shape collective approaches to organizational paradoxes, but provide a template for addressing issues concerning the interplay between multiple paradoxes at multiple levels of analyses more broadly (Schad and Bansal, 2018; Schad et al., 2016).

In addition, our findings also advance social network research by expanding our understanding of how instrumental and expressive networks shape collective processes in qualitatively distinctive ways. The distinction between the two forms of networks have long been a central component of social network theory (e.g., Ibarra, 1993), as individuals navigate different groups of contacts when determining who to seek advice from or who to socialize with. However, while most discussions have focused on how instrumental and expressive networks contribute to various individual-level outcomes, our cross-level results point to the role of instrumental and expressive networks in shaping different types of collective processes. Specifically, by finding that instrumental network heterogeneity contributed to the formation of consensus views and expressive network homogeneity contributed to the formation of polar views, our results point to task-related knowledge exchanges (Tortoriello and Krackhardt, 2010) and identify-forming knowledge exchanges (Gibbons, 2004) as qualitatively distinct mechanisms for shaping collective responses to paradoxes. By integrating social network theory with paradox theory, which is inherently multi-level (Schad et al., 2016; Andriopoulos and Gotsi, 2017), our study demonstrates that the impact instrumental and expressive network heterogeneity on individual outcomes

depends on how the networks tap into organizational-level issues of inquiry. In our case, our results suggest that instrumental networks tap into organization-wide concerns over the paradoxical performing objectives of the organization, whereas expressive networks tap into subgroup concerns over the paradoxical identities within the organization.

Managerial Implications

Our results also present key managerial implications. In particular, by demonstrating that social networks play a role in individuals' responses to organizational paradoxes, our results point to social networks as a mechanism for influencing how employees throughout the organization respond to paradoxes, particularly in response to paradoxes that become increasingly salient after a major organizational change. Our results suggest that managers do not only influence employees' responses through their own strategic decision-making process (Smith, 2014) or through creating salient contexts (Knight and Paroutis, 2017), but by influencing both the formal and informal social network structures that facilitate social interactions. Whereas managers can use formal structures that combine employees of varying backgrounds to encourage a consensus response, such efforts may not have a strong impact on reducing polarized views if the polarized views are tied to employees' expressive feelings. Managers must then also address how to encourage diversity in informal social interactions, which require the use of less tangible mechanisms. As friendship networks are less likely to follow task demands and are certainly not built overnight, cultivating more diverse friendship networks would likely require more time and effort in creating meaningful shared activities that sow the seeds for the development of positive affect.

Limitations and Future Directions

As in all empirical research, there are a number of limitations that could be addressed in future research. Some of our limitations are empirical. First, our empirical examination focused on a research institute facing a performing paradox around meeting scientific and commercial goals (Bednarek et al., 2017). Future research can examine other organizational paradoxes, including other performing paradoxes such as the demand to serve both social missions and commercial objectives (e.g., Smith and Besharov, 2017; Hahn et al., 2014; Sharma and Bansal, 2017), as well as other forms of paradoxes such as organizing paradoxes primarily centered on the issue of collaboration and control within corporate governance (Sundaramurthy and Lewis, 2003).

Second, while capturing an entire organization's distribution of beliefs and network ties is, in itself, a complex endeavor, the cross-sectional nature of our data only captures collective responses to an organizational paradox at a given time. The notion that paradox is dynamic is a core component of paradox theory (Smith and Lewis, 2011), and our two-stage study was limited in its capacity to capture the dynamic nature of change at multiple levels of analyses. Some future research can demonstrate how the relationship between networks and collective responses to paradoxes shift over time. Even if we are able to ascertain how responses shift over time, we recognize that changes in responses over time are not linear (Lüscher and Lewis, 2008) to "stable" responses to paradoxes. Views can oscillate, even within the same social interaction and with the same people (Bednarek et al., 2017). It is therefore difficult to capture how individuals experience and navigate paradoxes within social interactions based on our assessments of social network structure. To address this issue, future research can aim at integrating process-oriented studies that capture "in-the-moment" social interactions with our patterned interaction approach from network theory to examine how discourse, rhetoric and other communication mechanisms trigger dynamic changes in responses to paradoxes through networks. While our approach advances our

understanding of how individual responses aggregate to form collective responses to paradoxes, we recognize that other factors contribute to collective processes. For example, a socio-political perspective on collective responses to paradoxes (e.g., Putnam et al., 2016; Hargrave and Van de Ven, 2016) can be used to examine coalition building, which may play an indirect role in shaping the social networks that influence the collective response.

Finally, a social network approach involves a set of ontological assumptions about how structures constrain communication contexts (Buch‐Hansen, 2014). Other studies on the role of communication operate under a different set of ontological assumptions For example, the discursive perspective emphasizes the use of language as a tool for constructing the paradox experience (e.g., Sheep et al., 2017a; Putnam et al., 2016). While our approach does not directly contradict the role of discourse in shaping social interactions, future research can address how to integrate the two perspectives more directly.

Conclusions

In conclusion, by incorporating a social network approach to understanding how individual responses aggregate to the collective-level, we provide a new approach to addressing the microfoundation of paradox, centered on how patterned interactions at the individual-level lead to distinct collective responses. Rather than assuming that organizations are homogeneous and extrapolating what we see at the micro-level to the organization as a whole, we treat collectives as heterogeneous and, at times, polarized collectives (Hargrave and Van de Ven, 2016). These heterogeneous collective responses, which include organization-wide consensus and polarized subgroups with opposing responses, are shaped, in part, by the structure of social interactions that individuals engage in. In sum, when it comes to understanding how organizations collectively

respond to paradoxes, it is important to ask who do people turn to for advice and who do people turn to when in need of friendship.

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Tables

Table 1 *Coding of responses to issues with activities, systems and structures*

Area	No. of people	No. of comments
Activities		
Scientific breakthrough (scientific) vs. applications of existing science (commercial)	7	9
High risk/high reward (scientific) vs. low risk/low reward (commercial)	3	14
Focusing on research (scientific) vs. servicing industry (commercial)	10	19
Internal research (scientific) vs. reliance on partner institutes (commercial)	8	19
Systems		
KPIs based on publications (scientific)	6	11
KPIs based on patents (scientific)	7	10
KPIs based on direct revenue from projects (commercial)	6	8
KPIs based on performance on industry service (commercial)	5	9
KPIs based on individual performance (scientific) vs. group performance (commercial)	5	7
Structures		
Low (scientific) vs high (commercial) disciplinary diversity in teams	4	11
Employees engaged in single (scientific) vs. multiple (commercial) tasks	2	2
Depth of knowledge (scientific) vs. breadth of knowledge (commercial) in hiring priorities	2	10
Low (scientific) vs high (commercial) frequency of job rotation	5	6
Low (scientific) vs high (commercial) uniform procedures and incentives	7	11

Table 2 *Consensus and subgroup scores for each response*

	Consensus	Science Subgroup	Commerce Subgroup
Activities			
Breakthrough vs. Incremental Research: Min	0.27	0.56	0.12
Breakthrough vs. Incremental Research: Max	0.38	0.41	0.26
High Risk vs. Low Risk Research: Min	–0.19	0.53	–0.63
High Risk vs. Low Risk Research: Max	–0.01	0.62	–0.66
Servicing Industry vs. Research: Min	–0.53	–0.59	0.19
Servicing Industry vs. Research: Max	–0.38	–0.60	0.34
Internal Research vs. Outsourced: Min	0.34	0.84	–0.24
Internal Research vs. Outsourced: Max	0.42	0.85	–0.18
Systems (KPIs)			
Academic Journals: Min	–0.68	–0.02	–0.79
Academic Journals: Max	–0.76	0.11	–0.79
Patents: Min	–0.25	0.47	–0.47
Patents: Max	–0.11	0.61	–0.45
Revenue: Min	0.02	–0.37	0.59
Revenue: Max	0.18	–0.33	0.78
Team–based: Min	–0.35	–0.67	0.26
Team–based: Max	–0.37	–0.75	0.43
Structures			
Completely Separated	–0.57	0.44	–0.57
Minor Integration	0.10	–0.48	0.45
Major Integration	–0.60	–0.67	–0.55
Deep Disciplinary Knowledge	–0.33	0.36	–0.41
Deep Functional Experience	–0.34	0.37	–0.36
Frequent Team Change	0.76	0.59	0.94
Consistent KPI Across Teams	–0.31	–0.82	0.49

Table 3 *Descriptive Results and Correlations*

	Variable	Mean(SD)	1	2	3	4	5	6	7	8	9	10	11	12
1	Rank	2.744(.982)												
2	Professional Tenure	1.858(7.988)	.513**											
3	Performance	3.59(.686)	.393**	0.055										
4	Education Level	.29(.455)	-.536**	.158*	-.299**									
5	Basic Science Education	.523(.501)	0.107	-0.031	0.082	-.263**								
6	Basic Science Identity	.703(.458)	0.012	-.231**	0.071	-.238**	.272**							
7	Need for Cognitive Closure	3.706(.554)	-0.065	-0.044	0.061	0.074	-0.004	0.072						
8	Instrumental Advice Size	4.959(3.254)	.597**	.290**	.383**	-.342**	.154*	0.051	-0.09					
9	Expressive Friendship Size	3.733(3.559)	.228**	0.036	.189*	-.193*	0.03	0.008	-0.044	.531**				
10	Instrumental Network Heterogeneity	.294(.233)	0.084	0.061	0.08	0.019	-0.071	-.239**	0.025	.288**	.581**			
11	Expressive Network Heterogeneity	.223(.235)	.255**	.153*	0.125	-0.106	-0.042	-.267**	-0.079	.474**	.249**	.360**		
12	Congruence with Consensus	.297(.242)	.165*	0.106	0.06	-0.057	-0.073	-0.053	-.276**	.218**	0.133	0.125	.266**	
13	Congruence with Polarization	.046(.337)	0.064	-0.097	0.12	-.218**	.166*	.229**	0.096	-0.037	-0.022	-.191*	-0.148	-0.167

*$p \leq .05$; **$p \leq .01$.

Table 4 *Hierarchical Regression Analyses of Social Networks on Congruence with Consensus*[a]

	Base	H1	H2	Combined
Rank	.014	.013	.014	.013
	(.035)	(.035)	(.035)	(.035)
Professional Tenure	.001	.001	.001	.001
	(.004)	(.004)	(.004)	(.004)
Performance	.001	.005	.001	.005
	(.030)	(.030)	(.030)	(.030)
Educational Level	.011	.011	.008	.010
	(.043)	(.042)	(.043)	(.043)
Basic Science Education	-.040	-.034	-.039	-.034
	(.039)	(.038)	(.039)	(.038)
Basic Science Identity	.003	.037	.015	.041
	(.043)	(.045)	(.045)	(.046)
Need for Cognitive Closure	-.117**	-.116**	-.120**	-.118**
	(.033)	(.032)	(.033)	(.033)
Instrumental Net Size	.008	.001	.007	.002
	(.006)	(.006)	(.006)	(.006)
Expressive Net Size	.004	.004	.004	.002
	(.006)	(.006)	(.007)	(.006)
Instrumental Heterogeneity		.217**		.205**
		(.093)		(.096)
Expressive Heterogeneity			.103	.053
			(.099)	(.101)
R^2	.135	.165	.141	.167
ΔR^2		.030	.006	.002

*p ≤ .1; **p ≤ .05. Standard errors are in parentheses. [a] N = 172

Table 5 *Hierarchical Regression Analyses of Social Networks on Congruence with Polar Subgroup*[a]

	Base	H3	H4	Combined
Rank	.010	.010	.011	.011
	(.050)	(.050)	(.055)	(.050)
Professional Tenure	.002	.002	.002	.002
	(.005)	(.005)	(.005)	(.005)
Performance	.048	.046	.048	.047
	(.043)	(.043)	(.042)	(.042)
Educational Level	-.083	-.083	-.073	-.073
	.061	.061	.060	.061
Basic Science Education	.064	060	.061	.059
	(.055)	(.055)	(.054)	(.055)
Basic Science Identity	.127**	.106*	.091	.082
	(.061)	(.064)	(.063)	(.065)
Need for Cognitive Closure	.037	.037	.046	.046
	(.047)	(.047)	(.046)	(.046)
Instrumental Net Size	-.013	-.009	-.013	-.011
	(.008)	(.009)	(.008)	(.009)
Expressive Net Size	.001	01	.013	.012
	(.008)	(.008)	(.010)	(.010)
Instrumental Heterogeneity		-.132		-.070
		(.134)		(.137)
Expressive Heterogeneity			-.297**	-.280**
			(.139)	(.143)
R^2	.111	.117	.137	.139
ΔR^2		.006	.026	.002

*$p \leq .05$; **$p \leq .01$. Standard errors are in parentheses [a] N = 172

ONLINE SUPPLEMENTAL APPENDIX 1: DEVELOPMENT OF ITEMS ON VIEWS ON ORGANIZATIONAL RESPONSES TO TENSIONS

Our development of items followed standard practices for CCT research (Weller, 2007). We asked respondents to rate each of the 25 items on how they contributed to the organization's innovativeness. We chose ratings on innovativeness because "innovation" was considered to be the primary organizational-level outcome of interest for members of the institute, as revealed in our qualitative results and supported by prior research on science organizations (e.g., Simpson and Powell, 1999; Grigoriou and Rothaermel, 2014). Moreover, it was a concept that was sufficiently concrete to warrant a general agreed-upon meaning, but sufficiently socially constructed and abstract (Harrisson and Laberge, 2002), which allows variance in its precise meaning (Keller & Loewenstein, 2011).

The 25 items were divided into three sections. The first section asked respondents to rate the minimum and maximum proportion of time an institute should spend on each of the following activities in order to foster innovation: 1) potential breakthrough vs. incremental research, 2) high risk vs. low risk research, 3) conducting research internally vs. relying on external research, and 4) conducting research vs. servicing industry. The second section asked respondents the minimum and maximum proportion of an individual's KPIs that should be allocated to each of the following criteria in order to foster innovation: 1) academic papers, 2) patents, 3) immediate revenue earned for a project, 4) feedback from industry on service to industry, and 5) individual vs. team performance.

The first two sections asked respondents to select a minimum and maximum number between 0 and 100. This enabled each respondent to choose to emphasize both poles instead of being forced to choose one over the other. For example, if one respondent selects 20%-30% and another respondent selects 20-50% as the ideal time the organization spent time on

high risk vs. low risk research, the two respondents would agree on the necessary proportion of time devoted to high risk research (i.e., 20%), but disagree on the proportion of time devoted to low risk research (i.e., 70% or 50%). We then measured the grand mean for the sample for the minimum and maximum numbers (respectively) across all items (0–100) and coded the score as "1" if the respondent's score on a particular activity or performance criterion was above the grand mean and "–1" if below the grand mean. The third section was a set of seven multiple choice questions about the team composition and member selection procedures that foster innovation, including team diversity (two items), disciplinary depth vs. breadth (one item) and functional depth vs. breadth (one item) of team members, the frequency of team rotation (two items) and consistency of KPIs across teams (one item). Items selected received a "1" score and not selected received a "-1" score.

ONLINE SUPPLEMENTAL APPENDIX 2: CODING OF CONTROL VARIABLES

We included nine control variables in our regression analyses. Disciplinary background w measured using two dummy variables (science and management, with engineering as the reference category). Respondents indicated their rank according to six levels (6 = senior management; 5 = directors of R&D; 4 = deputy directors of R&D; 3 = senior R&D; 2 = junior R&D; 1 = assistants); and occupational identity according to their dominant affiliation to basic or applied science (basic science identity is a dummy variable, with applied science identity as the reference category). We controlled for education level, as 63% of the respondents had PhDs and those who spent longer time in a discipline were more likely to develop discipline-specific views. We controlled for performance (based on supervisor ratings), as low performing employees are less likely to pay attention to the organizational activities, systems and structures necessary for them to perform well. In addition, we included instrumental network size (advice outdegree centrality) and expressive network size (friendship outdegree centrality) as network-related controls since the number of colleagues that individuals turn to for advice or friendship

respectively impacts their exposure to information or viewpoints. In addition, since individuals' experience in their respective professions may further cement their professional beliefs, we controlled for professional tenure, which is in years. Moreover, because individuals' likelihood of integrating multiple perspectives into their views on organizing paradoxes can also depend on their general openness to alternative viewpoints (Miron-Spektor et al., 2018), we also controlled for Need for Cognitive Closure (α = .93; Webster and Kruglanski, 1994).