Exploring the antecedents of organizational resilience practices – A transactive memory systems approach

Diogo Cotta
Department of Marketing and Supply Chain Management, Maastricht University, Maastricht, Netherlands, and
Fabrizio Salvador
IE Business School, IE University, Madrid, Spain

Received 31 December 2019
Revised 23 May 2020
Accepted 26 May 2020

Abstract

Purpose – The purpose of this paper was to explore individual- and firm-level antecedents of the ability of a manufacturing firm's personnel to collaborate and integrate knowledge for organizational resilience practices.
Design/methodology/approach – The authors apply hierarchical regression analysis to study a sample of 192 European industrial equipment manufacturers. Data for each firm are collected from surveys of two key informants in each firm, as well as from public sources.
Findings – Firms' personnel's ability to integrate information and knowledge for organizational resilience practices was positively related with the extent of the head of manufacturing's network of personal contacts inside the firm. This effect was stronger in firms with more formalized job descriptions and clearly defined roles. The head of manufacturing's orientation to teamwork and cooperation impacted this ability only in firms that did not financially incentivize cooperation. The authors also found that cooperation incentives and role formalization directly relate to firms' personnel's ability to integrate information and knowledge for organizational resilience practices.
Originality/value – The study proposes to study organizational resilience practices through a transactive memory systems lens. The study is also the first to link characteristics of individual managers to firm-level resilience practices by examining the antecedents of firms' ability to integrate information and knowledge to recover from operational disruptions. Furthermore, the study serves to enhance the knowledge of resilience practices by examining the role of firm-level antecedents and their interplay with characteristics of individual managers.

Keywords Organizational resilience, Manufacturing managers, Transactive memory systems, Regression analysis
Paper type Research paper

1. Introduction

Every manufacturing firm has to contend with unforeseen operational disruptions (Shewart, 1931; Perrow, 2011). Suppliers deliver components late or with quality defects. Customers ask for modifications in product requirements midway through the development process. Machine breakdowns interrupt production flows. Incorrect engineering specifications generate manufacturability failures. Conformance problems only reveal themselves during final assembly. In response to the occurrence of such operational disruptions, manufacturers

This work has been funded by the ManEtei Project of the European Commission (PITN-GA-2009-238382). The authors wish to thank Stefano Chiozzotto for invaluable assistance in data collection. We would also like to acknowledge the very helpful insights of two anonymous reviewers.

are forced to adjust their original order-fulfillment plans, which negatively impacts their delivery reliability (Tenhiala and Salvador, 2014; Tenhiala *et al.*, 2018) and financial performance (Hendricks *et al.*, 2005). In order to minimize the impact of having to adjust original order-fulfillment plans, manufacturers deploy organizational resilience practices (Craighead *et al.*, 2007; Tenhiala and Salvador, 2014; Polyviou *et al.*, 2019; Scholten *et al.*, 2019). We define organizational resilience practices as efforts that manufacturers make to amend order-fulfillment plans in reaction to operational disruptions. The effectiveness of resilience practices benefits from the possession of redundant (Sheffi and Rice, 2005) and flexible resources (Anand and Ward, 2004), such as safety inventory, duplicated supply sources, or multipurpose labor and machinery. However, collaboration and knowledge integration are often essential to the deployment of these and other relevant resources (Kogut and Zander, 1992; Grant, 1996; Brandon and Hollingshead, 2004). By accessing organizationally dispersed information and knowledge resources and integrating them towards the amendment of original plans, organizations become better able to cope with unforeseen operational disruptions (Tenhiala and Salvador, 2014; Scholten and Schilder, 2015; Ambulkar *et al.*, 2015; Revilla and Saenz, 2017; Tenhiala *et al.*, 2018; Polyviou *et al.*, 2019; Scholten *et al.*, 2019).

Despite heightened interest in resilience, little is known about what people do when they engage in organizational resilience practices, and, specifically, how managers' individual characteristics, as well as organizational factors, can actually affect the level of this engagement. With this paper, we conceptualize the amendment of original order-fulfillment plans triggered by operational disruptions as a knowledge-intensive task that requires the contribution of different domain experts – a phenomenon that has been studied by transactive memory systems theory in the organizational behavior field (Moreland *et al.*, 1996; Brandon and Hollingshead, 2004; Nevo and Wand, 2005). This conceptualization enables us to advance the study of resilience antecedents. Transactive memory systems research demonstrated that collectives of specialists are better at addressing complex problems when individuals (1) are mutually aware of their expertise domain, (2) deem such expertise as credible and (3) are able to coordinate expertise retrieval efforts (Hollingshead, 1998; Faraj and Sproull, 2000; Austin, 2003; Ren *et al.*, 2006; Miller *et al.*, 2012, 2014). Building on information and knowledge sharing literature, we investigate possible antecedents of organizational resilience practices, both at the individual and at the organizational levels. We do so by studying antecedents to interpersonal engagement in transactive memory systems for the amendment of original order-fulfillment plans. We inquire the characteristics of firms and of manufacturing managers that render more likely the engagement of dispersed organizational specialists in such organizational resilience practices. We expect that manufacturing managers can influence engagement in these resilience practices to the extent that they control a broad network of personal relations within the organization and that they stress collaboration and cooperation in performing business activities and in making business decisions (Hult and Nichols, 1999). We also expect that organizational factors, such as the presence of incentives for cooperation as well as the definition of formal roles, favor the development of transactive memory systems for organizational resilience practices.

We test our hypotheses using survey and archival data from 192 industrial equipment manufacturers in Europe. We rely on information from the head of manufacturing to capture the extent to which each firm is able to deploy organizational resilience practices, and on data from the head of human resources to capture information on the hypothesized antecedents at the level of the head of manufacturing and at the organizational level. We complement this information with firm-level controls collected through secondary data sources. We find that not all hypothesized antecedents have a main effect on the engagement in organizational resilience practices, but that their interaction does. As a whole, the results of the study enhance our understanding of the practices that individuals enact to respond to the occurrence of adverse events that hinder the execution of original order-fulfillment plans. We shed light on the antecedents of these practices, highlighting the existence of an interplay between individual and organizational factors. In this regard, our paper contributes to a growing stream of literature that investigates the influence of interpersonal relationships and interactions on resilience practices and capabilities (Ambulkar *et al.*, 2016; Durach and Machuca, 2018; Polyviou *et al.*, 2019). It also contributes to our understanding of the role of social capital in resilient performance (Durach and Machuca, 2018; Fan and Stevenson, 2019; Polyviou *et al.*, 2019) by evidencing that the level of manufacturing managers' social capital influences individual engagement in organizational resilience practices. Finally, from a practical standpoint, our paper suggests which characteristics of manufacturing managers' firms should foster to support the deployment organizational resilience practices and under which organizational-level conditions are these characteristics effective.

The rest of the article proceeds as follows. First, we succinctly review organizational resilience and transactive memory systems literature. Then, building on information sharing and knowledge integration literature, we articulate six hypotheses about antecedents to the development of transactive memory systems towards disruption recovery activities. Afterward, we present the data collection procedure together with the measures used in the study. Finally, we report on the findings from the statistical analysis and articulate the implications of the study for organizational resilience research and practice.

2. Literature review and hypotheses

2.1 Organizational resilience practices as transactive memory systems

Every manufacturing firm is vulnerable to operational disruptions that hinder the execution of original order-fulfillment plans. In order to maintain continuity of operations and achieve adequate customer service levels, manufacturing firms must be resilient to the occurrence of disruptions (Ambulkar *et al.*, 2015; Parker and Ameen, 2018; Ponomarov and Holcomb, 2009). We define organizational resilience practices as the set of actions that manufacturers engage in when original plans cannot be executed and require amendment in reaction to operational disruptions. These practices are the basic constitutive elements of manufacturers' resilience capability to mitigate the damaging impact of disruptions (Birkie *et al.*, 2017; Dabhilkar *et al.*, 2016).

Several studies have identified that maintaining operational redundancies and developing flexible processes are key enablers of resilience practices. Maintaining redundancies such as safety stock (Hendricks *et al.*, 2009), slack capacity (Chopra and Sodhi, 2004; Pettit *et al.*, 2013) or backup suppliers (Colicchia *et al.*, 2010) empowers manufacturers to react to changes in customer requests, to adjust to machine breakdowns and other production disturbances or to quickly recover from supplier delivery and quality failures. By maintaining redundancies, manufacturers can adjust their original plans by calling on reserves if the order-fulfillment process is disrupted. In turn, developing flexible processes grounded in a multipurpose production infrastructure (Anand and Ward, 2004), in adjustable contracting with customers, staff, and suppliers (Tang and Tomlin, 2008), or in versatile distribution channels (Tang, 2006), facilitates smooth adaptation of plans that are no longer adequate to new order-fulfillment requirements. However, redundancies and process flexibility are expensive and typically imply a considerable degree of leverage over supply chain partners (Sheffi and Rice, 2005).

Other studies have highlighted specifically the criticality of collaboration and knowledge routines for the effectiveness of resilience practices (MacDuffie, 1997; Hoopes and Postrel, 1999; Hoopes, 2001; Rauniar *et al.*, 2008; Koufteros *et al.*, 2010; Scholten and Schilder, 2015; Tenhiala and Salvador, 2014; Tenhiala *et al.*, 2018; Polyviou *et al.*, 2019; Scholten *et al.*, 2019). From this perspective, adjusting original order-fulfillment plans following operational disruptions benefits from the integration of information and knowledge resources dispersed within the firm. In the event of operational disruptions such as manufacturability failures, part shortages or customer change orders, integrating information and knowledge from different internal functions enables production planners and other relevant decision-makers to consider market, engineering, sourcing and production parameters when adjusting original plans. Thus, the compilation and the integration of information and knowledge embedded in specialists from different functions render the development and implementation of adequate amendments more likely by clarifying the disruption's implications and facilitating the development of effective countermeasures that do not affect the fulfillment of other in-process orders. Resilience practices that result from interactions and relationships among organizational actors have been discussed as underexploited (Gunasekaran *et al.*, 2011; Lengnick-Hall *et al.*, 2011), yet there is empirical evidence of their effectiveness (Durach and Machuca, 2018; Polyviou *et al.*, 2019). What we are still missing is an understanding of which individual and organizational characteristics influence collective engagement in this kind of organizational resilience practices.

As little is currently known about which factors stimulate the development of resilience practices rooted in information sharing and knowledge integration in manufacturing firms, the present study seeks to bridge that gap by employing a transactive memory theory lens. Transactive memory systems theory has been widely used by organizational psychologists and teamwork researchers to explore how groups of individual specialists can effectively share information and integrate knowledge to address a common task. The theory builds on the observation that as individuals interact, they often acquire knowledge about the expertise of others– for example, Mary is good at calculus, or John knows everyone's birthday. This knowledge is called *transactive memory* (Wegner, 1987); a group is said to interact through a transactive memory system if members can recurrently procure and integrate each other's specialized expertise through ad hoc communication while pursuing a collective task (Wegner, 1987; Wegner *et al.*, 1991). In this sense, a transactive memory system comprises specialized information and knowledge of each group member and a shared awareness of who is specialized in what. Such systems also include codification processes that ensure that new information entering the group will be stored by the appropriate specialist, along with retrieval processes that enable individual members to readily access relevant information available within the group (Lewis, 2003; Liang *et al.*, 1995).

Employing a transactive memory systems lens allows us to study resilience practices as emergent from the interactions and relationships among dispersed organizational specialists. This lens has been applied to the investigation of social units engaged in knowledge-intensive tasks, such as software development (Faraj and Sproull, 2000), consulting projects (Lewis, 2004) or strategic decision-making (Heavey and Simsek, 2017). Conceptually, the development and implementation of amendments to original order-fulfillment plans in reaction to disruptions is a knowledge-intensive task, which renders this an adequate lens to investigate organizational resilience practices. A transactive memory systems lens enables us to examine antecedents of organizational resilience practices that connect dispersed specialists based on their shared awareness of who is specialized in what disruption-relevant expertise. Specifically, this lens suggests approaching this inquiry through the determinants of individual information sharing and integration behaviors in organizational settings.

Transactive memory systems literature evidences that collectives that interact through transactive memory systems achieve higher levels of performance in complex tasks (Hollingshead, 1998; Faraj and Sproull, 2000; Austin, 2003; Agkun *et al.*, 2005; Reagans *et al.*, 2005; Ren *et al.*, 2006). In the present study, we contend that manufacturers that develop a transactive memory system to amend order-fulfillment plans are more resilient to operational disruptions. The main thrust of our inquiry is to investigate factors that influence this development. Predictably, as the performance benefits of transactive memory systems have been well documented, empirical studies have turned to exploring their causal underpinnings. Existing research has identified three main antecedents to the emergence of transactive memory systems in groups: member familiarity (Lewis, 2004; Akgun *et al.*, 2005; He *et al.*, 2007), member communication frequency (Hollingshead and Brandon, 2003;

Palazzolo *et al.*, 2006; Kanawattanachai and Yoo, 2007) and member reciprocal interdependence (Brandon and Hollingshead, 2004; Zhang *et al.*, 2007). While these studies offer important insights, these relate predominantly to contextual aspects directly inherent in group membership. Furthermore, most of these studies have been conducted in settings of small teams formally designed to pursue well-defined tasks. Hence, knowledge of what drives multiple organizational actors to interact with each other in transactive memory systems remains incipient (Anand *et al.*, 1998; Moreland and Argote, 2003; Peltokorpi, 2012). In particular, little is known about what manufacturers can do to engage dispersed organizational specialists in a transactive memory system for organizational resilience practices. Drawing on individual information and knowledge sharing literature, we derived hypotheses regarding the motivation and ability of organizational specialists to interact through a transactive memory system in amending order-fulfillment plans.

2.2 Individual-level antecedents of organizational resilience practices

Even though our understanding of organizational transactive memory systems is in its infancy, several studies have examined the antecedents of information sharing and knowledge integration behaviors in organizational settings (e.g. Argote *et al.*, 2003; Siemsen *et al.*, 2008). The development of organizational transactive memory systems largely depends on individuals sharing information that increasingly reveals their respective areas of specialization and then integrating that information in designing knowledge-based responses to operational incidents. To explain how co-workers provide, elicit and compile knowledge, information sharing and knowledge integration literature takes account of the factors underpinning their ability to do so, their motivation to do so and opportunities afforded by contextual features beyond their control. Adopting this logic, we propose that the development of a transactive memory system to implement amended order-fulfillment plans is a function of factors that influence organizational actors' *ability* and *motivation* to procure relevant information from internal specialists and to integrate that specialized knowledge following the *opportunity* afforded by the occurrence of an operational disruption. Motivation to engage in disruption-related information sharing and knowledge integration refers to an individual's willingness to communicate with co-workers in the context of disruption management activities (Borgatti and Cross, 2003; Boudreau *et al.*, 2003). The ability to engage in disruption-related information sharing and knowledge integration refers to co-workers' capacity to transfer or receive relevant knowledge (Rothschild, 1999).

The present study focuses on the impact of heads of manufacturing (i.e. individuals running a production or manufacturing department) on the motivation and ability of dispersed organizational specialists to interact as a transactive memory system in amending order-fulfillment plans. There is evidence that leaders play an important role in encouraging the cooperative behaviors necessary for information sharing and knowledge integration (Zaccaro *et al.*, 2002; Day *et al.*, 2004; Srivastava *et al.*, 2006; Sarin and O'Connor, 2009; Zhang *et al.*, 2011). Here, we look specifically at the position of the departmental head because social network analyses suggest that these individuals facilitate formal and informal interactions among disparate organizational actors (Ambrecht *et al.*, 2001; Garner, 2006; Jackson, 2012). Furthermore, transactive memory systems literature suggests that individuals in leadership positions may act as catalysts in the development and functioning of transactive memory systems in contexts beyond those of small teams (Mell *et al.*, 2014; Walsh and Ungson, 1991). We focus specifically on the head of manufacturing position because it occupies a pivotal role in manufacturing firms, with close ties to procurement, engineering and sales. Moreover, most adjustments to original plans are triggered by disruptions in production-related activities. As a result, heads of manufacturing not only have frequent opportunities to connect to disparate organizational specialists but also play a crucial role in assessing the implications of operational disruptions and setting in motion efforts to address them.

Regarding motivation, we examined the extent to which the head of manufacturing's teamwork orientation influences the engagement of organizational specialists in information sharing and knowledge integration behaviors, where teamwork orientation reflects an individual's propensity for stressing collaboration and cooperation for the performance of organizational activities and decision-making (Eby and Dobbins, 1997). Heads of manufacturing with high teamwork orientation value collective rather than discrete gains (Moorman and Blakely, 1995) and are more motivated by shared rather than individual goals (Wilmot and Hocker, 2001). We anticipated that heads of manufacturing with high teamwork orientation would stimulate and inspire organizational specialists to procure and integrate information in amending order-fulfillment plans (Peltokorpi and Manka, 2008; Nevo *et al.*, 2012), and that they would promote the advantages of collaborative problem solving and arbitrate any conflicts arising during disruption recovery activities. We further anticipated that this type of manager would be able to curtail the opportunistic individual behaviors that often hamper collective action (Williamson, 1991; Sitkin, 1992; Agkun *et al.*, 2005; Rau, 2006; Koufteros *et al.*, 2010; Hood *et al.*, 2014), instead promoting a culture of interpersonal cooperation. In this way, heads of manufacturing with a high teamwork orientation could motivate co-workers to interact through a transactive memory system when engaged in organizational resilience practices.

H1. A higher level of head of manufacturing teamwork orientation is associated with a more developed organizational transactive memory system for the amendment of order-fulfillment plans.

In terms of ability, we investigated whether a head of manufacturing's level of organizational connectedness influences the extent to which manufacturers deploy a transactive memory system as organizational resilience practice. Organizational connectedness refers to managers' network of personal contacts inside the organization, regardless of hierarchical position or departmental affiliation (Jaworski and Kohli, 1993). It refers both to the size of the network, in terms of total number of contacts, and to its density, in terms of number of contacts relative to all possible contacts one could have. In this sense, highly connected individuals not only have a lot of contacts but also know most people in the firm. Thus, highly connected individuals will have repeated opportunities to develop transactive memory about the expertise domain of dispersed organizational actors (Jansen *et al.*, 2006, 2009). Highly connected individuals are also better able to retrieve requisite information and knowledge resources from organizational actors with differing expertise and multiple functional membership (Galbraith, 1973; Hansen, 2005; Tsai, 2002). These two characteristics enable highly connected heads of manufacturing to act as intermediaries between information seekers and providers when adjusting original order-fulfillment plans. Highly connected heads of manufacturing also engender intimacy and trust among dispersed organizational specialists (Rindfleisch and Moorman, 2001; Adler and Kwon, 2002), so reducing the occurrence of interpersonal conflicts when resilience practices are being deployed. For these reasons, we would expect highly connected heads of manufacturing to strengthen the ability of individual organizational specialists to access and share functionally dispersed information and to integrate their specialized knowledge for joint amendment of plans. This ability underpins the development of a collective transactive memory system for organizational resilience practices.

H2. A higher level of head of manufacturing organizational connectedness is associated with a more developed organizational transactive memory system for the amendment of order-fulfillment plans.

2.3 Firm-level antecedents of organizational resilience practices

Conveying information about one's expertise and making it available upon request involves costs that must be outweighed by expected benefits (Argote *et al.*, 2003; Borgati and Cross, 2003; Alewell and Martin, 2006). In fact, the motivation to cooperate within organizations can be hindered by a combination of knowledge hoarding (Gilmour, 2003), inter-functional rivalry (Maltz and Kohli, 1996; Ruyter and Wetzels, 2000) and lack of perceived interdependence (McCann and Ferry, 1979; Tjosvold, 1986). Specifically, knowledge sharing behaviors are less likely in the absence of financial (Menon and Pfeffer, 2003) or social (Hargadon and Sutton, 1997; Uzzi, 1997) rewards. Organizational actors require incentives to counteract these tendencies and act in a cooperative manner (Siemsen *et al.*, 2007; Wageman and Baker, 1997). Furthermore, the need to engage in organizational resilience practices following the occurrence of operational disruptions puts organizational specialists under pressure, which may restrict information search (Staw *et al.*, 1981), information sharing (Moser, 1988) and willingness to interact with others (Cohen, 1980). We expect that manufacturers able to reward cooperative behaviors are more likely to have organizational specialists sharing information and integrating knowledge for the purposes of plan amendment. Thus, we define cooperation incentives as the extent to which individual rewards and compensation are tied to firm performance. We expect that the extent to which manufacturers employ compensation systems that reward overall goal attainment over individual or departmental targets has a positive influence on the motivation of organizational actors to interact through a transactive memory system during disruption recovery activities. By designing reward structures that incentivize cooperation, firms engender perceptions of interdependence among organizational actors (Dovidio and Morris, 1975; Batson *et al.*, 1979). If individuals are compensated by how well the organization performs, they are more likely to look for and to offer advice during disruption recovery activities. In particular, we expect the existence of cooperation incentives to have a positive influence on the motivation of organizational specialists to interact through a transactive memory system for organizational resilience practices.

H3. A higher level of cooperation incentives is associated with a more developed organizational transactive memory system for the amendment of order-fulfillment plans.

In groups with few individual members, it is relatively easy to match expertise domains with specific individuals. In larger groups, such as organizations, there are many experts to keep in mind and much of their expertise is highly differentiated. In this sense, it is difficult to establish who is an expert in what (Anand *et al.*, 1998; Nevo *et al.*, 2012) – a difficulty that likely intensifies under the time pressures created by the occurrence of disruptions (Majchrzak and Jarvenpaa, 2007). In order to overcome this difficulty, organizations can foster role identification practices – interpersonal interactions focused on establishing individual roles and skills – to enable organizational actors to share information about their specialized expertise and to learn about the specialized expertise of others (Kozlowski *et al.*, 1999; Pearsal *et al.*, 2010). One of these practices is role formalization. Role formalization refers to the extent to which formal role definitions, job descriptions and organizational charts assign specific responsibilities to specific individuals within the organization. More detailed and codified job titles, descriptions and organizational charts boost the ability of dispersed organizational actors to mutually identify what sort of expertise they possess (Lewis *et al.*, 2005; Bechky, 2006). Hence, we expect that the engagement in resilience practices rooted in information sharing and knowledge integration would benefit from high levels of role formalization. The ability to identify co-workers as "Quality Assurance Technician 3," "HGV Driver cat-2," "Energy Specialist" or an account manager for a particular geographical region, for example, clarifies who can be expected to possess knowledge on what and what their usefulness might be in the context of particular disruptions. Because role formalization enhances clarity regarding everyone's responsibilities and capabilities, it enables dispersed specialists to construct a mental map of expertise distribution, which can be activated every time access to disruption-relevant information is required. Hence, role formalization fosters the ability of organizational specialists to interact through a transactive memory system for organizational resilience practices.

H4. A higher level of role formalization is associated with a more developed organizational transactive memory system for the amendment of order-fulfillment plans.

2.4 Interplay of individual- and firm-level antecedents of organizational resilience practices

In examining individual- and firm-level antecedents of organizational resilience practices separately, interaction effects should not be overlooked. For example, compensation policies or role formalization may affect the sphere of influence and effectiveness of individual managers (Felin *et al.*, 2015). Hence, we propose that the impact of head of manufacturing's teamwork orientation and organizational connectedness is contingent on the level of cooperation incentives and role formalization, respectively.

We would expect that the relationship between head of manufacturing teamwork orientation and the extent to which organizational actors interact through a transactive memory system is partially dependent on the extent to which manufacturers' compensation systems reward overall goal attainment. The success with which heads of manufacturing can advocate for the benefits of teamwork and inspire organizational specialists to procure and exchange information for organizational resilience practices is more likely in the presence of compensation systems that incentivize cooperation and privilege overall goal attainment. Moreover, the curtailment of opportunistic individual behaviors and the arbitration of potential interpersonal conflicts are less complicated if compensation is tied to firm performance. Specifically, we would expect that the effectiveness with which heads of manufacturing motivate colleagues to share information and integrate knowledge is strengthened by reward structures that induce interdependence and a sense of shared purpose within the organization.

H5. Cooperation incentives moderate the relationship between head of manufacturing teamwork orientation and level of development of organizational transactive memory systems for amending plans, such that the relationship is strengthened by greater cooperation incentives.

We also would expect that the extent to which manufacturers formalize internal roles will impact the relationship between head of manufacturing organizational connectedness and the extent to which organizational specialists interact through a transactive memory system for organizational resilience practices. The ability of highly connected heads of manufacturing to develop transactive memory about the expertise domain of dispersed organizational specialists and to efficiently retrieve disruption-relevant information is amplified in the presence of a mental map of everyone's responsibilities and capabilities. Specifically, we would expect that the head of manufacturing's ability to use a network of personal contacts to facilitate information seekers and providers in amending plans will be strengthened if job positions are well defined and roles can be quickly identified on the organizational chart.

H6. Role formalization moderates the relationship between head of manufacturing organizational connectedness and the level of development of organizational transactive memory systems for amending plans, such that the relationship is strengthened by a higher level of role formalization.

Figure 1 presents a graphical depiction of our research model.

3. Methods

3.1 Sample and data collection

We tested our model on a cross-sectional sample of European industrial equipment manufacturers. This is a disruption-prone setting (Anders *et al.*, 2011; Salvador *et al.*, 2014), making it an ideal context for studying organizational resilience practices. We collected secondary information from medium-sized manufacturers in Spain and Italy, with primary two-digit SIC codes 34, 35 and 36 and secondary code 35. Italy is Europe's second largest producer of industrial equipment, and Spain is the fifth largest. According to Eurostat data, these two countries together account for 25% of overall European output in the industry and for 20% of total employment. We focused on medium-sized firms, because even though they are a critical part of several major economies, there is a shortage of studies examining resilience practices in these contexts (Polyviou *et al.*, 2019). Furthermore, small firms tend to face very specific operational challenges, have very fluid functional configurations and experience more employee turnover, whereas large firms are too functionally and geographically distributed. We considered these characteristics undesirable to engage in the first study of the antecedents of resilience practices based on interactions and relationships among organizational actors. Thus, in accordance with the European Union definition (European Commission, 2015), we limited the sample to manufacturers having between 50 and 250 employees. Table 1 breaks down the sample's demographic profile.

Using the Orbis database, we identified 687 firms in Spain and 667 in Italy. Primary data were collected from four surveys sent to each of the 1,354 firms, customized for the heads of sales, design/engineering, manufacturing and human resources. We received complete responses (i.e. four completed surveys) from 60 companies in Italy and from 132 in Spain, totaling 768 individual respondents. The response rates (9% and 19%, respectively) were typical of survey response rates in the field of operations and supply chain management

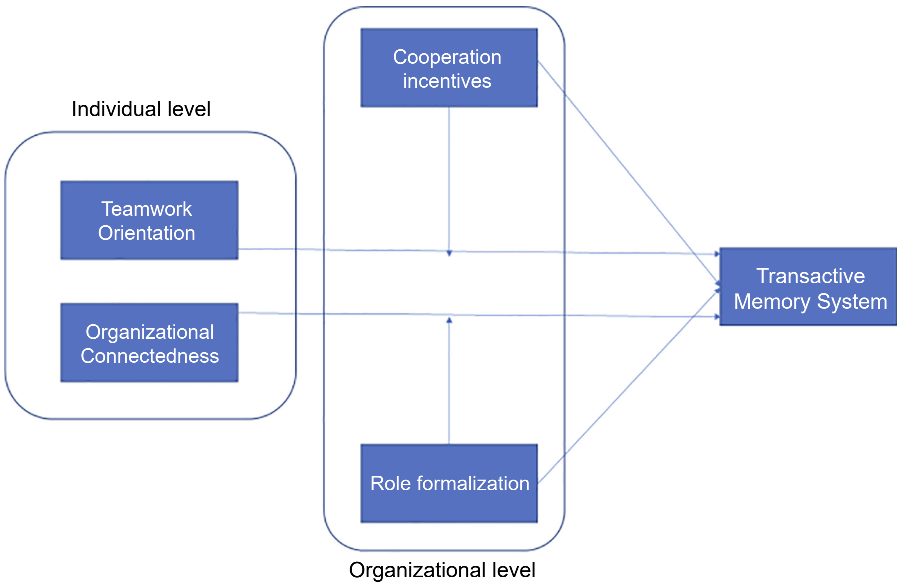

Figure 1.
Research model

Table 1.
Sample

SIC code	Spain	Italy	Total	Sales (M of EUR)	Spain	Italy		Employees	Spain	Italy	Total
(34) Fabricated metal products	48	5	*53*	<10	39	15	*54*	50–99	72	30	*102*
(35) Industrial and commercial machinery	32	54	*86*	10–19.9	44	17	*61*	100–149	40	19	*59*
(36) Electronic and other electric equipment	21	1	*22*	20–30	27	8	*35*	150–199	18	5	*23*
35 as secondary code*	31	0	*31*	>30	22	20	*42*	200–250	2	6	*8*
Total	*132*	*60*	*192*		*132*	*60*	*192*		*132*	*60*	*192*

Note(s): *This category excludes firms that have 34 and 36 as their primary SIC code (e.g. Braunscheidel and Suresh, 2009; Kristal *et al.*, 2010). The variables examined in the present study are based on data provided by the heads of manufacturing and by the heads of human resources of the 192 firms that compose our sample.

3.2 Non-response bias and common method variance

Non-response bias. We investigated the extent of non-response bias in three ways. First, we contacted all 1, 354 firms and inquired all firms about reasons for non-participation; we learned that the main issue was lack of time. Second, we compared the demographics and financial performance of participating and non-participating firms. Independent sample *t*-tests failed to detect significant differences between the two populations in terms of number of employees ($p = 0.23$), profits ($p = 0.59$) and operating revenues ($p = 0.19$). Finally, on comparing responses from early and late respondents (Armstrong and Overton, 1977), these *t*-tests also failed to reveal any statistically significant differences ($p > 0.10$) between the two groups, reducing concerns about non-response bias.

Common method variance (CMV). Following Podsakoff *et al.* (2003), we implemented procedural remedies for CMV by distributing dependent and independent variables across the two informants. Additionally, we conducted a latent factor test to assess the extent of CMV. This test introduces a structural model that combines all constructs with a latent method factor on which all measurement items load. We then compared the results of this model to one without the method factor. A comparison of the results showed no loss of significance in item loadings due to the presence of the latent method factor, indicating that CMV was not a serious problem (Podsakoff *et al.*, 2003).

3.3 Measures, validity and reliability

Dependent variable. The dependent variable was the extent to which organizational actors interact through a transactive memory system for amendment of order-fulfillment plans (TMS). According to the relevant literature, organizational actors can be said to interact through a transactive memory system if (1) they exhibit mutual awareness of each other's areas of *specialization,* (2) they confer *credibility* on each other's specialized knowledge and (3) they achieve *coordination* in retrieving required information (Liang *et al.*, 1995; Lewis, 2003). We adapted Lewis's (2003) survey instrument to measure the level of development of manufacturers' transactive memory system for the amendment of order-fulfillment plans. This measurement scale has been used in most field research that assesses the development of transactive memory systems (for recent reviews, see Ren and Argote, 2011; Bachrach *et al.*, 2019) and measures the variable of interest as a second-order latent factor reflecting specialization, credibility and coordination. We adapted the scale to reflect our focus on operational disruptions and organizational resilience practices. Furthermore, we adapted the scale to the context of industrial equipment manufacturing and asked informants to consider operational situations in which original manufacturing plans cannot be executed, which covers their most common disruptions. Details of the survey items, loadings and reliability metrics are shown in Table 2; the respondents were heads of manufacturing.

Independent variables. The present study employed four independent variables: two for the effects of head of manufacturing personal characteristics and two for firm-level antecedents. To measure head of manufacturing's teamwork orientation (TO), we adapted items from existing scales. The rationale for combining items from different scales was to address the full content domain of teamwork in organizational contexts. Thus, we adapted two items (TO_1 and TO_2) from Tangpong *et al.* (2010), one item (TO_3) from Zacharia *et al.* (2011) and one item (TO_4) from Kirkman and Shapiro (2000). Organizational connectedness (OC) captures the extent to which heads of manufacturing have personal contact with organizational actors across different departments and hierarchical levels. We operationalized this variable using a four-item scale

Item	Mean	SD	Load	t-value	AVE	CR	Cronbach's α
Teamwork Orientation	3.6	0.53			0.70	0.94	0.72
TO_1- The head of manufacturing enjoys activities that involve a high level of cooperation			0.86	9.47			
TO_2- The heads of manufacturing prefers to work independently more often than in a group[a]			0.94	25.77			
TO_3- The heads of manufacturing regularly identifies opportunities to collaborate with colleagues			0.76	7.32			
TO_4- The heads of manufacturing favors being rewarded for individual rather than organizational performance[a]			0.78	9.02			
Organizational Connectedness	4.1	0.71			0.82	0.95	0.85
OC_1- There are many opportunities for the heads of manufacturing to talk to individuals from all kinds of different organizational units			0.82	8.92			
OC_2- The heads of manufacturing has very frequent contact with people, regardless of rank or position			0.99	36.62			
OC_3- The personal network the heads of manufacturing has throughout the organization can be called "extensive."			0.84	9.23			
OC_4- The heads of manufacturing is very comfortable calling others, regardless of rank, position or organizational unit, when the need arises			0.95	19.17			
Cooperation Incentives	3.8	0.74			0.52	0.86	0.79
CI_1- Individual work goals come directly from the goals of the company			0.66	10.02			
CI_2- Individual work activities in any given day are determined by the company's goals for that day			0.69	10.84			
CI_3- Individuals do very few activities on the job that are not directed to the goals of the company			0.71	5.32			
CI_4- Feedback about how individuals are doing comes primarily from information about how well the entire company is doing			0.80	10.96			
CI_5- Individual performance evaluation is strongly influenced by how well the organization performs			0.79	12.04			
CI_6- Many rewards for individual jobs (e.g. pay, Promotion, etc.) are determined in large part by their contribution as organizational members			0.64	9.5			
Role Formalization	4.1	0.81			0.69	0.87	0.81
RF_1- Formal job descriptions are maintained for occupation groups and job types			0.69	11.12			
RF_2- Reporting relationships are formally defined			0.97	25.84			
RF_3- Lines of authority are specified in formal organizational charts			0.80	14.14			
Task Interdependence	4.1	0.62			0.52	0.84	0.73
TI_1- Employees work closely with one another in doing their work			0.66	8.39			

(*continued*)

Table 2.
Descriptives and measurement properties

Item	Mean	SD	Load	t-value	AVE	CR	Cronbach's α
TI_2- Employees frequently must coordinate their efforts with one another			0.76	11.77			
TI_3- Employee performance is dependent on receiving accurate information from one another			0.66	12.85			
TI_4- The way employees perform their job has a significant impact on one another			0.71	9.29			
TI_5- Employees' work requires them to consult with one another fairly frequently			0.79	14.9			
Transactive Memory System	3.8	0.53			0.66	0.85	0.70
During situations in which the original manufacturing plans cannot be executed (due to technical problems, changes in customer requests, etc.) in your company							
Specialization			0.72	8.89	0.50	0.77	0.70
S_1- The specialized knowledge of several different departments is needed			0.65	10.85			
S_2- Each department has specialized knowledge of some relevant aspect to perform these activities			0.76	12.52			
S_3- Manufacturing personnel has knowledge that no other department has			–	–			
S_4- Different departments are responsible for expertise in different aspects			0.65	7.80			
S_5- Manufacturing personnel know which departments have expertise in specific areas			0.67	6.35			
Credibility			0.91	15.14	0.66	0.85	0.85
CR_1- Manufacturing personnel are comfortable accepting procedural suggestions from other departments			0.71	16.63			
CR_2- Manufacturing personnel trust that other departments' knowledge is credible			0.89	27.27			
CR_3- Manufacturing personnel are confident in relying on the information that other departments bring to discussion			0.83	23.22			
CR_4- When other departments give information, manufacturing personnel double-checks it[a]			–	–			
CR_5- Manufacturing personnel do not have much faith in other departments' expertise[a]			–	–			
Coordination			0.79	9.68	0.52	0.76	0.73
CO_1- People from several areas works together in a well-coordinated fashion			0.87	7.93			
CO_2- People from several areas have very few misunderstandings about what to do			0.64	5.60			
CO_3- People from several areas have to backtrack and start over a lot[a]			–	–			
CO_4- People from several areas accomplish these activities smoothly and efficiently			0.63	6.35			
CO_5- There is much confusion about how to accomplish these activities[a]			–	–			

Note(s): Number of observations: 192; SD = standard deviation; AVE = average variance extracted; CR = composite reliability; a = reverse coded; all items measured on a five-point scale (1 = "strongly disagree" to 5 = "strongly agree")

Table 2.

based on Jansen *et al.* (2006) and Mom *et al.* (2009). OC and TO were both measured on five-point Likert scales. In both cases, the respondents were heads of human resources, because we aimed to circumvent social desirability bias. Given that TO and OC are typically perceived as positive characteristics, asking heads of manufacturing to self-report could generate the desire to project a favorable image toward the research team (Donaldson and Grant-Vallone, 2002; Fisher, 1993).

Regarding the two firm-level variables, we operationalized cooperative incentives (CI) by combining and adapting Campion *et al.*'s (1993) two three-item scales, measuring goal and reward interdependence. Cooperation incentives capture the extent to which individual employees' goals and rewards depend on overall firm performance. This domain content matches Campion's conceptualization of goal interdependence as the extent to which individual goals are dependent on group goals and reward interdependence as the extent to which individual rewards are tied to group performance. The other firm-level variable was role formalization (RF), referring to the extent to which job descriptions and reporting relationships were formally defined. We operationalized this variable using Patel's (2011) three-item scale. Both CI and RF were measured on five-point Likert scales; again, the respondents were heads of human resources.

Control variables. We controlled for task interdependence (TI), understood here as the extent to which individual organizational actors must rely on others to complete their tasks. Greater task interdependence increases the incentive to interact through a transactive memory system and has been identified as one of the main drivers of transactive memory system development (Wegner *et al.*, 1985; Brandon and Hollingshead, 2004; Hollingshead, 2001; Zhang *et al.*, 2007). To measure TI, we used Pearce and Gregersen's (1991) five-item scale to ask heads of human resources about the extent to which the work of three departmental heads (sales, engineering, Mmanufacturing) was dependent on the inputs of others.

Longer tenure means that managers have had more opportunities to develop relationships with colleagues and to learn about who knows what. Moreover, managers with experience of working in multiple departments have had more opportunities to develop relationships across organizational functions. For that reason, we controlled for head of manufacturing's cross-functional experience (CFE) – that is, the extent to which they had worked in other departments – and for tenure (TEN) within the firm. We operationalized CFE by asking these managers to enumerate all departments in which they had worked during their time with the firm. We operationalized TEN by asking how many years they had been active in the organization.

We also controlled for firm age (Age), measured as years since founding. As older firms have had longer to learn from experience (Argote, 1999; Levitt and March, 1988), they are more likely to interact as a transactive memory system. We also controlled for firm size (Size), operationalized as the number of employees active in the firm. Both Age and Size data were retrieved from the Orbis database. Finally, in order to isolate country- and industry-specific effects, we also included dummy variables to account for unobservable heterogeneity due to these factors.

Measurement validation. Confirmatory factor analysis (CFA) was implemented using MPlus (version 6) to assess operationalization measurement properties (see results in Table 1). We used average variance extracted (AVE) and composite reliability statistics to assess reliability (Williams *et al.*, 2003). As all AVE values are equal to or above 0.5, and all composite reliability values are equal to or above 0.7, scale reliability can be considered adequate (Fornell and Larcker, 1981). AVE values also suggest that most of the item variance is accounted for by the constructs, indicating convergent validity; this is further supported by the fact that all are statistically significant (Anderson and Gerbing, 1988). To assess discriminant validity, we compared each construct's AVE values with the squared correlations of the corresponding pairs. The AVE values for all constructs are larger than the squared correlations, providing statistical support for the constructs' discriminant validity (Bagozzi, 1994).

4. Findings

4.1 Analytical approach

Table 3 presents correlations and significance levels. We tested the six hypotheses using hierarchical ordinary least squares regression. For the purpose of testing H5 and H6, we created two interaction terms by multiplying TO with CI (H5) and OC with RF (H6). Visual inspection of the residual plot shows that the variance of the residuals is not constant across the values of the independent variables. For that reason, we estimated the three models using White-Huber estimators to correct for heteroscedasticity. Table 3 presents the results from our analysis. Model 1 introduces the control variables only; model 2 adds the independent variables related to the head of manufacturing's personal characteristics, whereas model 3 adds the firm-level antecedents. Finally, model 4 enters interaction terms. Variance inflation factors for models 1, 2 and 3 are well below 2; model 4 exhibits high variance inflation factors for the interaction terms, but this is not indicative of a multicollinearity problem (Disatnik and Sivan, 2016; McClelland *et al.*, 2017).

4.2 Results

Four control variables exhibit a significant relationship with the dependent variable. As expected, Age and TI had a positive influence on the extent to which organizational actors interact through a transactive memory system for amendment of order-fulfillment plans. However, contrary to our expectation, CFE was negatively related to this dependent variable. In model 2, testing hypotheses 1 and 2, the coefficient for TO was not significant; this means there is no support for H1. As coefficient OC was positive and significant ($\beta_{OC} = 0.16$, $p = 0.03$), H2 is supported. Model 3, which tests hypotheses 3 and 4, shows that the coefficients for the firm-level antecedents, CI and RF, are also significant and of the expected sign. Hence, H3 and H4 are also supported. Model 4 tested the hypothesized interactive effects; as the multiplicative term TOxCI is indeed significant ($p = 0.01$), but not with the predicted sign ($\beta_{ToxCI} = -1.17$), the results suggest a substitutive effect between TO and CI rather than the hypothesized synergistic effect. In this sense, H5 is not supported. Finally, model 3 confirms the interaction effect articulated in H6, but only at the 10% significance level ($p = 0.08$). To assist interpretation, both interaction effects are plotted in Figures 2 and 3.

5. Discussion

Although it is well established that organizational resilience practices are important (Craighead *et al.*, 2007; Hendricks *et al.*, 2009; Tenhiala and Salvador, 2014; Scholten *et al.*, 2019), little is currently known about the drivers that underpin their development and deployment (Wieland and Wallenburg, 2013). Employing a transactive memory systems lens allows us to study antecedents of organizational resilience practices that emerge from the interactions and relationships among dispersed individuals and are based on their shared awareness of who is specialized in what disruption-relevant expertise. We examine the relationship among two personal characteristics of heads of manufacturing, two firm-level attributes and the extent to which dispersed organizational specialists engage in organizational transactive memory systems for the amendment of original order-fulfillment plans. Our contribution to organizational resilience literature indicates that while heads of manufacturing organizational connectedness positively influences the extent to which organizational specialists interact through a transactive memory system during

Table 3.
Correlation table

	1	2	3	4	5	6	7	8	9	10
TO	0.15**									
OC	0.26***	0.42***								
CI	0.45***	0.16**	0.14*							
RF	0.42***	0.11	0.15**	0.53***						
TI	0.28***	0.35***	0.44***	0.28***	0.19***					
CFE	−0.11	−0.06	0.13*	0.02	−0.11	0.05				
TEN	0.03	−0.14*	−0.03	0.07	−0.13*	−0.04	0.27***			
Age	0.23***	0.02	0.08	0.09	−0.02	−0.02	0.02		0.08	
Size	0.01	0.05	−0.11	−0.01	0.14	0.01	−0.05	−0.02	0.03	

Note(s): $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

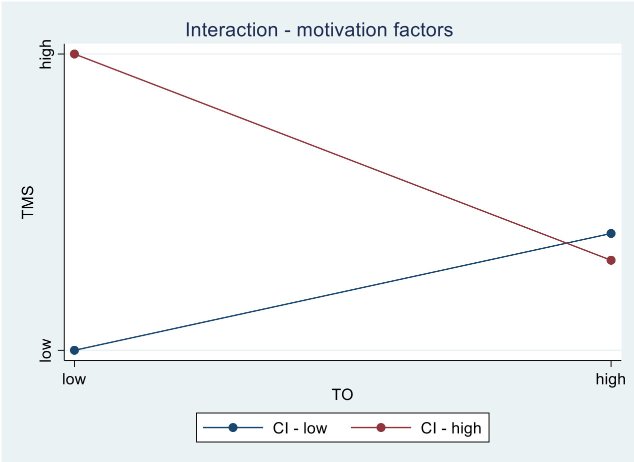

Figure 2.
Interaction between cooperation incentives and teamwork orientation of heads of manufacturing on transactive memory system for amendment of plans

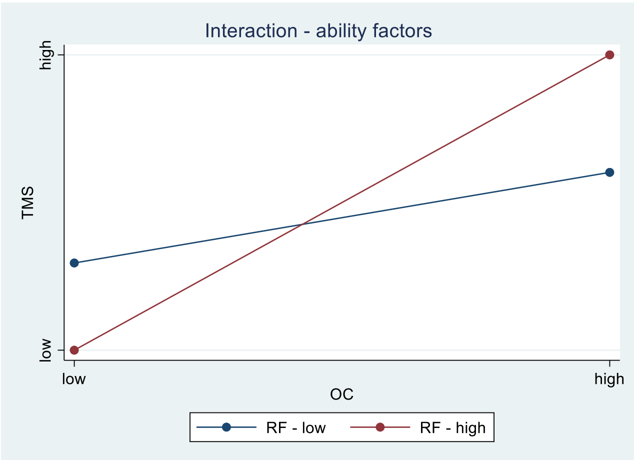

Figure 3.
Interaction between role formalization and organizational connectedness of heads of manufacturing on transactive memory system for amendment of plans

disruption recovery activities, teamwork orientation has no direct influence. Moreover, our findings evidence that the existence of cooperation incentives and role formalization positively relate to organizational transactive memory systems for amendment of plans. Our moderation analysis reveals that teamwork orientation positively and significantly influences the level of development of transactive memory systems only when there are no cooperation incentives in place. The analysis also confirms that organizational connectedness and role formalization have a synergistic effect, although this is only significant at the 10% level.

5.1 Research contributions

Organizational resilience research highlights the relevance of integrating information and expertise from different organizational actors in devising adjustments to original order-fulfillment plans to minimize the impact of operational disruptions on manufacturing firms'

Variables	Model 1	Model 2	Model 3	Model 4
Age	0.21***	0.20***	0.19***	0.20***
Size	0.02	0.04	0.06	0.02
Country	−0.27***	−0.26	−0.16*	−0.13
SIC34	−0.07	−0.06	−0.05	−0.03
SIC36	0.06	0.07	0.08	0.12*
SIC35s	0.02	0.02	−0.01	−0.01
TI	0.32***	0.26***	0.15**	0.16**
CFE	−0.16**	−0.18**	−0.17**	−0.19**
TEN	0.10	0.10	0.08	0.09
TO		−0.03	−0.05	0.72**
OC		0.16**	0.15**	−0.26
CI			0.26***	1.02***
RF			0.15**	−0.31
TO × CI				−1.17**
OC × RF				0.67*
R^2	0.24	0.25	0.36	0.38
F	6.27	5.17	11.61	3.47
ΔR^2		0.01**	0.11***	0.02**

Note(s): DV – Transactive memory system; standardized βs; $*p < 0.10$, $**p < 0.05$, $***p < 0.01$

Table 4.
Results of hierarchical regression analysis (White-Huber estimators)

performance (Hoopes and Postrel, 1999; Rauniar *et al.*, 2008; Koufteros *et al.*, 2010; Tenhiala and Salvador, 2014; Polyviou *et al.*, 2019; Scholten *et al.*, 2019), but understanding of the enablers of such integration remains underdeveloped. There is also a growing recognition that individuals and the interpersonal level play a considerable role in manufacturers' resilience capability (Ambulkar *et al.*, 2016; Durach and Machuca, 2018; Gunasekaran *et al.*, 2011; Lengnick-Hall *et al.*, 2011; Polyviou *et al.*, 2019). However, we still do not know what influences the extent to which dispersed organizational specialists engage in the resilience practices that build such a capability. Our findings contribute to the literature by illuminating the antecedents of individual engagement in collective efforts to amend order-fulfillment plans in reaction to operational disruptions. The primary insight is that individuals in managerial positions can have a strong impact in the development of resilience practices rooted in interpersonal information sharing and knowledge integration. This lends empirical support to the notion that core employees can exert a critical influence on an organization's capacity for resilience (Lengnick-Hall *et al.*, 2011; Linnenluecke, 2017). Furthermore, we complement prior studies that have linked the characteristics of individual managers to individual-level resilience practices (Ambulkar *et al.*, 2016) and the characteristics of direct interpersonal relationships to organizational resilience practices (Polyviou *et al.*, 2019; Durach and Machuca, 2018). Our study links the characteristics of individual managers to organizational resilience practices.

Our findings also evidence that manufacturers can develop their resilience practices through the design of reward schemes that incentivize interpersonal cooperation and through the implementation of formal job descriptions with clear reporting relationships. These results constitute a step toward better understanding of how manufacturers can improve their capability to mitigate the impact of operational disruptions. These are important in that they provide firms with operative policies that may enhance their ability to cope with unforeseen disruptions above and beyond the generic prescriptions of collaboration, agility and visibility put forth by existing resilience literature (Christopher and Peck, 2004; Jüttner and Maklan, 2011; Wieland and Wallenburg, 2013; Scholten *et al.*, 2019). Fundamentally, our findings suggest that, even though transactive memory systems for plan adjustment are ultimately rooted in individual relationships and interpersonal interactions, manufacturers are able to influence the dynamics of those relationships and interactions.

In addition, our findings show that managerial influence on resilience practices does not operate in a void, and that firm policies can affect the relationship between managers' personal characteristics and the development of resilience practices. The unexpected finding that teamwork orientation is significant only for very low levels of cooperation incentives suggests that individual and organization-level motivational factors are substitutive rather than complementary in the context of organizational resilience practices. The economics literature on incentives offers one possible explanation for this finding: that extrinsic incentives often reduce the impact of intrinsic motivation on employee effort (Gneezy and Rustichini, 2000; Frey and Jegen, 2001). In any case, the results confirm that firm capabilities are formed through the interplay between contextual elements of organizational structure and the personal characteristics of individual managers (Salvato and Rerup, 2011; Felin *et al.*, 2012). The fact that role formalization strengthens the influence of the heads of manufacturing's network of contacts on the extent to which organizational actors interact through a transactive memory system for amendment of order-fulfillment plans substantiates this view for the case of resilience capabilities.

Finally, our findings complement recent research on the role of social capital in resilient performance (Durach and Machuca, 2018; Fan and Stevenson, 2019; Polyviou *et al.*, 2019). In particular, we offer quantitative empirical evidence that managerial social capital enhances individual engagement in organizational resilience practices. In this sense, our findings support the extension of organizational resilience research beyond structural remedies involving redundancies and flexibility toward the complexity of interpersonal relationships in networks for information sharing and knowledge integration.

5.2 Practical contributions

Our findings also have some important implications for managerial practice, and especially for manufacturers seeking to improve their ability to cope with unforeseen operational disturbances in disruption-prone environments. The results clearly show that appointing heads of manufacturing who are highly networked within the organization can facilitate the engagement of dispersed specialists in information sharing and knowledge integration practices in reaction to disruptions. This suggests that firms should appoint internal candidates with long firm tenure because they are more likely to have high levels of the necessary firm-specific social capital (Fang *et al.*, 2011). Our results also indicate that this approach can be implemented more effectively by formalizing job roles in organizational charts and other relevant documents. More detailed formal job descriptions and reporting relationships enable heads of manufacturing to link information seekers and providers more effectively.

Our findings also suggest that manufacturers should take note of the substitutive effect of intrinsic and extrinsic motivational factors in relation to information sharing and knowledge integration for resilience practices. If the organization's compensation systems already reward cooperative behavior, there is no reason to appoint heads of manufacturing with high teamwork orientation (and vice versa).

6. Conclusion, limitations and future research opportunities

To minimize the impact of unforeseen operational disruptions on performance, manufacturers need to develop and implement adequate amendments to order-fulfillment plans, ensuring that organizational actors can access and integrate dispersed information and knowledge. This study investigated individual- and firm-level enablers of organizational resilience by examining how the personal characteristics of heads of manufacturing together with two organizational policies influence the extent to which organizational actors interact through transactive memory systems for disruption recovery activities. We found that heads of manufacturing with an extensive network of contacts within the organization can positively influence the development of such systems, and that this effect is stronger in firms with a high level of role formalization. We also found that heads of manufacturing's teamwork orientation influences the development of organizational transactive memory systems only when no formal cooperation incentives are in place. Furthermore, we found that cooperation incentives and role formalization directly impact the development of organizational transactive memory systems for organizational resilience practices.

The study has several limitations. In particular, measurement of organizational transactive memory systems depended on a single informant (heads of manufacturing). While our knowledge of the manufacturing industry supports the use of heads of manufacturing, sampling a range of organizational actors to measure the level of development of transactive memory systems would undoubtedly increase precision. Another limitation of the study is its cross-sectional design, which precludes strict inference of any causal relationship between independent and dependent variables. Additionally, as our sample was restricted to medium-sized firms, small and large firms must be further investigated to ensure generalizability. Large firms are of particular interest because it is reasonable to suppose that interacting through a transactive memory system becomes more difficult as the number of organizational actors increases. Future studies should explore whether our findings are replicable in larger firms.

As the development of organizational transactive memory systems requires the participation of organizational actors dispersed across multiple functions, future research should also investigate the influence of department leaders other than heads of manufacturing. This would significantly advance our understanding of how best to develop disruption recovery practices rooted in information sharing and knowledge integration by clarifying how the personal characteristics of other heads of department contribute to such development. Finally, it seems worthwhile to explore the antecedents of transactive memory systems among different organizations in the same supply chain. The close integration between buyers and suppliers that characterizes much of contemporary manufacturing affords frequent opportunities for interaction among employees of different firms, creating the conditions for the emergence of transactive memory systems. For that reason, future research should examine the extent to which transactive memory systems develop among individuals employed in different firms, along with the underlying drivers of that development.

References

Adler, P.S. and Kwon, S.W. (2002), "Social capital: prospects for a new concept", *Academy of Management Review*, Vol. 27 No. 1, pp. 17-40.

Akgün, A.E., Byrne, J., Keskin, H., Lynn, G.S. and Imamoglu, S.Z. (2005), "Knowledge networks in new product development projects: a transactive memory perspective", *Information and Management*, Vol. 42 No. 8, pp. 1105-1120.

Alewell, D. and Martin, S. (2006), "Transaktionskostenansatz und Personalwirtschaftslehre", *Zeitschrift für Management*, Vol. 1 No. 3, pp. 282-302.

Ambulkar, S., Blackhurst, J.V. and Grawe, S. (2015), "Firm's resilience to supply chain disruptions: scale development and empirical examination", *Journal of Operations Management*, Vol. 33, pp. 111-122.

Ambulkar, S., Blackhurst, J.V. and Cantor, D.E. (2016), "Supply chain risk mitigation competency: an individual-level knowledge-based perspective", *International Journal of Production Research*, Vol. 54 No. 5, pp. 1398-1411.

Anand, G. and Ward, P.T. (2004), "Fit, Flexibility and Performance in manufacturing: coping with dynamic environments", *Production and Operations Management*, Vol. 13 No. 4, pp. 369-385.

Anand, V., Manz, C.C. and Glick, W.H. (1998), "An organizational memory approach to information management", *Academy of Management Review*, Vol. 23 No. 4, pp. 796-809.

Anders, H., Hvam, L. and Mortensen, N.H. (2011), "The impact of product configurators on lead times in engineering-oriented companies", *Artificial Intelligence for Engineering Design, Analysis and Manufacturing*, Vol. 25, pp. 197-206.

Anderson, J.C. and Gerbing, D.W. (1988), "Structural equation modeling in practice: a review and recommended two-step approach", *Psychological Bulletin*, Vol. 103 No. 3, pp. 411-423.

Argote, L. (1999), *Organizational Learning: Creating, Retaining and Transferring Knowledge*, Kluwer, Norwell, MA.

Argote, L., McEvily, B. and Reagans, R. (2003), "Managing Knowledge in Organizations: an integrative framework and review of emerging themes", *Management Science*, Vol. 49 No. 4, pp. 571-582.

Armbrecht, F.M., Chapas, R.B., Chappelow, C.C., Farris, G.F., Friga, P.N., Hartz, C.A. and Whitwell, G.E. (2001), "Knowledge management in research and development", *Research-Technology Management*, Vol. 44 No. 4, pp. 28-48.

Armstrong, J.S. and Overton, T.S. (1977), "Estimating nonresponse bias in mail surveys", *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.

Austin, J.R. (2003), "Transactive memory in organizational groups: the effects of content, consensus, specialization, and accuracy on group performance", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 866-878.

Bachrach, D.G., Lewis, K., Kim, Y., Patel, P.C., Campion, M.C. and Thatcher, S. (2019), "Transactive memory systems in context: A meta-analytic examination of contextual factors in transactive memory systems development and team performance", *Journal of Applied Psychology*, Vol. 104 No. 3, pp. 464-493.

Bagozzi, R.P. (Ed.) (1994), *Principles of Marketing Research*, Blackwell Business.

Batson, C.D., Coke, J.S., Chard, F., Smith, D. and Taliaferro, A. (1979), "Generality of the 'glow of goodwill': effects of mood on helping and information acquisition", *Social Psychology Quarterly*, Vol. 42, pp. 176-179.

Bechky, B.A. (2003), "Sharing Meaning across Occupational Communities: the transformation of understanding on a production floor", *Organization Science*, Vol. 14 No. 3, pp. 312-330.

Birkie, S.E., Trucco, P. and Fernandez Campos, P. (2017), "Effectiveness of resilience capabilities in mitigating disruptions: leveraging on supply chain structural complexity", *Supply Chain Management: An International Journal*, Vol. 22 No. 6, pp. 506-521.

Borgatti, S.P. and Cross, R. (2003), "A relational view of information seeking and learning in social networks", *Management Science*, Vol. 49 No. 4, pp. 432-445.

Boudreau, J., Hopp, W., McClain, J.O. and Thomas, L.J. (2003), "On the interface between operations and human resources management", *Manufacturing and Service Operations Management*, Vol. 5 No. 3, pp. 179-202.

Brandon, D.P. and Hollingshead, A.B. (2004), "Transactive memory systems in organizations: matching tasks, expertise, and people", *Organization Science*, Vol. 15 No. 6, pp. 633-644.

Braunscheidel, M.J. and Suresh, N.C. (2009), "The organizational antecedents of a firm's supply chain agility for risk mitigation and response", *Journal of Operations Management*, Vol. 27, pp. 119-140.

Campion, M.A., Medsker, G.J. and Higgs, A.C. (1993), "Relations between workgroup characteristics and effectiveness: implications for designing effective workgroups", *Personnel Psychology*, Vol. 46, pp. 823-849.

Chopra, S. and Sodhi, M.S. (2004), "Managing risk to avoid supply-chain breakdown", *MIT Sloan Management Review*, Vol. 46 No. 1, p. 53.

Christopher, M. and Peck, H. (2004), "Building the resilient supply chain", *International Journal of Logistics Management*, Vol. 15 No. 2, pp. 1-13.

Cohen, S. (1980), "Aftereffects of stress on human performance and social behavior: a review of research and theory", *Psychological Bulletin*, Vol. 88, pp. 82-108.

Colicchia, C., Dallari, F. and Melacini, M. (2010), "Increasing supply chain resilience in a global sourcing context", *Production Planning and Control*, Vol. 21 No. 7, pp. 680-694.

Craighead, C.W., Blackhurst, Rungtusanatham, M.J. and Handfield, R.B. (2007), "The severity of supply chain disruptions: design characteristics and mitigation capabilities", *Decision Sciences*, Vol. 38 No. 1, pp. 131-156.

Dabhilkar, M., Birkie, S.E. and Kaulio, M. (2016), "Supply-side resilience as practice bundles: a critical incident study", *International Journal of Operations and Production Management*, Vol. 36 No. 8, pp. 948-970.

Day, D.V., Gronn, P. and Salas, E. (2004), "Leadership capacity in teams", *The Leadership Quarterly*, Vol. 15 No. 6, pp. 857-880.

Disatnik, D. and Sivan, L. (2016), "The multicollinearity illusion in moderated regression analysis", *Marketing Letters*, Vol. 27 No. 2, pp. 403-408.

Donaldson, S.I. and Grant-Vallone, E.J. (2002), "Understanding self-report bias in organizational behavior research", *Journal of Business and Psychology*, Vol. 17 No. 2, pp. 245-260.

Dovidio, J.F. and Morris, W.N. (1975), "Effects of stress and commonality of fate on helping behavior", *Journal of Personality and Social Psychology*, Vol. 31 No. 1, pp. 145-161.

Durach, C.F. and Machuca, J.A. (2018), "A matter of perspective–the role of interpersonal relationships in supply chain risk management", *International Journal of Operations and Production Management*, Vol. 38 No. 10, pp. 1866-1887.

Eby, L.T. and Dobbins, G.H. (1997) "Collectivistic orientation in teams: an individual and group-level analysis", *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, Vol. 18 No. 3, pp. 275-295.

European Commission (2015), *User Guide to the SME Definition*, Office for Official Publications of the European Communities, Luxembourg.

Fan, Y. and Stevenson, M. (2019), "Non-linear effects of relational capital on supply-side resilience", *International Journal of Operations and Production Management*, Vol. 39 No. 9, pp. 1053-1075.

Faraj, S. and Sproull, L. (2000), "Coordinating expertise in software development teams", *Management Science*, Vol. 46 No. 12, pp. 1554-1568.

Felin, T. and Zenger, T.R. (2011), "Information aggregation, matching and radical market–hierarchy hybrids: implications for the theory of the firm", *Strategic Organization*, Vol. 9 No. 2, pp. 163-173.

Felin, T., Foss, N.J., Heimeriks, K.H. and Madsen, T.L. (2012), "Microfoundations of routines and capabilities: individuals, processes, and structure", *Journal of Management Studies*, Vol. 49 No. 8, pp. 1351-1374.

Felin, T., Foss, N.J. and Ployhart, R.E. (2015), "The microfoundations movement in strategy and organization theory", *The Academy of Management Annals*, Vol. 9 No. 1, pp. 575-632.

Fisher, R.J. (1993), "Social desirability bias and the validity of indirect questioning", *Journal of Consumer Research*, Vol. 20 No. 2, pp. 303-315.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.

Frey, B.S. and Jegen, R. (2001), "Motivation crowding theory", *Journal of Economic Surveys*, Vol. 15 No. 5, pp. 589-611.

Galbraith, J.R. (1973), *Designing Complex Organizations*, Addison-Wesley Longman Publishing, Boston, MA.

Garner, J.T. (2006), "It's Not what you Know: a transactive memory analysis of knowledge networks at NASA", *Journal of Technical Writing and Communication*, Vol. 36 No. 4, pp. 329-351.

Gilmour, D. (2003), "How to fix knowledge management", *Harvard Business Review*, Vol. 81 No. 10, pp. 16-17.

Gneezy, U. and Rustichini, A. (2000), "Pay enough or don't pay at all", *The Quarterly Journal of Economics*, Vol. 115 No. 3, pp. 791-810.

Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17 No. S2, pp. 109-122.

Gunasekaran, A., Rai, B.K. and Griffin, M. (2011), "Resilience and competitiveness of small and medium size enterprises: an empirical research", *International Journal of Production Research*, Vol. 49 No. 8, pp. 5489-5509.

Hansen, M.T., Mors, M.L. and Løvås, B. (2005), "Knowledge sharing in organizations: multiple networks, multiple phases", *Academy of Management Journal*, Vol. 48 No. 5, pp. 776-793.

Hargadon, A. and Sutton, R.I. (1997), "Technology brokering and innovation in a product development firm", *Administrative Science Quarterly*, Vol. 42, pp. 716-749.

He, J., Butler, B.S. and King, W.R. (2007), "Team cognition: development and evolution in software project teams", *Journal of Management Information Systems*, Vol. 24 No. 2, pp. 261-292.

Heavey, C. and Simsek, Z. (2017), "Distributed cognition in top management teams and organizational ambidexterity: the influence of transactive memory systems", *Journal of Management*, Vol. 43, pp. 919-945.

Hendricks, K.B. and Singhal, V.R. (2005), "An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm", *Production and Operations Management*, Vol. 14 No. 1, pp. 35-52.

Hendricks, K.B., Singhal, V.R. and Zhang, R. (2009), "The effect of operational slack, diversification, and vertical relatedness on the stock market reaction to supply chain disruptions", *Journal of Operations Management*, Vol. 27 No. 3, pp. 233-246.

Hollingshead, A.B. (1998), "Retrieval processes in transactive memory systems", *Journal of Personality and Social Psychology*, Vol. 74 No. 3, pp. 659-671.

Hollingshead, A. (2001), "Cognitive interdependence and convergent expectations in transactive memory", *Journal of Personality and Social Psychology*, Vol. 81 No. 6, pp. 1080-1089.

Hollingshead, A.B. and Brandon, D.P. (2003), "Potential benefits of communication in transactive memory systems", *Human Communication Research*, Vol. 29 No. 4, pp. 607-615.

Hood, A.C., Bacharach, D.G. and Lewis, K. (2014), "Transactive memory systems, conflict, size and performance in teams", *Journal of Leadership, Accountability and Ethics*, Vol. 11 No. 3, pp. 11-24.

Hoopes, D. (2001), "Why are there glitches in product development?", *R&D Management*, Vol. 31 No. 4, pp. 381-390.

Hoopes, D.G. and Postrel, S. (1999), "Shared knowledge 'glitches' and product development performance", *Strategic Management Journal*, Vol. 20, pp. 836-865.

Hult, G. and Nichols, E.L. Jr (1999), "A study of team orientation in global purchasing", *Journal of Business and Industrial Marketing*, Vol. 14 No. 3, pp. 194-212.

Jackson, P. (2012), "Transactive directories of organizational memory: towards a working data model", *Information and Management*, Vol. 49 No. 2, pp. 118-125.

Jansen, J.J., Van Den Bosch, F.A. and Volberda, H.W. (2006), "Exploratory innovation, exploitative innovation, and performance: effects of organizational antecedents and environmental moderators", *Management Science*, Vol. 52 No. 11, pp. 1661-1674.

Jansen, J.J., Tempelaar, M.P., Van den Bosch, F.A. and Volberda, H.W. (2009), "Structural Differentiation and Ambidexterity: the mediating role of integration mechanisms", *Organization Science*, Vol. 20 No. 4, pp. 797-811.

Jaworski, B.J. and Kohli, A.K. (1993), "Market Orientation: antecedents and consequences", *The Journal of Marketing*, Vol. 57 No. 3, pp. 53-70.

Jüttner, U. and Maklan, S. (2011), "Supply chain resilience in the global financial crisis: an empirical study", *Supply Chain Management: An International Journal*, Vol. 16 No. 4, pp. 246-259.

Kanawattanachai, P. and Yoo, Y. (2007), "The impact of knowledge coordination on virtual team performance over time", *MIS Quarterly*, Vol. 31 No. 4, pp. 783-808.

Kirkman, B.L. and Shapiro, D.L. (2000), "Understanding why team members won't share: an examination of factors related to employee receptivity to team-based rewards", *Small Group Research*, Vol. 31 No. 2, pp. 175-209.

Kogut, B. and Zander, U. (1992), "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organization Science*, Vol. 3 No. 3, pp. 383-397.

Koufteros, X.A., Rawski, G.E. and Rauniar, R. (2010), "Organizational Integration for Product Development: the effects on glitches, on-Time execution of engineering change orders, and Market Success", *Decision Sciences*, Vol. 41 No. 1, pp. 49-80.

Kozlowski, S.W., Gully, S.M., Nason, E.R. and Smith, E.M. (1999), "Developing adaptive teams: a theory of compilation and performance across levels and time", Pulakos (Ed.), *The Changing Nature of Performance: Implications for Staffing, Motivation, and Development*, Jossey-Bass, San Francisco, pp. 240-292.

Kristal, M.M., Huang, H. and Roth, A.V. (2010), "The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance", *Journal of Operations Management*, Vol. 28, pp. 415-429.

Lengnick-Hall, C.A., Beck, T.E. and Lengnick-Hall, M.L. (2011), "Developing a capacity for organizational resilience through strategic human resource management", *Human Resource Management Review*, Vol. 21 No. 3, pp. 243-255.

Levitt, B. and March, J.G. (1988), "Organizational learning", *Annual Review of Sociology*, Vol. 14, pp. 319-340.

Lewis, K. (2003). "Measuring transactive memory systems in the field: scale development and validation", *Journal of Applied Psychology*, Vol. 88 Nol. 4, pp. 587-604.

Lewis, K. (2004), "Knowledge and Performance in Knowledge-Worker Teams: a longitudinal study of transactive memory systems", *Management Science*, Vol. 50 No. 11, pp. 1519-1533.

Lewis, K., Lange, D. and Gillis, L. (2005), "Transactive memory systems, learning, and learning transfer", *Organization Science*, Vol. 16 No. 6, pp. 581-598.

Liang, D.W., Moreland, R. and Argote, L. (1995), "Group versus individual training and group performance: the mediating role of transactive memory", *Personality and Social Psychology Bulletin*, Vol. 21 No. 4, pp. 384-393.

Linnenluecke, M.K. (2017), "Resilience in business and management research: A review of influential publications and a research agenda", *International Journal of Management Reviews*, Vol. 19 No. 1, pp. 4-30.

MacDuffie, J.P. (1997), "The Road to 'Root Cause': shop-floor problem-solving at three auto assembly plants", *Management Science*, Vol. 43 No. 4, pp. 479-502.

Majchrzak, A., Jarvenpaa, S.L. and Hollingshead, A. (2007), "Coordinating expertise among emergent groups responding to disasters", *Organization Science*, Vol. 18 No. 1, pp. 147-161.

Maltz, E. and Kohli, A.K. (1996), "Market intelligence dissemination across functional boundaries", *Journal of Marketing Research*, pp. 47-61.

McCann, J.E. and Ferry, D.L. (1979), "An approach for assessing and managing inter-unit interdependence", *Academy of Management Review*, Vol. 4 No. 1, pp. 113-119.

McClelland, G.H., Irwin, J.R., Disatnik, D. and Sivan, L. (2017), "Multicollinearity is a red herring in the search for moderator variables: a guide to interpreting moderated multiple regression models and a critique of Iacobucci, Schneider, Popovich, and Bakamitsos (2016)", *Behavior Research Methods*, Vol. 49 No. 1, pp. 394-402.

Mell, J.N., Van Knippenberg, D. and Van Ginkel, W.P. (2014), "The catalyst effect: the impact of transactive memory system structure on team performance", *Academy of Management Journal*, Vol. 57 No. 4, pp. 1154-1173.

Menon, T. and Pfeffer, J. (2003), "Valuing Internal vs. External knowledge: explaining the preference for outsiders", *Management Science*, Vol. 49 No. 4, pp. 497-513.

Miller, K.D., Pentland, B.T. and Choi, S. (2012), "Dynamics of performing and remembering organizational routines", *Journal of Management Studies*, Vol. 49 No. 8, pp. 1536-1558.

Miller, K.D., Choi, S. and Pentland, B.T. (2014), "The role of transactive memory in the formation of organizational routines", *Strategic Organization*, Vol. 12 No. 2, pp. 109-133.

Mom, T.J., Van Den Bosch, F.A. and Volberda, H.W. (2009), "Understanding variation in managers' ambidexterity: investigating direct and interaction effects of formal structural and personal coordination mechanisms", *Organization Science*, Vol. 20 No. 4, pp. 812-828.

Moorman, R.H. and Blakely, G.L. (1995), "Individualism-collectivism as an individual difference predictor of organizational citizenship behavior", *Journal of Organizational Behavior*, Vol. 16 No. 2, pp. 127-142.

Moreland, R.L. and Argote, L. (2003), *Transactive Memory in Dynamic Organizations, Leading and Managing People in the Dynamic Organization*, Lawrence Erlbaum, New Jersey, pp. 135-162.

Moreland, R.L., Argote, L. and Krishnan, R. (1996), "Socially shared cognition at work: transactive memory and group performance", in Nye, J.L. and Brower, A.M. (Eds), *What's Social about Social Cognition? Research on Socially Shared Cognition in Small Groups*, Sage Publications, pp. 57-84.

Moser, G. (1988), "Urban stress and helping behavior: effects of environmental overload and noise on behavior", *Journal of Environmental Psychology*, Vol. 8 No. 4, pp. 287-298.

Nevo, D. and Wand, Y. (2005), "Organizational memory information systems: a transactive memory approach", *Decision Support Systems*, Vol. 39 No. 4, pp. 549-562.

Nevo, D., Benbasat, I. and Wand, Y. (2012), "The knowledge demands of expertise seekers in two different contexts: knowledge allocation versus knowledge retrieval", *Decision Support Systems*, Vol. 53 No. 3, pp. 482-489.

Palazzolo, E.T., Serb, D.A., She, Y., Su, C. and Contractor, N.S. (2006), "Coevolution of communication and knowledge networks in transactive memory systems: using computational models for theoretical development", *Communication Theory*, Vol. 16 No. 2, pp. 223-250.

Parker, H. and Ameen, K. (2018), "The role of resilience capabilities in shaping how firms respond to disruptions", *Journal of Business Research*, Vol. 88, pp. 535-541.

Patel, P.C. (2011), "Role of manufacturing flexibility in managing duality of formalization and environmental uncertainty in emerging firms", *Journal of Operations Management*, Vol. 29 Nos 1-2, pp. 143-162.

Pearce, J.L. and Gregersen, H.B. (1991), "Task Interdependence and Extrarole Behavior: a test of the mediating effects of felt responsibility", *Journal of Applied Psychology*, Vol. 76 No. 6, pp. 838-844.

Pearsall, M.J., Christian, M.S. and Ellis, A.P. (2010), "Motivating Interdependent Teams: individual rewards, shared rewards, or something in between?", *Journal of Applied Psychology*, Vol. 95 No. 1, pp. 183-193.

Peltokorpi, V. (2012), "Organizational transactive memory systems – review and extension", *European Psychologist*, Vol. 17 No. 1, pp. 11-20.

Peltokorpi, V. and Manka, M.-L. (2008), "Antecedents and the performance outcome of transactive memory in daycare work groups", *European Psychologist*, Vol. 13 No. 2, pp. 103-119.

Perrow, C. (2011), *Normal Accidents: Living with High Risk Technologies*, Updated ed., Princeton university press, Princeton.

Pettit, T.J., Croxton, K.L. and Fiksel, J. (2013), "Ensuring supply chain resilience: development and implementation of an assessment tool", *Journal of Business Logistics*, Vol. 34 No. 1, pp. 46-76.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common Method Biases in Behavioral Research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.

Polyviou, M., Croxton, K.L. and Knemeyer, A.M. (2019), "Resilience of medium-sized firms to supply chain disruptions: the role of internal social capital", *International Journal of Operations and Production Management*, Vol. 40 No. 1, pp. 68-91.

Ponomarov, S.Y. and Holcomb, M.C. (2009), "Understanding the concept of supply chain resilience", *The International Journal of Logistics Management*, Vol. 20 No. 1, pp. 124-143.

Rau, D. (2006), "Top management team transactive memory, information gathering, and perceptual accuracy", *Journal of Business Research*, Vol. 59 No. 4, pp. 416-424.

Rauniar, R., William, D., Greg, R. and Hong, P. (2008), "Shared knowledge and product design glitches in integrated product development", *International Journal of Production Economics*, Vol. 114, pp. 723-736.

Reagans, R., Argote, L. and Brooks, D. (2005), "Individual Experience and Experience Working Together: predicting learning rates from knowing who knows what and knowing how to work together", *Management Science*, Vol. 51 No. 6, pp. 869-881.

Ren, Y. and Argote, L. (2011), "Transactive memory systems 1985–2010: an integrative framework of key dimensions, antecedents, and consequences", *The Academy of Management Annals*, Vol. 5 No. 1, pp. 189-229.

Ren, Y., Carley, K.M. and Argote, L. (2006), "The contingent effects of transactive memory: when is it more beneficial to know what others know?", *Management Science*, Vol. 52 No. 5, pp. 671-682.

Revilla, E. and Saenz, M.J. (2017), "The impact of risk management on the frequency of supply chain disruptions: a configurational approach", *International Journal of Operations & Production Management*, Vol. 37 No. 5, pp. 557-576.

Rindfleisch, A. and Moorman, C. (2001), "The acquisition and utilization of information in new product alliances: a strength-of-ties perspective", *Journal of Marketing*, Vol. 65 No. 2, pp. 1-18.

Rothschild, M.L. (1999), "Carrots, sticks, and promises: a conceptual framework for the management of public health and social issue behaviors", *Journal of Marketing*, Vol. 63 No. 4, pp. 24-37.

Ruyter, K.D. and Wetzels, M. (2000), "Determinants of a relational exchange orientation in the MarketingManufacturing interface: an empirical investigation", *Journal of Management Studies*, Vol. 37 No. 2, pp. 257-276.

Salvato, C. and Rerup, C. (2011), "Beyond collective entities: multilevel research on organizational routines and capabilities", *Journal of Management*, Vol. 37 No. 2, pp. 468-490.

Sarin, S. and O'Connor, G.C. (2009), "First among equals: the effect of team leader characteristics on the internal dynamics of cross-functional product development teams", *Journal of Product Innovation Management*, Vol. 26 No. 2, pp. 188-205.

Scholten, K. and Schilder, S. (2015), "The role of collaboration in supply chain resilience", *Supply Chain Management: An International Journal*, Vol. 20 No. 4, pp. 471-484.

Scholten, K., Sharkey Scott, P. and Fynes, B. (2019), "Building routines for non-routine events: supply chain resilience learning mechanisms and their antecedents", *Supply Chain Management: An International Journal*, Vol. 24 No. 3, pp. 430-442.

Sheffi, Y. and Rice, J. (2005), "A supply chain view of the resilient enterprise", *MIT Sloan Management. Review*, Vol. 47 No. 1, pp. 41-48.

Shewhart, W.A. (1930), "Economic quality control of manufactured product", *Bell Labs Technical Journal*, Vol. 9 No. 2, pp. 364-389.

Siemsen, E., Balasubramanian, S. and Roth, A.V. (2007), "Incentives that induce task-related effort, helping, and knowledge sharing in workgroups", *Management Science*, Vol. 53 No. 10, pp. 1533-1550.

Siemsen, E., Roth, A.V. and Balasubramanian, S. (2008), "How motivation, opportunity, and ability drive knowledge sharing: the constraining-factor model", *Journal of Operations Management*, Vol. 26 No. 3, pp. 426-445.

Sitkin, S.B. (1992), "Learning through Failure: the strategy of small losses", *Research in Organizational Behavior*, Vol. 14, pp. 231-266.

Srivastava, A., Bartol, K.M. and Locke, E.A. (2006), "Empowering leadership in management teams: effects on knowledge sharing, efficacy, and performance", *Academy of Management Journal*, Vol. 49 No. 6, pp. 1239-1251.

Staw, B.M., Sandelands, L.E. and Dutton, J.E. (1981), "Threat rigidity effects in organizational behavior: a multilevel analysis", *Administrative Science Quarterly*, Vol. 26 No. 4, pp. 501-524.

Tang, C.S. (2006), "Perspectives in supply chain risk management", *International Journal of Production Economics*, Vol. 103 No. 2, pp. 451-488.

Tang, C. and Tomlin, B. (2008), "The power of flexibility for mitigating supply chain risks", *International Journal of Production Economics*, Vol. 116 No. 1, pp. 12-27.

Tangpong, C., Hung, K.T. and Ro, Y.K. (2010), "The interaction effect of relational norms and agent cooperativeness on opportunism in buyer–supplier relationships", *Journal of Operations Management*, Vol. 28 No. 5, pp. 398-414.

Tenhiälä, A. and Salvador, F. (2014), "Looking inside glitch mitigation capability: the effect of intraorganizational communication channels", *Decision Sciences*, Vol. 45 No. 3, pp. 437-466.

Tenhiälä, A., Rungtusanatham, M.J. and Miller, J.W. (2018), "ERP system versus stand-alone enterprise applications in the mitigation of operational glitches", *Decision Sciences*, Vol. 49 No. 3, pp. 407-444.

Tjosvold, D. (1986), "The dynamics of interdependence in organizations", *Human Relations*, Vol. 39 No. 6, pp. 517-540.

Tsai, W. (2002), "Social structure of 'coopetition' within a multiunit organization: coordination, competition, and intraorganizational knowledge sharing", *Organization Science*, Vol. 13 No. 2, pp. 179-190.

Uzzi, B. (1997), "Social structure and competition in interfirm networks: the paradox of embeddedness", *Administrative Science Quarterly*, Vol. 42 No. 1, pp. 35-67.

Wageman, R. and Baker, G. (1997), "Incentives and cooperation: the joint effects of task and reward interdependence on group performance", *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, Vol. 18 No. 2, pp. 139-158.

Walsh, J.P. and Ungson, G.R. (1991), "Organizational memory", *Academy of Management Review*, Vol. 16 No. 1, pp. 57-91.

Wegner, D. (1987), "Transactive Memory: a contemporary analysis of the group mind", in Mullen, B. and Goethals, G. (Eds), *Theories of Group Behavior: 185-208*, New York, NY, Springer.

Wegner, D., Herber, R. and Raymond, P. (1991), "Transactive memory in close relationships", *Journal of Personality and Social Psychology*, Vol. 61 No. 6, pp. 923-929.

Wieland, A. and Marcus Wallenburg, C. (2013), "The influence of relational competencies on supply chain resilience: a relational view", *International Journal of Physical Distribution and Logistics Management*, Vol. 43 No. 4, pp. 300-320.

Williams, L.J., Edwards, J.R. and Vanderberg, R.J. (2003), "Recent advances in causal modeling methods for organizational and management research", *Journal of Management*, Vol. 29 No. 6, pp. 903-936.

Williamson, O.E. (1991), "Comparative Economic Organization: the analysis of discrete structural alternatives", *Administrative Science Quarterly*, Vol. 36 No. 2, pp. 269-296.

Wilmot, W.W. and Hocker, J.L. (2001), *Interpersonal Conflict*, McGraw-Hill, New York, NY.

Zaccaro, S.J., Rittman, A.L. and Marks, M.A. (2002), "Team leadership", *The Leadership Quarterly*, Vol. 12 No. 4, pp. 451-483.

Zacharia, Z.G., Nix, N.W. and Lusch, R.F. (2011), "Capabilities that enhance outcomes of an episodic supply chain collaboration", *Journal of Operations Management*, Vol. 29 No. 6, pp. 591-603.

Zhang, Z.X., Hempel, P.S., Han, Y.L. and Tjosvold, D. (2007), "Transactive memory system links work team characteristics and performance", *Journal of Applied Psychology*, Vol. 92 No. 6, pp. 1722-17.

Zhang, A.Y., Tsui, A.S. and Wang, D.X. (2011), "Leadership behaviors and group creativity in Chinese organizations: the role of group processes", *The Leadership Quarterly*, Vol. 22 No. 5, pp. 851-862.

Further reading

Ancona, D.G. (1990), "Outward Bound: strategic for team survival in an organization", *Academy of Management Journal*, Vol. 33 No. 2, pp. 334-365.

Blumberg, M. and Pringle, C.D. (1982), "The missing opportunity in organizational research: some implications for a theory of work performance", *Academy of Management Review*, Vol. 7 No. 4, pp. 560-569.

Burt, R.S. (1997), "The contingent value of social capital", *Administrative Science Quarterly*, Vol. 42 No. 2, pp. 339-365.

Cepeda, G. and Vera, D. (2007), "Dynamic capabilities and operational capabilities: a knowledge management perspective", *Journal of Business Research*, Vol. 60 No. 5, pp. 426-437.

Felin, T. and Foss, N.J. (2005), "Strategic organization: a field in search of micro-foundations", *Strategic Organization*, Vol. 3 No. 4, pp. 441-455.

Foss, N.J. (2003), "Bounded rationality and tacit knowledge in the organizational capabilities approach: an assessment and a re-evaluation", *Industrial and Corporate Change*, Vol. 12 No. 2, pp. 185-201.

Helfat, C.E. and Peteraf, M.A. (2003), "The dynamic resource-based view: capability lifecycles", *Strategic Management Journal*, Vol. 24 No. 10, pp. 997-1010.

Kettinger, W.J., Li, Y., Davis, J.M. and Kettinger, L. (2015), "The roles of psychological climate, information management capabilities, and IT support on knowledge-sharing: an MOA perspective", *European Journal of Information Systems*, Vol. 24 No. 1, pp. 59-75.

Reinholt, M.I.A., Pedersen, T. and Foss, N.J. (2011), "Why a Central Network Position isn't Enough: the role of motivation and ability for knowledge sharing in employee networks", *Academy of Management Journal*, Vol. 54 No. 6, pp. 1277-1297.

Trentin, A., Somià, T., Sandrin, E. and Forza, C. (2019). "Operations managers' individual competencies for mass customization", *International Journal of Operations and Production Management*. Ahead of print.

Watson, W.E., Johnson, L. and Merritt, D. (1998), "Team orientation, self-orientation, and diversity in task groups: their connection to team performance over time", *Group and Organization Management*, Vol. 23 No. 2, pp. 161-188.

Wesselink, R., Blok, V., van Leur, S., Lans, T. and Dentoni, D. (2015), "Individual competencies for managers engaged in corporate sustainable management practices", *Journal of Cleaner Production*, Vol. 106, pp. 497-506.

Wu, S.J., Melnyk, S.A. and Flynn, B.B. (2010), "Operational capabilities: the secret ingredient", *Decision Sciences*, Vol. 41 No. 4, pp. 721-754.

Corresponding author
Diogo Cotta can be contacted at: D.cotta@maastrichtuniversity.nl