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The role of cognitive capital in supply chain resilience: an investigation during the COVID-19 pandemic

Abstract

Purpose: Research on the 'black box' of cognitive capital remains limited in supply chain resilience (SCRES) literature. Drawing from an in-depth single case study of a major consumer electronics multinational facing the COVID-19 disruption, this paper develops a clearer picture of cognitive capital's elements while contextualizing how they interact with SCRES temporal capabilities to prepare, respond, recover, and learn.

Design/methodology/approach: Consisting of 40 in-depth interviews collected during a four-month period, this single case revolves around the buyer's view across 36 multiregional buyer-supplier dyads, spanning 17 product and service categories. Data were processed during the pandemic, while findings discuss pre- and intra-crisis events based on two scenarios: the impact of disruption on (1) category demand, comparing sudden pandemic-driven product and service demand fluctuations (i.e., increase, decrease), and (2) the geographical proximity of the supplier relative to the buying firm.

Findings: The case unveils different elements of cognitive capital (e.g., shared goals, assumptions, values, kinesics language, multilingualism, virtual negotiation, prior disruption experience, shared process capabilities) during a major global disruption, suggesting that different cognitive capital elements influence positively and differently SCRES' temporal capabilities. Overall, buying firms are urged to build on cognitive capital to improve SCRES preparation, response, recovery, and learning.

Originality: This paper extends the understanding of cognitive capital in buyer-supplier relationships by identifying its elements and offering a theoretical articulation of how they enable episodically the four SCRES temporal capabilities under contingencies of increased and decreased demands, and suppliers' geographical proximity.

Keywords: supply chain resilience, social capital, cognitive capital, buyer-supplier relationships, interorganizational relationships.

Article classification: Research paper, Case study.

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1. Introduction

Given the growing number of disruptions and players immersed in global supply chains, firms are increasingly looking to develop supply chain resilience (SCRES) or the adaptive ability to prepare for, respond to, recover from, and learn from turbulences (Hendry et al., 2019). However, the increasing number and the geographical dispersion of actors involved in the design and delivery of products and services have demanded firms move beyond their organizational boundary and engage and invest in relationships with various external upstream and downstream actors to achieve SCRES (Christopher and Peck, 2004; Scholten and Schilder, 2015). Previous studies have investigated the role of collaborative interorganizational relationships, and the social capital embedded within or available through these relationships in driving SCRES (Ali et al., 2017; Daghar et al., 2021; Johnson et al., 2013).

Drawing on the three key facets of social capital suggested by Nahapiet and Ghoshal (1998) in their seminal work, operations and supply chain management scholars have highlighted the importance of structural, relational, and cognitive capital in driving SCRES (Daghar et al., 2021). For instance, research has highlighted the role of structural capital with shared routinized practices such as information sharing, joint decision-making, and joint planning (e.g., Jain et al., 2017; Scholten and Schilder 2015), but also the structure of interactions (i.e., connectivity patterns/overall configuration of relationships) (Choi and Krause, 2006). Similarly, extant studies have examined the role of relational capital through closeness, reciprocity, and trust that parties develop in relationships (e.g., Jüttner and Maklan, 2011). Scholars have also increasingly recognized that meaningful collaboration requires sharing of context, representations, interpretations, and meaning between parties (i.e., cognitive capital, Johnson et al., 2013). Manifested through shared codes and language, and shared narratives, cognitive capital provides a behavioral framework that can promote synergies and reduce friction among parties (Rossetti and Choi, 2005). Previous studies have suggested that interest harmonization using cognitive capital develops shared understanding and reduces buyer-supplier opportunism (Gittell, 2002), and hence supports collaboration, task completion (Inkpen and Tsang, 2005), and conflict resolution (Christopher and Lee, 2004; Johnson et al., 2013). In their case study of the Grayrigg derailment, a fatal railway accident that occurred in Northwest England, Johnson et al. (2013) showed that the shared codes and language that exist among parties in terms of shared goals, key performance indicators, sector language, and past adaptive responses improved shared cognitions and identity, establishing rules of coordination and collaborative identification, and thus mitigating supply chain risks.

Despite the significance of cognitive capital in supply chain risk and resilience, the extant literature examining collaborative interorganizational relationships has largely focused on the structural capital and/or relational capital that exist in these relationships (Daghar et al., 2021). Where the supply chain risk and resilience literature has examined the role of cognitive capital, the focus has been predominantly on the four most cited mechanisms

that enable SCRES (i.e., collaboration, flexibility, visibility, velocity, Jüttner and Maklan, 2011), overlooking the dynamics and temporal aspects of disruptions (Stone and Rahimifard, 2018). Additionally, recognized as the most challenging dimension to operationally separate from other social capital dimensions (Nahapiet and Ghoshal, 1998; Chowdhury et al., 2019; Krause, 2007; Villena et al., 2011), cognitive capital has remained an elusive concept requiring contextualization.

This study aims to investigate the 'black box' of cognitive capital in the context of supply chain disruptions. It further seeks to clarify and articulate how the cognitive capital that exists in interorganizational relationships can affect parties' ability to prepare for, respond to, recover, and learn from disruptions (i.e., SCRES temporal capabilities, Ali et al., 2017). Adopting an inductive case study approach in a buyer-supplier setting, this paper asks two specific research questions: (1) what is cognitive capital in the context of a supply chain disruption? (2) what is the role of cognitive capital in SCRES temporal capabilities? This study involves a major Japanese multinational electronics company and its dyadic relationships with 36 multiregional suppliers, spanning 17 product and service categories facing severe supply chain disruptions due to COVID-19 pandemic, which affected 95% of global supply chains in 2020 (van Hoek, 2020). The data were collected in 2020 in the US division of the company, four months after the COVID-19 started, allowing both pre- and intra- crisis episodical analysis which compares to the phased approach (i.e., mitigation, preparedness, response, recovery) used in the humanitarian supply chain literature (Helferich and Cook, 2002; Kovács and Spens, 2007; Natarajarathinam et al., 2009; Scholten et al., 2014).

This study contributes to supply chain risk and resilience and buyer-supplier relationships research in several ways. First, the paper extends the understanding of the role of the cognitive capital embedded in or available through a buying firm's relationships with suppliers in its SCRES by identifying its underlying relevant elements within a unique global supply chain disruption context resulting in fluctuations in both supply and demand. Second, this study extends the previous literature by unpacking the role of cognitive capital in the temporal SCRES capabilities observed to be at play as the disruption events unfolded. In particular, this study offers a theoretical articulation of how various aspects of cognitive capital enable the four SCRES temporal capabilities to prepare for, respond to, recover, and learn from disruptions. Third, the findings add to the existing research regarding the role of cognitive capital in SCRES by identifying two contingencies that affect the relationships between different aspects of cognitive capital and SCRES capabilities, namely 1) category demand, comparing sudden pandemic-driven product and service demand fluctuations (i.e., increase, decrease) (Chopra and Sodhi, 2004), and (2) the geographical proximity of suppliers relative to the buying firm (Choi and Krause, 2006).

2. Theoretical background

2.1 Cognitive capital in buyer-supplier relationships: definitions and conceptualizations

Critical in social affairs, social capital is defined as "the sum of the actual and potential resources embedded within, available through and derived from the network of relations possessed by an individual or social unit" (Nahapiet and Ghoshal 1998, p.243). Social capital theory postulates that the access to and use of resources embedded in social networks can lead to a better social and economic return (Granovetter, 1992; Lin, 1999). As a set of resources rooted in relationships, social capital has many facets. Nahapiet and Ghoshal (1998) recommend considering the different facets of these resources in terms of 1) structural, 2) relational and 3) cognitive capital. Structural social capital has been predominantly characterized in terms of systems, routinized practices (e.g., information sharing, joint decision-making, joint planning), or regular patterns of interactions structuring interorganizational communication and joint actions (Carey et al., 2010; Lawson et al., 2007) by ways of both formal and informal methods (Roden and Lawson, 2014). Structural social capital deals with collaborative practices, but also the network-level configuration that they shape through connectivity patterns and overall configuration of relationships (Choi and Krause, 2006). Relational capital refers to closeness, reciprocity, and trust developed in relationships (Daghar et al., 2021; Roden and Lawson, 2014).

Cognitive capital, the focus of this study, represents resources providing shared representations, meanings, and values (Daghar et al., 2021). Cognitive capital can be separated into two categories according to Nahapiet and Ghoshal (1998)'s view, (1) shared codes and language, and (2) shared narratives (Figure 1). As a means through which individuals discuss and share information, shared codes and language organize sensory data through perceptual categorization and establish a framework enabling the examination and interpretation of the environment (Nahapiet and Ghoshal, 1998). As such, shared codes and language represent shared goals, shared key performance indicators, shared vision, shared absorptive capacity, shared task ownership, shared cognition, shared ambitions, standardization, shared curiosity, shared training (Fan and Stevenson, 2018; Johnson et al., 2013; Tsai and Ghoshal, 1998), but also shared sector language (sectorial jargon) (Fan and Stevenson, 2018; Johnson et al., 2013). Shared narratives involve stories, myths, and metaphors (Nahapiet and Ghoshal, 1998) including shared approaches (Johnson et al., 2013). Accordingly, they comprise shared prior disruption experiences (i.e., past adaptive responses), shared identity (Johnson et al., 2013), shared corporate culture, shared norms (Inkpen and Tsang, 2005), national cultures (Gupta and Gupta, 2019; Manhart et al., 2020), shared company values, shared philosophies, shared business approach, shared capabilities, and shared management styles (Chowdhury et al., 2019, Villena et al., 2011). We detail these cognitive capital elements in Figure 1.

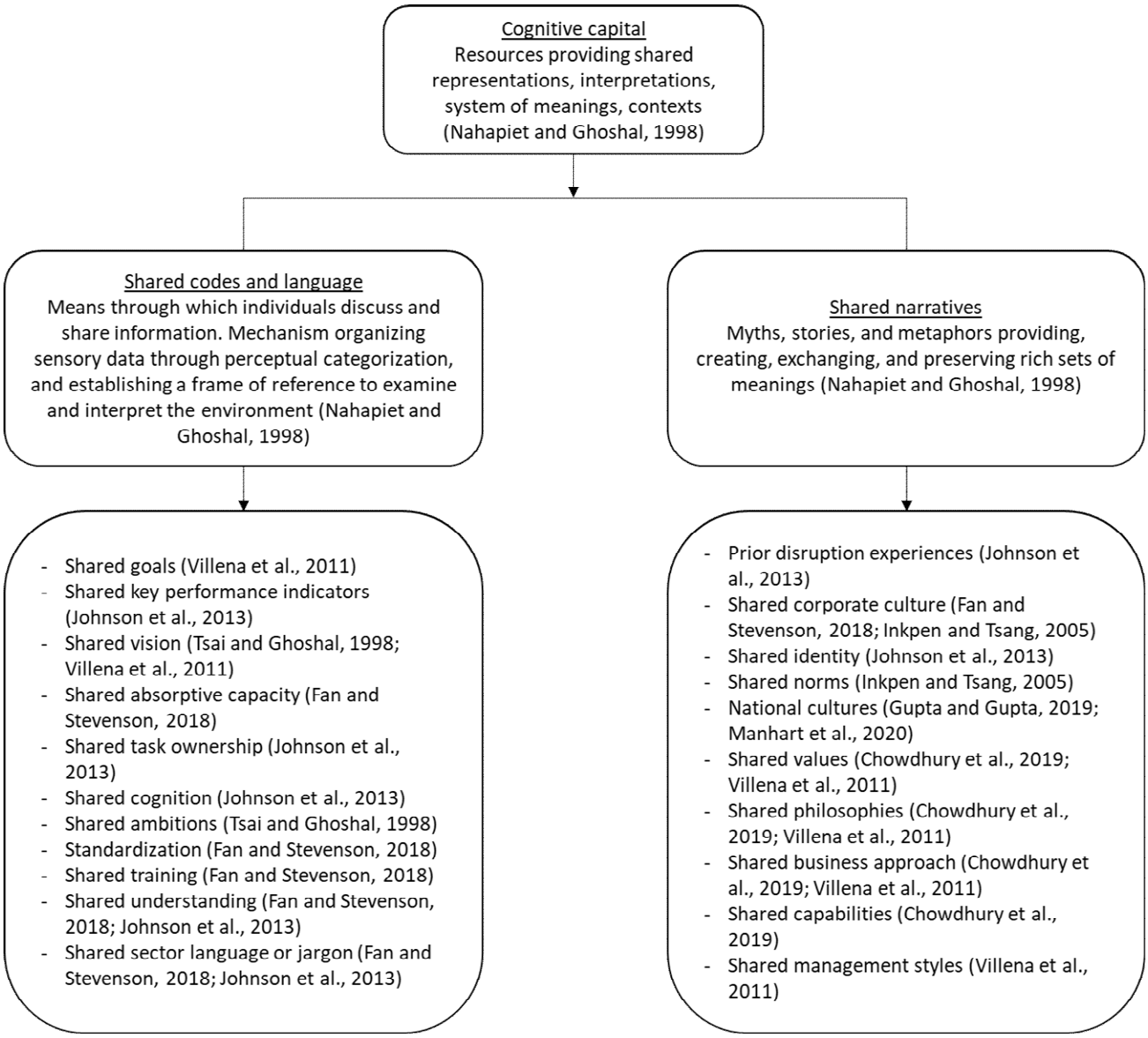

Figure 1. Cognitive capital's elements

Overall, cognitive capital's elements developed between actors enable the understanding of information and classification of categories. Through participative and continuous sense-making processes, cognitive capital develops shared understanding and ideas needed to frame the coordination of exchanges and share thinking processes (Carey et al., 2010; Krause et al., 2006).

2.2 A temporal operationalization of SCRES

The notion of resilience has become increasingly salient over the last decades and is applied across a wide variety of disciplines from engineering, ecology, economics, to social sciences. In the field of engineering, resilience is the

ability of a system to absorb shock (maintain the status quo) or bounce back to an equilibrium state (Simmie and Martin, 2010). Drawing from the study of ecosystems, social systems, and the stability and change panarchy framework in the field of ecology, researchers examine how resilient systems recover from disruptions by developing adaptative cycle dynamics consisting of continual transformative reorganization, change adaptation, and regeneration (Adobor, 2020; Gunderson and Holling, 2002). The ecologist Holling (1973) brings to light the existence of multiple stability states in natural ecosystems where event randomness, and diversity in temporal and spatial scales prevail. Thus, in social and ecological systems, resilience is about learning how to change, not by keeping the system in a constant state, but by exposing it to a full non-linear range of social and environmental variations to adapt (Walker 2020), learn and self-organize (Folke, 2006; Novak et al., 2021). In the supply chain literature, scholars have predominantly adopted an engineering view of resilience, emphasizing the system's ability to bounce back to an equilibrium state (Sheffi and Rice, 2005). However, in recent years, some supply chain researchers have begun to re-examine this view. Indeed, the perception of one equilibrium state confines supply chain in a fixed state and does not consider the disruption as an opportunity to metamorphose (Wieland and Durach, 2021). In fact, SCRES is the ability to constantly adapt, evolve, and transform to respond to the dynamic multiscale feedbacks existing between organizations, and social and ecological systems (Novak et al., 2021). Drawing on complex adaptive systems, scholars have further introduced the notion of growth in the face of turbulence (Day, 2014), which is enabled by post-disruption learning (Hendry et al., 2019) and is consistent with the resilience view of adaptation, transformability (Walker, 2020; Wieland and Durach, 2021), as well as antifragility (i.e., going beyond resilience by embracing and learning from disorder rather than avoiding it) (Nikookar et al., 2021; Taleb, 2012).

Coping with supply chain risks and operational difficulties (Turner et al., 2018), SCRES strategies consist of proactive and reactive approaches (Chowdhury and Quaddus, 2016; Dabhilkar et al., 2016; Turner et al., 2020). The proactive strategy detects the crisis pre-disruption (beforehand), while the reactive strategy repairs the consequences of a disaster or crisis (Grötsch et al., 2013) intra- or post-disruption (during or after the event) (Figure 2). As a result, the SCRES proactive strategy is enabled by the SCRES capability to prepare through plan development and implementation. SCRES reactive strategy is enabled by three SCRES capabilities. The first is to respond by evaluating risks and implementing response plans; the second is to recover by resuming or maintaining operations continuity while improving (Hendry et al., 2019; Johnson et al., 2013; Jüttner and Maklan, 2011; Sá et al., 2019; Scholten and Schilder, 2015); Ali et al. (2017) add learning as a third capability strengthening SCRES reactive strategy via lessons learned, continuous improvement and mitigation plans. This is consistent with some recent theorizations of SCRES such as transformability or antifragility that promote the idea of embracing and

learning from disorder to achieve growth (Nikookar et al., 2021; Wieland and Durach, 2021). Similarly, scholars adopting dynamic capabilities (Teece et al., 1997) as a theoretical lens highlight the importance of transformation and growth by conceptualizing SCRES capabilities in terms of an ability to (1) sense or recognize threats and opportunities (i.e., ability to prepare and learn), (2) seize or respond to these threats and opportunities (i.e., the capability to respond), and (3) transform or improve, combine, and protect the firm's capabilities (i.e., the capability to recover and learn) (Hendry et al., 2019). In the same vein, the supply chain risk management literature highlights the capabilities of preparation (e.g., prevention), response (e.g., risk detection and assessment, solution planning and implementation), recovery and learning (e.g., continuous improvement) (Kauppi et al., 2016, Sinha et al., 2004). Accordingly, this study considers SCRES as an adaptive capability preparing the supply chain to deal with unexpected events, respond to disruptions and recover and learn from disruptions through business operations continuity (Ponomarov and Holcomb, 2009).

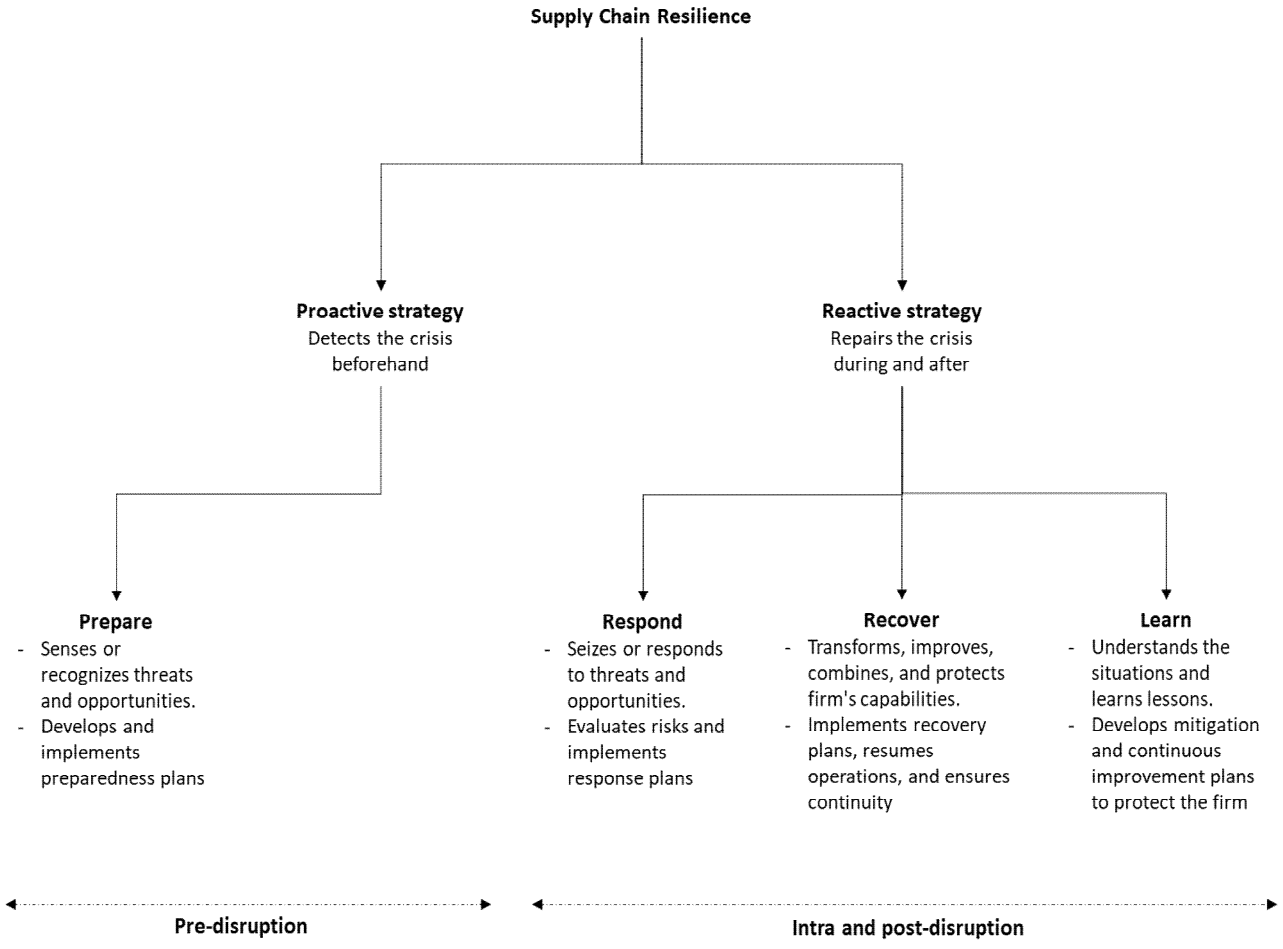

Figure 2. Supply chain resilience temporal conceptualization

SCRES capabilities of preparation, response, recovery, and learning are enabled by elements (also referred to as enablers, capabilities, antecedents, dimensions, and measures in the SCRES literature) (Ali et al., 2017; Christopher and Peck, 2004; Hohenstein et al., 2015). The most common SCRES enablers discussed in the literature are collaboration, flexibility, visibility, and velocity (Ali et al., 2017; Jüttner and Maklan, 2011; Johnson et al., 2013, Sá et al., 2019; Scholten and Schilder, 2015). Other than these four enablers, a myriad of other enablers can be found in the supply chain risk and resilience literatures such as agility (i.e., velocity, visibility) (Jain et al., 2017; Liu et al., 2018), management support (Chowdhury and Quaddus, 2016; Dabhilkar et al., 2018), continuity teams, training, past learning (Chowdhury and Quaddus, 2016), risk awareness, supply chain re-engineering (i.e., efficiency, redundancy, robustness) (Scholten et al., 2014), knowledge management, but also social capital (Ali et al., 2017) such as personal relationships, social interactions, sharing of personal concerns, and caring for one another (Nikookar and Yandori, 2021).

2.3 The role of cognitive capital in SCRES

The extant literature identifies some cognitive capital elements influencing highly cited SCRES enablers such as collaboration, flexibility, visibility, velocity, agility, or risk awareness.

2.3.1 The role of shared codes and language in SCRES

Shared codes and language appear in the form of buyer-supplier goals, key performance indicators, sector language, task ownership, standardization, and training. These essential elements drastically improve collaboration and flexibility needed for SCRES, and establish explicit and tacit understanding (Johnson et al., 2013) used in buyer-supplier absorptive capacity, but also cognitive efforts needed in supply risk identification (Fan and Stevenson, 2018) and mitigation (Chowdhury et al., 2019).

Buyers establishing collaborative codes with their suppliers via goal setting are more prepared for supply chain risks and can see their supply risks decrease (Chen et al., 2013). Training is another component invigorating SCRES agility, collaboration, and supply chain re-engineering (Liu et al., 2018). From a language perspective, Subramanian et al. (2015) have demonstrated through an empirical study that buyer-supplier language differences can be a barrier for multinational OEMs to understand and adapt to the Chinese socio-cultural and professional practices.

2.3.2 The role of shared narratives in SCRES

Nahapiet and Ghoshal (1998) associate shared narratives with stories, myths, and metaphors sustaining meaning in communities. Investigating the management of the Grayrigg rail crash in the UK, Johnson et al. (2013) suggest that shared narratives of past adaptive responses help solidify network collaboration, and the identification and

resolution of complex problems. In addition, the authors propose that shared narratives support the curiosity for resource location and status, enhancing visibility and collaboration.

Shared organizational culture is a shared narrative consisting of company values, philosophies, approaches to business dealings, management styles, and business capabilities (Chowdhury et al., 2019). Shared corporate culture helps mitigate supply chain risks, by supporting the process of shared understanding and cognitive effort needed in supply risk identification (Fan and Stevenson, 2018) and mitigation (Chowdhury et al., 2019). For example, buyer-supplier shared vision is an element of interorganizational culture used to help better apprehend and respond to supply disruption (Manhart et al. 2020). Along the lines of shared corporate culture, supply chain risk management (SCRM) cultures are specific organizational cultures infusing, respectively, the concepts of resilience (Christopher and Peck, 2004), and SCRM (Chowdhury et al., 2019). SCRM culture diffusion, at the firm and buyer-supplier level, is positively related to the risk assessment and analysis capacity (Fan et al. 2017). Indeed, through risk-sharing, continuity teams, risk awareness (Chowdhury et al., 2019), agility (i.e., velocity and flexibility), collaboration, and supply chain re-engineering (Liu et al., 2018), SCRM culture positively impacts SCRES.

Additionally, national culture is another shared narrative that appears to impact collaboration strategies in supply disruption management (Manhart et al., 2020). Different countries, based on their individualism, collectivism, and feminism levels, seem to have differences in their risk-taking and negotiation approaches, but research remains poor in this domain (Gupta and Gupta, 2019).

Overall, the current literature recognizes the role of some cognitive capital elements in SCRES enablers (i.e., collaboration, flexibility, visibility, velocity), but remains limited as to what and how cognitive capital's elements impact the four SCRES capabilities to prepare, respond, recover, and learn. Thus, the aim of this study is to answer the following research questions:

1. What is cognitive capital in the context of a disruption?
2. What is the role of cognitive capital in SCRES temporal capabilities?

3. Method

The aim of this study is to shed some light on cognitive capital in buyer-supplier relationships to clarify its underlying elements, but also examine how they connect with the SCRES capabilities to prepare, respond, recover, and learn during a disruption. Cognitive capital, SCRES, and COVID-19 are complex, unique, misinterpretable, and underexplored contemporary real-life phenomena. Consequently, their study lends itself well to the rich and

explorative nature of a qualitative case-study scouting for meaning and context over causality and positivist generalization (Eisenhardt, 1989).

As an extreme case context enabling potent depictions of phenomenon characteristics (Scholten et al., 2014), the COVID-19 pandemic was an opportunity to examine potential interrelationships between cognitive capital and SCRES. This study adopted a single case study approach of a Japanese multinational electronics company that provides an ideal platform for rich description, in-depth analysis of data and exploring contextual factors (Yin, 2018). The case study involved an examination of the buying firm's relationships with its 36 multiregional suppliers, spanning 17 product and service categories facing severe supply chain disruptions due to the COVID-19 pandemic. Having multiple suppliers across different product and service categories was deemed appropriate to help capture the buying's firms SCRES capabilities in a diverse set of contexts. This further allowed a much richer analysis identifying suppliers and/or product and service categories contingencies. The data were collected over the course of four months, seeking episodical explanation (Helferich and Cook, 2002; Kovács and Spens, 2007; Natarajarathinam et al., 2009; Scholten et al., 2014) before and during COVID-19.

3.1 Empirical setting and case study selection

The multinational electronics company (hereafter, ELECTRO Co.) was chosen as the focal buying firm for several reasons. First, ELECTRO Co. provided an ideal setting as a large multi-billion-dollar electronics manufacturer with a global presence in both developed and emerging markets as well as a fragmented and geographical dispersed supply base that had experienced both supply and demand fluctuations during the pandemic. The company's diverse portfolio of products and services spanning multiple industries allowed the authors to observe and thus compare and contrast different patterns of supply and demand fluctuations. Furthermore, given the primary focus of this study to unpack the 'black box' of cognitive capital, the buying firm's geographically dispersed supply chain provided an appropriate setting to investigate the alignments of meaning, values or goals that may have emerged due to different geographical locations or cultural differences. Finally, being embedded in the company, one of the authors had exceptional access to the entire supply chain team supporting the supply and procurement, production and logistics and transportation activities of a wide range of products and services.

ELECTRO Co. develops and manufactures various products and services including rechargeable batteries, automotive and avionics systems, home appliances, construction, televisions, video projectors, cameras, computers, and software. 17 specific product and service categories, and a myriad of associated incidents in the context of COVID-19 were identified, enabling the utilization of critical incident analysis (Flanagan, 1954) to understand how individuals viewed and interpreted unfolding events. The case revolves around the buyer or manufacturer's point of view in dyadic settings, consisting of multiple buyer-supplier dyads where the buyer is

constant, but the suppliers are different per product and service category. A dyadic approach was selected to examine qualitatively the unexplored connection between cognitive capital and SCRES temporal capabilities.

Table I uses the supply chain risk framework based on Ho et al. (2015) to describe how the major environmental risk of COVID-19 trickled down to all other supply chain risks (i.e., supply, manufacturing, demand, informational, transportation, financial risks). No pattern emerged from specific supply chain risks, except the demand risk of demand fluctuations (i.e., sharp increases, decreases) discussed next.

From the data emerged two scenarios that contextualize what and how cognitive capital elements surfaced in relationship to SCRES. These two contingencies are the (1) sudden product demand fluctuations (increases, decreases) (Chopra and Sodhi, 2004), and (2) the supply-base complexity element of supplier geographical proximity (Choi and Krause, 2006). First, the diversity of product and service categories consisted of 17 different products and service categories with increased or decreased demand:

- Nine categories saw their demand at least double, which made supply and inventory levels drop substantially and rapidly after COVID-19 hit.
- Eight products saw a demand decrease: seven products had a demand level decreased dramatically by at least 50% with consequential supply and inventory levels surging. One category saw a slight 10% demand decrease with inventory and supply levels increasing slowly.

Product	Demand level	Environmental risks	Supply risks	Manufacturing risks	Demand risks	Information risks	Transportation risks	Financial risks
Rugged laptops	↑	• COVID-19's US expansion • US lock-down with social distancing, masks recommendations, etc. • Political Turmoil • Manifestations and riots	• Long lead times • Surge in costs for critical PPE items • Material supply disruption • First and second-tier suppliers shutdowns • Single and sole-sourcing • Production and supply flow halt in Asia • Inventory shortages	• Absenteeism • Production line stoppage due to parts and PPE shortages • Overload of emails drowning employees • Management of social distancing measures • COVID-19 contagion	• Increase of obsolete part demand in repairs for all products. • Between 100% and 200% demand increase for laptops, handheld devices, tablets, scanners for first responders like the Police, Hospitals, Military, Pentagon, White House. • 75% demand increase for Police cameras and video systems • 55% demand increase for registers used in Fast Food restaurants	• Web-based connection • Remote work • Lack of face-to-face meetings • Overabundance of emails overloading personnel • Miscommunication • Lack of communication	• Ports and airports reduction of personnel • Passenger flights dropped down • Transportation rate fluctuations with peaks exceeding 300% • Transportation lanes capacity decrease • Air capacity reduced because of drastic passenger flight cancellations • Unprecedented manpower shortage • Embargoed port terminals: backlog of inbound products not received with congestion • Drivers starting to get more unemployment benefits paying more than actual salaries in logistics and transportation (e.g., drivers, pickers)	• Potential loss of sales revenue due to competition
Handheld Devices								
Tablets								
Scanners								
Registers								
Police Body-Worn Cameras								
Police In-Car Video Systems								
3PL								
PPE								
Medical Cameras	↓	• COVID-19's US expansion • US lock-down with social distancing, masks recommendations, etc. • Hospital restrictions to treat only essential needs			• 10% demand decrease			• Loss of sales revenue due to demand decrease
Food Kiosks		• COVID-19's US expansion • Lock-down with social distancing, masks recommendations, etc. • Remote work. • Closure of restaurants, outdoor entertainments, festivals, movie theatres, concerts, etc.	• Stock piling • Lack of space to store excess inventory		• Between 50% and 95% demand fall, notably for Professional Telephone Systems which will be discontinued			
Counters								
Displays								
Flat Panels								
Projectors								
Sound Systems								
Professional Telephone Systems								

Table I. COVID-19 supply chain risks by product and service category

Second, the suppliers in this case study were geographically dispersed in Vietnam, Malaysia, China, Taiwan, Japan, Germany, UK, Italy, Mexico, Canada, and the USA. Every product consisted of numerous parts and sub-assemblies supplied from multiple suppliers in these countries and assembled or used for repairs in the US (except for third-party logistics services provided by carriers located in the US). Overall, a total of 36 dyads were represented in the

sample (Table II). The purpose of this study is to investigate cognitively embedded relational aspects or the extent to which buyer-supplier dyads share and operate on common cognitive models, typically embodied in shared meaning or categorization systems, which is separate from physical aspects such as firms' physical asset investments embedded in external relationships (e.g., cross-shareholding) and relational aspects (e.g., trust) (Alinaghian et al., 2020). As such, although ELECTRO is a Japanese multinational electronics company based in the US with some suppliers located in Japan, keiretsu relationships (i.e., cross-shareholding) did not surface in the interviews. Preponderant in the Japanese culture, particularly in the automotive industry (Kosaka et al., 2020), keiretsu relationships are dense groups of buyer-supplier relationships (Kraude, et al., 2018; Matsuo, 2015) where parties benefit from each other notably through higher selling prices, high-quality incentives, contractual exclusivity clauses, and shared new product developments (Todo and Inoue, 2021).

	Number of suppliers in:										
Product	Vietnam	Malaysia	China	Taiwan	Japan	Germany	UK	Italy	Mexico	Canada	USA
Rugged laptops					2						
Handheld Devices				2							
Tablets				1							
Scanners			1								
Registers	1	1									
Police Body-Worn Cameras					1		1			1	1
Police In-Car Video Systems					1		1				1
3PL											3
PPE			1								1
Medical Cameras					1						1
Food Kiosks	1							1	1		
Counters	1							1			
Displays				1	1	1					
Flat Panels				1	1						
Projectors			1	1							
Sound Systems			1								
Professional Telephone Systems									1		
Sub-total of dyads	**3**	**1**	**4**	**6**	**7**	**1**	**2**	**2**	**2**	**1**	**7**
Total number of dyads	**36**										

Table II. Number of dyads by product categories and supplier country

3.2 Data collection

The study was mainly based on 40 semi-structured interviews in one manufacturing multinational across 17 different product and service categories and services over a period of four months between June and September 2020. 30 participants provide a credible estimate within one organization (Saunders and Townsend, 2016). Data saturation was reached at 40 interviews. Data triangulation was possible with information available in the form of shared presentations, ad-hoc meetings, emails, but also phone calls. To enable a holistic viewpoint and deep understanding of the supply chain from the buyer's perspective, the individuals selected for the interviews were all working in the US headquarters and experts in either one, two, or three functions of the Supply Chain (i.e., (a) Procurement; (b) Planning: finished goods, repair, and services; (c) Transportation) across different managerial levels (i.e., senior buyer, senior planner, manager, senior manager, director, vice president) (Table III). We acknowledge that functions such as sales and R&D are important to the wider business, but these elements were outside the scope of the study.

Interviewee number	Managerial level	Age	Department	Product Category	Gender	Experience	Interview length in minutes
1	Manager	41-50	Procurement	Police Body-worn Cameras, Police In-Car Video System, Medical Cameras	Male	10+ years	33
2	Senior Manager	41-50	Transportation	3PL, Laptops, Handheld Devices, Tablets, Scanners	Female	10+ years	49
3	Director	41-50	Transportation	3PL, Laptops, Handheld Devices, Tablets, Scanners, Police Body-worn Cameras, Police In-Car Video System, Medical Cameras	Male	10+ years	51
4	Senior Manager	41-50	Supply Chain Planning	ALL	Female	10+ years	37
5	Senior Planner	21-30	Supply Chain Planning	Laptops, Handheld Devices, Tablets, Scanners	Male	4-6 years	34
6	Senior Manager	41-50	Procurement	Laptops, Handheld Devices, Tablets, Scanners	Male	10+ years	47
7	Senior Manager	51+	Transportation	3PL, Food Kiosks, Registers, Counters	Female	10+ years	44
8	Senior Manager	51+	Transportation	3PL, Laptops, Handheld Devices, Tablets, Scanners	Male	10+ years	38
9	Senior Planner	41-50	Supply Chain Planning	Food Kiosks, Registers, Counters	Female	10+ years	31

10	Senior Manager	51+	Transportation	3PL, Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems, PPE	Female	10+ years	38
11	Senior Buyer	31-40	Procurement	Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems	Female	7-9 years	32
12	Manager	51+	Supply Chain Planning	Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems	Female	10+ years	51
13	Senior Planner	31-40	Supply Chain Planning	Laptops, Handheld Devices, Tablets	Male	10+ years	36
14	Senior Planner	41-50	Supply Chain Planning	Police Body-worn Cameras, Police In-Car Video System, Medical Cameras	Female	10+ years	44
15	Senior Planner	41-50	Transportation	3PL, Laptops, Handheld Devices, Tablets, Scanners	Female	10+ years	54
16	Manager	51+	Supply Chain Planning	Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems	Male	10+ years	41
17	Senior Planner	51+	Transportation	3PL, Police Body-worn Cameras, Police In-Car Video System, Medical Cameras	Male	10+ years	43
18	Vice President	51+	Transportation	ALL	Male	10+ years	46
19	Manager	31-40	Procurement	Food Kiosks, Registers, Counters	Male	7-9 years	49
20	Senior Planner	31-40	Transportation	3PL, Food Kiosks, Registers, Counters	Male	4-6 years	34
21	Director	41-50	Procurement	Laptops, Handheld Devices, Tablets, Scanners	Female	10+ years	48
22	Manager	51+	Supply Chain Planning	Police Body-worn Cameras, Police In-Car Video System, Medical Cameras	Male	10+ years	42
23	Senior Planner	51+	Supply Chain Planning	Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems	Female	10+ years	36
24	Director	41-50	Supply Chain Planning	ALL	Male	10+ years	76
25	Senior Buyer	41-50	Procurement	Food Kiosks, Registers, Counters	Female	10+ years	46

26	Vice President	51+	Procurement	ALL	Female	10+ years	39
27	Senior Buyer	41-50	Procurement	Food Kiosks, Registers, Counters	Male	10+ years	43
28	Manager	31-40	Supply Chain Planning	Laptops, Handheld Devices, Tablets, Scanners	Male	7-9 years	39
29	Manager	31-40	Supply Chain Planning	Laptops, Handheld Devices, Tablets, Scanners	Female	7-9 years	35
30	Senior Planner	21-30	Supply Chain Planning	Laptops, Handheld Devices, Tablets, Scanners	Female	7-9 years	36
31	Senior Planner	31-40	Supply Chain Planning	Laptops, Handheld Devices, Tablets	Female	7-9 years	45
32	Vice President	51+	Supply Chain Planning	ALL	Female	10+ years	40
33	Manager	41-50	Procurement	3PL, PPE	Male	10+ years	44
34	Senior Planner	51+	Supply Chain Planning	Police Body-Worn Cameras, Police in-car video system, Medical Cameras	Male	10+ years	42
35	Manager	31-40	Procurement	Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems, PPE	Male	10+ years	38
36	Senior Planner	51+	Supply Chain Planning	Food Kiosks, Registers, Counters	Female	10+ years	40
37	Senior Manager	51+	Transportation	3PL, Police Body-worn Cameras, Police In-Car Video System, Medical Cameras	Male	10+ years	42
38	Senior Manager	31-40	Supply Chain Planning	ALL	Male	10+ years	43
39	Director	51+	Transportation	3PL, Food Kiosks, Registers, Counters, Professional Telephone Systems, Displays, Flat Panels, Projectors, Sound Systems, PPE	Male	10+ years	56
40	Senior Buyer	21-30	Procurement	Laptops, Handheld Devices, Tablets, Scanners	Female	4-6 years	32

Table III. Respondent profiles

93% of the interviewees had seven or more years of experience in the Supply Chain organization, while the other 7% had a minimum of four years. The informants were selected jointly with the executive team based on their

supply chain expertise and time on the job. No pattern emerged specifically from the employees' time at the organization, function, or managerial levels.

Held over Microsoft Teams, all interviews were recorded and fully transcribed. A few phone calls and emails were used after transcription for clarification. Guided by a literature review based on Daghar et al. (2021), an interview protocol was established leveraging broad defined themes in open-ended questions to enable exploration, avoid confusion for professionals, and trigger follow-up questions requiring explanative responses. To avoid misinterpretation from the interviewees regarding cognitive capital and SCRES, the question themes were kept comprehensible. Indeed, cognitive capital was investigated using terms such as shared goals, training, shared values, shared narratives, shared ideas, or shared experiences, while ideas of preparation, response, recovery, and learning were used to discuss SCRES around the experienced COVID-19 global pandemic disruption.

3.3 Data analysis

The data analysis was based on an open-coding procedure, followed by axial and selective coding processes that brought to light different main elements of cognitive capital. First, shared codes and language consisted of shared goals like increasing sales or deliveries, shared training on inventory surplus and shortage management, shared assumptions encompassed mutual understanding of partners' situations and actions, but also multilingualism or multilingual interactions with suppliers from other regions (e.g., Japan, China), and non-verbal/kinesics (face-to-face) language developed notably with local suppliers through frequent visits. Second, shared narratives embodied shared prior disruption experiences including tsunamis or abrupt increases in demand, shared values (i.e., commitment or integrity, empathy, honesty, fairness, gratitude, team mentality or collaborative mindset, customer-focus), shared philosophies revolving around lean versus high-inventory philosophies (i.e., low and optimized inventory focus versus high and anticipative inventory focus), shared business approaches influenced by social distancing (i.e., remote working, virtual communication, virtual negotiation), shared capabilities in terms of company structures, processes, or technologies (i.e., company size, number of department, processes, information sharing speed), and buyer-supplier national culture differences experienced through shared multicultural interactions between partners of different countries.

Figure 3 highlights the results of this analysis, with the new elements underlined to distinguish them from the literature-derived concepts shown in Figure 1. Using the cognitive capital framework in Figure 3, the data coding was processed in NVivo 12, helping with the systematization of substantial textual data (Johnson et al., 2013).

Caption:
Regular font: cognitive capital dimensions discussed in the literature
Underlined font : underexamined cognitive capital dimensions in the literature

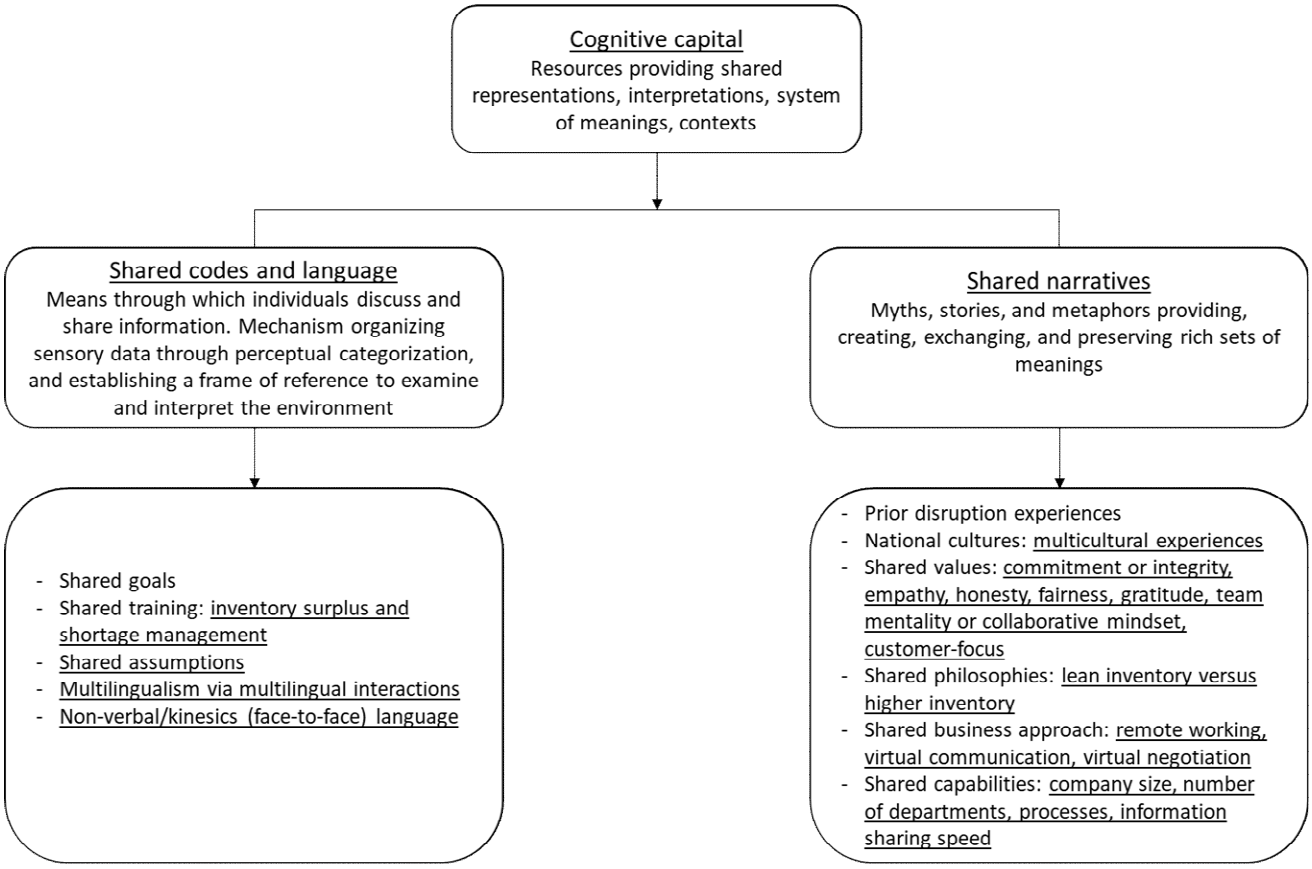

Figure 3. Cognitive capital coding and main data-based theme development

To better understand the data collected about cognitive capital elements, the top cognitive capital elements were ranked (Table IV) by percentage of participants discussing them per SCRES temporal capabilities in two different situations emerging and consisting of increased or decreased demand levels. Table IV is only illustrative and informative. It is not a claim or generalization of cognitive capital element importance. In this table, specific cognitive capital elements emerged in the interviews more frequently than others in relation to SCRES temporal capabilities (i.e., preparation, response, recovery, learning), and pandemic-driven demand patterns (i.e., increase, decrease). First, in SCRES preparation, prior disruption experiences, honesty, and face-to-face or kinesics language seem to prevail in building relationships regardless of how demand behaves. Second, in SCRES response, shared goals, shared assumptions, and virtual communication are essential when demand increases to promote collaboration geared towards sales, while shared assumptions and values of honesty and empathy become critical in determining what to do with oversupply when demand decreases. Third, in SCRES recovery, shared process

capability and team mentality foster problem resolutions whether demand increases or decreases. Shared goals bring partners together when demand increases, enabling shared profit, while shared assumptions are used to clarify contexts when demand decreases, notably when overstocking is a concern. Fourth, in SCRES learning, when demand increases, shared lean philosophy becomes obsolete, training on how to manage shortages turns into a necessity, and values of integrity and commitment become a sign of reliable relationships. When demand decreases, virtual negotiation takes precedence, particularly in stock positioning conflicts, training on how to manage surplus stock becomes relevant, and multilingual interactions, notably with geographically distant suppliers, create bonds propitious to consensus.

SCRES preparation				
Demand level	**Rank**	**Cognitive capital element**	**Cognitive capital dimension**	**Participant %**
↑ Demand	1	Prior disruption experiences	Shared narratives	46%
	2	Face-to-face/kinesics language	Shared codes and language	23%
	3	Honesty	Shared narratives	18%
	3	Gratitude	Shared narratives	18%
↓ Demand	1	Prior disruption experiences	Shared narratives	43%
	2	Honesty	Shared narratives	29%
	3	Face-to-face/kinesics language	Shared codes and language	14%

SCRES response				
Demand level	**Rank**	**Cognitive capital element**	**Cognitive capital dimension**	**Participant %**
↑ Demand	1	Shared goals	Shared codes and language	47%
	2	Shared assumptions	Shared codes and language	31%
	3	Virtual communication	Shared narratives	21%
↓ Demand	1	Shared assumptions	Shared codes and language	62%
	2	Honesty	Shared narratives	34%
	3	Empathy	Shared narratives	21%

SCRES recovery				
Demand level	**Rank**	**Cognitive capital element**	**Cognitive capital dimension**	**Participant %**
↑ Demand	1	Shared process capability	Shared narrative	52%
	2	Shared goals	Shared codes and language	34%
	3	Team mentality or collaborative mindset	Shared narrative	30%
↓ Demand	1	Shared assumptions	Shared codes and language	43%
	2	Team mentality or collaborative mindset	Shared narrative	25%
	3	Shared process capability	Shared narrative	21%

SCRES learning				
Demand level	**Rank**	**Cognitive capital element**	**Cognitive capital dimension**	**Participant %**
↑ Demand	1	Lean versus high inventory philosophy	Shared narrative	49%
	2	Training on inventory shortage management	Shared codes and language	25%
	3	Integrity or commitment	Shared narrative	19%
↓ Demand	1	Virtual negotiation	Shared narrative	25%
	2	Training on inventory surplus management	Shared codes and language	25%
	3	Multilingual interactions	Shared codes and language	25%

Table IV. Top cognitive capital elements per SCRES temporal capability

The SCRES capability framework (i.e., prepare, respond, recover, learn) based on Ali et al. (2017) and others (Hendry et al., 2019; Johnson et al., 2013; Jüttner and Maklan, 2011; Sá et al., 2019; Scholten and Schilder, 2015) highlighted action verbs per SCRES capability (Figure 2).

The interviews were collected during the pandemic. Quotes involving cognitive capital's elements (Table V) were organized using the cognitive capital framework in Figure 3 and SCRES action verbs in Figure 2. Pre-COVID experiences were connected to SCRES preparation, while intra-COVID experiences were linked to SCRES response, recovery, and learning offering an episodical view (Helferich and Cook, 2002; Kovács and Spens, 2007; Natarajarathinam et al., 2009; Scholten et al., 2014).

Dimension	**Sub-dimension**		**Illustrative quote**
Shared codes and language	Shared goals		*"The suppliers need to share our objectives so that we can go beyond what our contractual obligations are, right? You need to have the same to build a relationship. If you're on completely different paths, it's never going to work. Yeah, unless you can find some common ground. So, I think having the same goals matters a lot for strategic partnership and if they're not aligned, then we are going to have issues in that partnership. When your goals align, you get things done quicker". Senior Manager, interviewee 10*
	Training	Inventory surplus/shortage management	*"I was not trained for this crisis. I do think it would be helpful to have predicted a crisis. We would have managed some of our inventories differently. When there's a crisis, you just react to it, you learn through experience. Ah, you put out the fire, you take care of it". Senior Planner, interviewee 9*
	Shared assumptions		*"When they started telling me why the situation is what it is, then I started understanding the reasons. That is the evolving part of the relationship. And now, since we are on the same page, we are continuing to move forward with our strategic partnership, even if we are finding them not honoring the contract agreements, because we understand why pricing is beyond their control". Director, interviewee 3*
	Multilingualism		*"We usually have used some planners who luckily speak Japanese or Chinese with our suppliers on the phone located in Asia to better understand each other in times of rush". Manager, interviewee 29*
	Non-verbal/kinesics communication		*"I don't care what people say about TEAMS and all that stuff, you have to build that relationship face-to-face. So, I think the ones that I did not have that face-to-face camaraderie with, that was a big hindrance. It's hard for me to gauge people's honesty when I don't see them. On the phone, you can't read any of the facial expressions, the body language, and you're just going by someone's tone, and you have no idea what they're working with". Director, interviewee 24*
Dimension	**Sub-dimension**		**Illustrative quote**
Shared Narratives	Shared prior disruption experiences		*"We've had other situations in the past where we've had to deal with port lock downs and extended factory closures for other reasons, and so we had a little bit of experience dealing with supply chain disruption. So, I think just all those elements put together and our experience in dealing with situations like that in the past have helped out". Senior Buyer, interviewee 25*

	National culture	Multicultural experiences	*"In Japan, they thank you. They thank you for sending emails, they thank you for replying...My German vendor and my vendor in Italy are very strict. They are very much about the contract. They abide by everything that has to do with the contract. It is very hard to get them to adjust an invoice for instance. The European vendors, they point everything out to you. They want to make sure everything is out in the open, and everything is communicated". Senior Planner, interviewee 27*
			"With our domestic vendors, it's more of an informal conversation with them. If they need something quickly, they shoot me a text or give me a quick phone call. So, having a conversation with them is much easier". Senior Manager, interviewee 25
			"Overall, we are all in different places, but have the same goals in lowering inventory for example, getting things shipped out, decreasing our metrics or increasing depending on what metric you're looking at. We're all on the same page but we react and project things differently. So, it doesn't matter what the culture is, we all have the same goals and comply with our procedures and requirements". Senior Manager, interviewee 30
	Shared values	Commitment or integrity	*"I think these kinds of difficult, challenging times really show what companies actually follow through when things get tough. When suppliers don't respect their commitments, I will always remember that when I run my next request for pricing". Director, interviewee 3*
		Empathy	*"I learned how to be patient a little bit because they all have problem like us, and when you understand them, they want to return the favor". "Being a little more conscious about how they are doing like saying: I hope you and your family are well, helped calm us down and get things done". Senior Planner, interviewee 23*
		Honesty and Fairness	*"We've always treated people outside our company with the same honesty and fairness as we do inside the company. Consequently, most of our suppliers have dealt with us honestly and fairly. They don't have the same models, creed, basic principles and culture as us, but being fair with each other definitely helped our relationship". Manager, interviewee 22*
		Gratitude	*"For example, in Japan, I show a great deal of respect, you know. You start out your communications with "thank you for your usual support" or "thank you for your daily support", either ending it or beginning it with that note". Senior Planner, interviewee 36*
		Team mentality	*"If you don't have the team mentality, if each partner doesn't do its part, you're going to fail". Senior Manager, interviewee 37*
		Customer-focus	*"Those friendly suppliers that had strong customer-centric cultures were able to respond a lot faster and were more supportive than those who had just more kind of profit-based revenue business sense goals in mind for the relationship. So, I found that our collaborative partners and suppliers who had like-minded customer mindset were far simpler to deal with and could relate to our requests in a much more rapid pace than those suppliers of ours that were more transactional cost-based". Vice President, interviewee 18*
	Shared philosophies	Lean versus higher inventory	*"I do not think I have ever worked anywhere that was so lean before, but this company's general philosophy is no safety stock. So, I think one of the lessons is to have a little bit additional in our warehouses, or with our channel partners". Senior Manager, interviewee 4*
	Shared business approaches	Remote working	*"I think both the suppliers and our organization were really quick to adapt to the technology to adapt to the working from home culture. We were used to it before the pandemic. That is one thing that I noticed helped us collaborate". Manager, interviewee 35*

		Virtual communication	*"Luckily my work can be performed with just a laptop, of course with the internet. The only thing was that I had to wait longer for responses because our suppliers were inundated with emails. So, I called them instead sometimes". Senior Planner, interviewee 13*
		Virtual negotiation	*"It's better to get everybody in a room to have a meeting. You know you can do it on TEAMS, but it's really not the same because you don't know who's rolling their eyes, and most people don't like to put their camera on. But, you know, we negotiate for a living. And, it's a lot harder to negotiate via the web when I can't see somebody because I can't read how they're absorbing my information, or I can't perform body language to tell them one thing while my mouth is saying another. And, not to be deceitful, but as a negotiation tactic, I have to kind of play that. So, you've had to try to learn some alternate negotiation strategies or talking strategies when it comes to that approach. I am learning a bit more of how to do this virtually, and how to get responses and speak better. And, with the body language missing, I am learning how to interpret information and how to ask for clarity sometimes when I don't get it". Senior Manager, interviewee 6*
	Shared capabilities	Size	*"The bigger the organization is the better it can survive because it can take a financial hit like inventory increase or revenue loss. So, we helped our smaller suppliers by holding their stocks". Manager, interviewee 28*
		Number of departments	*"Because we have so many departments, they also sometimes experience delays due to some of the red tape that we would have here". Senior Manager, interviewee 4*
		Processes	*"When suppliers deal with us, they have issues because some of our manual processes are not something they can handle because they're more automated, but we put in place reports like the backlog report to follow-up ". Manager, interviewee 1*
		Information sharing speed	*"Suppliers sent their rates automatically. I will then need to reach out to different departments and get approval, and then come back to the suppliers to tell them okay this is approved. All this takes time. And then by the time you finally got approved, the rate might not be valid anymore because the market rate changes daily". Senior Manager, interviewee 2*

Table V. Illustrative quotes

The thematic analysis, patterns, and interview transcriptions were recorded in a database. Multiple sources of information consisting of interviews, follow-ups when needed, executive conversations, documents, and databases enabled data triangulation, which increased the reliability and validity of the results (Yin, 2018). All interview transcriptions were sent to respondents for verification.

4. Findings

4.1 SCRES preparation

4.1.1 Shared codes and language

Pre-COVID, ELECTRO Co's past face-to-face interactions with suppliers enriched shared information, not only enabling better grasp and conveyance of information, but also strengthening relationships, trust, and same-page attitude. This relational closeness, eased by past face-to-face communication, helped prepare and facilitate virtual interactions during the pandemic, notably in negotiations.

Also, prior to COVID, ELECTRO Co relied on few multilingual workers to communicate with (e.g., Vietnamese) suppliers having issues with English. Identification of multilingual team players prepared ELECTRO Co for future disruptions requiring language skills.

4.1.2 Shared narratives

ELECTRO Co relied on pre-prepared solutions mapped out from past supply disruptions such as tsunamis hitting Japanese suppliers or positive demand shocks (i.e., sudden demand increases) in the US. These prior disruption experiences developed shared survival goals, and buyer-supplier familiarity needed to improve joint threat recognition and built preparation plans avoiding time wasted in goal recalibration.

A pre-COVID shared collaborative team spirit had long existed between ELECTRO Co and most of its suppliers, which eased collaborative efforts during the crisis. However, while some agreed-upon collaboration on lean and just-in-time inventory philosophies previously helped minimize ELECTRO Co's stock before the crisis, they became disastrous after COVID hit, particularly for products sourced from Japan with sudden demands. Still, with an already built shared value system consisting of empathy, honesty and fairness, ELECTRO Co and its suppliers were mentally prepared for the pandemic shock. Indeed, empathetic anteriorly formed relationships were beneficial during the crisis as they helped prepare ELECTRO Co to facilitate conversations with suppliers.

Differences between ELECTRO Co and its suppliers in terms of size and processes influenced the velocity of shared information before the pandemic started. In fact, ELECTRO Co noticed that its high number of employees and departments involved in decision-making processes retarded internal information circulation and risk sensing, which ultimately hampered external communication with suppliers. For example, most 3PL suppliers in the US shared information automatically, whereas ELECTRO Co had to manually share data. This difference in information sharing speed and automation desynchronized effective decision-making in the past. Although not being highlighted as a major problem before the crisis, this information delay became far more significant during COVID,

preventing the propagation of risk recognition needed in swift decision-making, rendering the buyer unprepared to effectively recognize internally and share externally information. Nevertheless, with solid cash flow and a diverse product portfolio, ELECTRO Co was more financially prepared than its smaller suppliers to hold inventory and lose revenue.

ELECTRO Co made some cultural observations about the way suppliers from different national cultures responded, shared information, and communicated before the crisis. In Asia, Japanese suppliers seemed to be highly responsive, and often anxious to answer and quickly execute requests. They also constantly expressed gratitude in emails or by phone and considered respect to be very important. Consequently, ELECTRO Co learned through the years to reciprocate that gratefulness to align shared values. As to American suppliers, they tended to be direct and informal, sharing information via phone calls and text messages, while Italian and German suppliers were more formal, yet open in their interactions. Although these national culture disparities were not noticeably performance disruptive before COVID, ELECTRO Co's experience with these differences proved to be helpful to anticipate suppliers' behaviors and prepare for the crisis, and it was a source of comment from the respondents.

4.2 SCRES response

4.2.1 Shared codes and language

Shared goals emerged as the most cited cognitive capital element in SCRES response. Overall, the pandemic created a common goal to survive, regardless of demand increases or decreases. Rapid goal synchronization with suppliers prioritizing high-revenue shipments, became fundamental in improving response time. On the other hand, unmatched goals created response delays. Specifically, when suppliers tried to minimize costs by delivering poor quality, ELECTRO Co had to recalibrate quality expectations, which delayed effective response plan implementations.

Shared assumptions during daily operations, across all product and service categories, facilitated joint problem-solving, planning, and decision-making needed to evaluate and respond to risks. The more ELECTRO Co understood how suppliers were grappling with their environments, the smoother and quicker responses were implemented collaboratively. For example, any supply disruptions or transportation price fluctuations were handled immediately with suppliers through virtual meetings to respond effectively.

Before COVID-19 hit, some difficulties in understanding each other in English existed between ELECTRO Co and Asian suppliers in Vietnam and China, but the handicap was manageable as the information shared via emails was simple and not frequent. Nevertheless, as soon as COVID appeared, the level of information-sharing increased, triggering this linguistic difference to become more prominent. Fortunately, ELECTRO Co had some multilingual

employees assisting in conveying complex ideas to Asian suppliers when needed. Multilingualism enabled quick situation assessments and responses.

4.2.2 Shared narratives

ELECTRO Co considered integrity, team mentality or collaborative mindset, customer focus, empathy, and honesty helpful in improving alertness and reaction time needed to recover. Indeed, intra-COVID, ELECTRO Co went as far as reconsidering engagements with suppliers not expressing these traits, especially with transportation carriers that kept pushing multiple times their acknowledged shipment dates or were slow to answer ELECTRO's inquiries. Constantly looking for a trusted, aligned, partner, ELECTRO Co highly weighted suppliers' integrity and commitment. In fact, to avoid replacement back-ups, time to transition, and long response times, some employees infected by COVID-19 at ELECTRO Co kept working remotely with their suppliers to quickly respond to the crisis. Regular virtual communication strengthened relationships and enabled the implementation of response plans. Shared values of empathy and honesty, while sharing information, promoted transparency, which helped to assess risk. Essential shared high-inventory philosophies, notably in the aftermarket repair business, allowed ELECTRO Co to respond quickly to demand variability.

Shared experiences, such as tsunamis or abrupt demand increases, created relational bonds and joint reflexes like information sharing, stress containment, and shared planning, making ELECTRO Co and its suppliers more responsive to threats. Also, ELECTRO Co noticed that past multicultural experiences became instrumental to respond to disruptions from Asia.

In terms of shared capabilities, some suppliers had faster and more automated information-sharing capabilities than ELECTRO Co. For example, fluctuations in transportation and personal protective equipment (PPE) prices were disseminated by suppliers real-time and needed approval almost immediately. Disrupting response time, the approval process was manual and time-consuming at ELECTRO Co, with individuals working remotely at different levels and departments. Often using the Procurement team to negotiate these rates, ELECTRO Co delayed rates approval, but made intensified virtual negotiations a new key relational component with 3PL and PPE suppliers.

4.3 SCRES recovery

4.3.1 Shared codes and language

Shared goals, across product and service categories, facilitated teamwork, problem-solving, and process building. All partners wanted to survive the crisis financially. This common goal, along with a customer-satisfaction focus,

increased communication, shifting mindsets towards forecast refinement to ensure sales and business continuity. Misaligned goals emphasized the utilization of tools such as supplier performance management, leveraging contracts, metric tracking and risk identification allowing for progressive recovery. Dyads with conflicting sales goals, where ELECTRO Co saw decreased sales and suppliers were stuck with inventory, had jointly to balance the inventory. Communicating frequently, partners understood the unfortunate ramifications of the global pandemic, which smoothed inventory management negotiations and process development.

Through virtual communication, by ways of emails, MS Teams calls, video chats, and messages, partners stayed in touch to enable constant shared assumptions. These helped clarify goals, create joint processes, resolve daily issues, and ensure business continuity. For instance, shared assumptions of problems such as absenteeism or lockdowns forced dyads to find helpful solutions including quick hiring, shift rescheduling, and remote working to resume logistical operations.

4.3.2 Shared narratives

Shared values consisting of integrity, team mentality, customer focus, empathy, and honesty helped recovery from the impact of the pandemic. ELECTRO Co relied heavily on suppliers taking ownership of their commitments to keep operations running. ELECTRO Co exchanged trust against supplier's integrity and found shared team mentality and customer-focus to be valuable assets easing communication, problem-solving, and process-building in the recovery process. Demonstrated through regular virtual communication, shared integrity, team mentality, and customer focus eased the implementation of risk mitigation processes and recovery plans. During COVID, shared values of empathy and honesty, while sharing information, supported effective negotiations needed to recover. Moreover, shared high-inventory philosophies in the repair business kept service operations running.

Shared process capability supported ELECTRO Co's recovery across product and service categories. For example, shared demand forecasting, and inventory allocation processes became indispensable to anticipate unexpected demand and prioritize high-value customers. Furthermore, shared processes around information sharing frequency, backlog management, delivery allocation, alternative transportation route planning, shift scheduling and separation, but also virtual communication and negotiations became crucial for maintaining day-to-day operations.

4.4 SCRES learning

4.4.1 Shared codes and language

During the pandemic, ELECTRO Co expressed the need to develop special training for high demand products by managing inventory shortages through increased stock and multi-sourcing approaches for products sourced in

Vietnam, Malaysia, and China. As for decreased demand products, ELECTRO Co highlighted the need for training on how to handle surplus stock by developing or using already established customer networks in other regions to sell. Finally, ELECTRO Co recognized how key multilingual actors can bridge misunderstandings between countries sharing information. In fact, ELECTRO Co is contemplating asking Asian suppliers for English speakers to be more actively involved in buyer-supplier interactions.

4.4.2 Shared narratives

Inevitably, with demand picking up, just-in-time methodologies handicapped ELECTRO Co's ability to fulfill customers' increased demand for some product categories. Thus, ELECTRO Co learned to rethink the lean inventory philosophy with suppliers by adding safety stocks to guard against future disruptions.

From a value perspective, ELECTRO Co learned who were the suppliers who kept their commitment and integrity. Particularly, some large third-party logistics providers will not be reconsidered for business because of their lack of communication or commitment during the pandemic, while smaller logistics providers who were more responsive and committed won business with ELECTRO Co. Using empathy, ELECTRO Co also learned that most suppliers reciprocated the empathetic behavior by trying their best to perform, which strengthened relationships, continuous improvement, and performance.

ELECTRO Co's managers remarked that established and aligned goals and processes made consensus favorable during the pandemic, regardless of suppliers' national differences. Accordingly, ELECTRO Co learned to develop relationships over virtual settings through frequent scheduled meetings. The intent was to strengthen ties with suppliers and ensure alignment of goals and processes. Finally, during COVID-19, ELECTRO Co learned how to negotiate over the internet and phone to compensate for the lack of face-to-face communication with American suppliers. With increasing buyer-supplier virtual interactions, ELECTRO Co highlighted remote working, and virtual negotiation as new key kills to promote in a socially distant environment.

5. Discussion

This study focuses on the SCRES temporal capabilities of preparedness, response, recovery, and learning. In light of more contemporary debates from multiple disciplines (i.e., engineering, ecology, economics, to social sciences), we draw from complex adaptive systems (Day, 2014), and the concept of antifragility (Nikookar et al., 2021; Taleb, 2012) by considering the learning phase as growth in the face of turbulence enabled by post-disruption learning (Hendry et al., 2019), which is consistent with the resilience ideas of adaptation and transformability (Walker, 2020; Wieland and Durach, 2021), but also antifragility going beyond resilience as it embraces and learns from disorder rather than avoiding it (Nikookar et al., 2021; Taleb, 2012).

The results reveal the unique role that the various elements of cognitive capital play in the SCRES temporal capabilities to prepare, respond, recover, and learn, through the lens of two contingencies: (1) product and service categories with steep demand fluctuations (i.e., increase, decrease) (Chopra and Sodhi, 2004), and (2) the supply-base complexity element of supplier geographical proximity (Choi and Krause, 2006) (Figure 4). Throughout the information collection and analysis process, propositions emerged from the data. The proposition development logic follows a sequential four-step process: (1) the analysis of all the interviews to classify and understand the cognitive capital elements (Table V); (2) the definition of the SCRES temporal capabilities to prepare, respond, recover, and learn (Figure 2); (3) the statistical analysis of the top cognitive capital elements that surfaced from interviewees for every SCRES temporal capability (Table IV); this step cross-referenced data from the interviews with SCRES temporal capabilities and ranked top cognitive capital elements per SCRES capability; and (4) the consolidation of the main cognitive capital elements and observed contingencies that influence specific SCRES temporal capabilities (Figure 4).

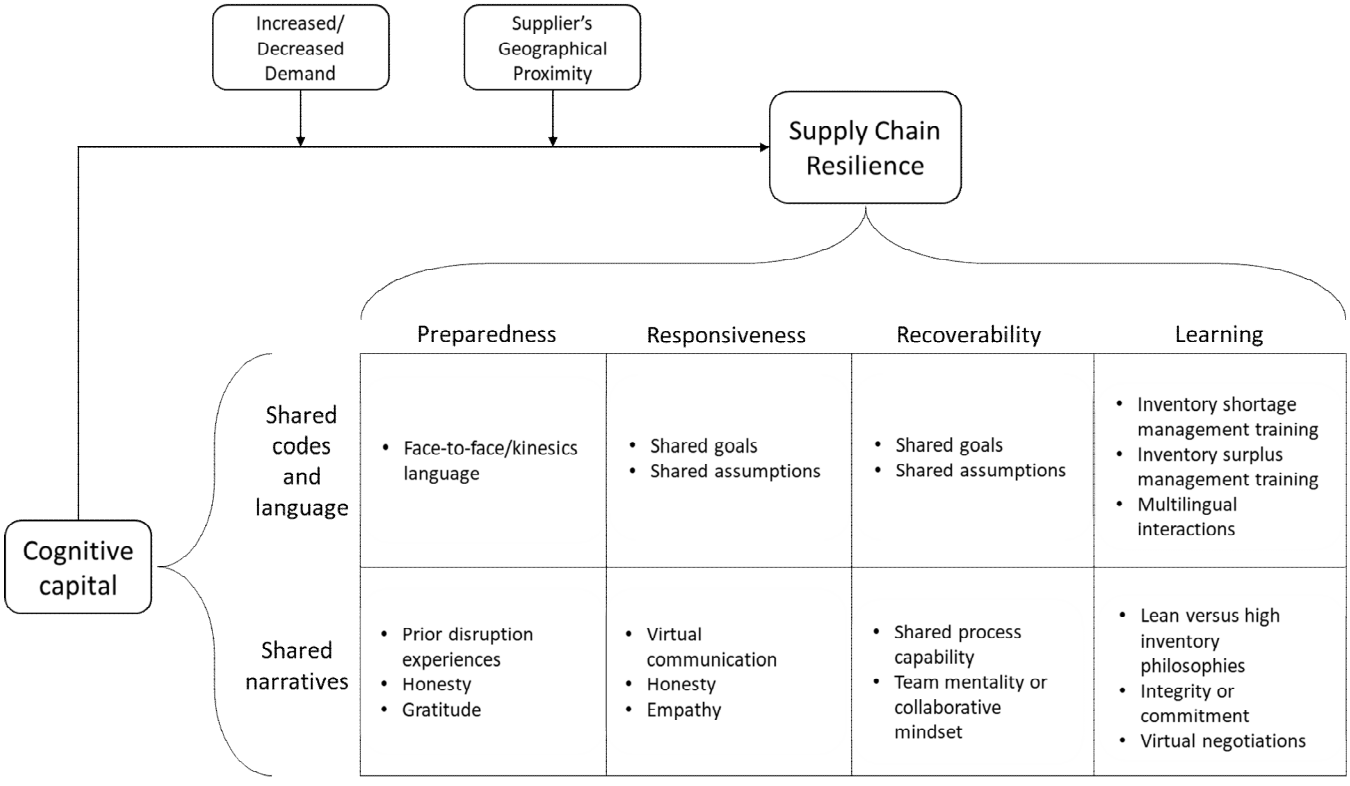

Figure 4. Main cognitive capital elements and contingencies influencing SCRES

5.1 The role of cognitive capital in SCRES preparation

Past physical buyer-supplier interactions strengthen relationships by familiarizing partners with each other, improving communication and trust needed for crisis preparation. Employees who already developed shared kinesics language with suppliers in the past, missed face-to-face communication, particularly with geographically close suppliers because of the socially distant environment.

Buyer-supplier prior disruption experiences improved SCRES preparation. Through participative, continuous, and shared sense-making processes, cognitive capital develops shared understanding used to share information (Carey et al., 2010; Krause et al., 2006). Pre-COVID events such as tsunamis or production shutdowns helped dyads better acquaint with disruptions, regardless of product categories. Also, building shared values such as honesty invigorated buyer-supplier trust, information exchange and understanding, helping better prepare for crisis.

Looking at differences between suppliers' geographical distances from the buyer, prior disruption experiences seem to be critical across all products and services no matter where suppliers are located, while kinesics interaction appears to be important in dyads with US-based suppliers, potentially because they are located in the buyer's region. Moreover, honesty and gratitude are fairly underlined by the buyer dealing with suppliers in Japan, where these values are important. As to American suppliers, they tend to share information informally via phone calls and text messages, while Italian and German suppliers use emails formally, remaining open in their interactions.

Consequently, the following proposition is developed:

Proposition 1. *For increased and decreased demand categories, buying firms that share kinesics language, prior disruption experience and values with their suppliers are more likely to make their supply chain prepared for an unexpected disruption. Kinesics language is more likely shared with geographically close suppliers, while shared values are more likely adjusted to be consistent with geographically distant suppliers.*

5.2 The role of cognitive capital in SCRES response

During response time, aligned goals, shared assumptions, and virtual communication avoid wasted time in goal recalibration, and shorten problem-solving time when demand for materials increases. Indeed, shared goals and assumptions enable better understanding (Johnson et al., 2013), facilitate quick joint decision, and create expected norms and behaviors (Fan and Stevenson, 2018), avoiding conflict (Villena et al., 2011).

Generally, low supply dispersion means low supply risks for buyers (Lei et al., 2019), who prefer dependable, responsive, and geographically close suppliers for quick problem-solving (Ellegaard, 2008). Examining differences

between suppliers' geographical distances with the buyer, virtual communication seemed essential, to keep information flowing and join efforts during the crisis, particularly with distant suppliers in Asia and Mexico.

For decreased demand products, partners had conflicting goals because the buyer did not want stock, while suppliers were trying to push inventory to the buyer. Constant communication fine-tuned buyer-supplier shared assumptions about each other's situation, while shared values of honesty and empathy alleviated tension and facilitated quick response time.

Overall, these propositions are suggested:

Proposition 2A. *For increased and decreased demand categories, buying firms that share assumptions with their suppliers are more likely to make their supply chain responsive to an unexpected disruption.*

Proposition 2B. *For increased demand categories, buying firms that share goals, and virtual communication with their suppliers are more likely to make their supply chain responsive to an unexpected disruption. Virtual communication may be particularly valuable with geographically distant suppliers.*

Proposition 2C. *For decreased demand categories, buying firms that share values with their suppliers are more likely to make their supply chain responsive to an unexpected disruption.*

5.3 The role of cognitive capital in SCRES recovery

Cognitive capital aspects are key enablers of inter-firm collaborations (Alinaghian et al., 2020; Boschma, 2005). Shared goals can encourage information sharing and ideas, but also enhance shared understanding, which reduces disagreements and refines the sense of shared responsibility, role, and task ownership (Chowdhury et al., 2019). During the crisis, selling was the number one goal for partners faced with increased demand, which enabled shared assumptions. Shared process capabilities became essential to control backorders, share forecasts, manage delivery priorities, monitor shift scheduling and separation, find transportation alternatives, and handle steep demand increases. Crucial in enabling a progressive recovery, team mentality facilitated communication and collaboration, which helped keep operations running.

When product demand decreases, the buyer avoids replenishment, while suppliers intend to ship inventory to the buyer. In this context, team mentality and shared assumptions become critical to keep business harmony, thus making shared process capabilities such as forecast sharing and regular virtual calls essential in the recovery process.

No major differences in cognitive capital elements are found regardless of suppliers' geographical distances with the buyer.

This leads to the development of these propositions:

Proposition 3A. *For increased and decreased demand categories, buying firms that share process capability, and team mentality with their suppliers are more likely to make their supply chain recover from an unexpected disruption.*

Proposition 3B. *For increased demand categories, buying firms that share goals and assumptions with their suppliers are more likely to make their supply chain recover from an unexpected disruption.*

Proposition 3C. *For decreased demand products, buying firms that share assumptions with their suppliers are more likely to make their supply chain recover from an unexpected disruption***.**

5.4 The role of cognitive capital in SCRES learning

Lean inventory philosophy precluded production ramp-ups for increased demand products and services. Consequently, the buyer learned to add safety stocks to plan for the worst. The lack of inventory shortage management training delayed the buyer's ability to find stock, but ultimately triggered the buyer to identify resolution plans and train teams to follow them. Facilitating a self-reinforcing process of sensemaking (Weick, 1995), shared values such as integrity or commitment became important factors for the buyer to gauge suppliers' dedication during the crisis. Integrity was difficult to evaluate for a few distant suppliers who did not consider virtual communication indispensable.

Regarding low-demand product, virtual negotiation is essential to convince suppliers to keep extra inventory in-house, particularly when suppliers are not geographically close to the buyer. Training on how to manage stock surplus for decreased demand products is an important factor to consider for future crises. Shared language eases communication, collaboration, and understanding (Inkpen and Tsang, 2005). Accordingly, the buyer realized quickly that sharing information in suppliers' national languages is often helpful in problem-solving.

The following propositions are elaborated:

Proposition 4A. *For increased demand categories, buying firms that focus on their shared lean inventory philosophies, inventory shortage management trainings, and partners' integrity levels with their suppliers are more likely to make their supply chain learn how to alleviate an unexpected disruption. Integrity is more difficult to assess with geographically distant suppliers not favoring virtual communication.*

Proposition 4B. *For decreased demand categories, buyer organizations that develop their virtual negotiation and multilingual skills, and inventory surplus management trainings with their suppliers are more likely to make their supply chain learn how to alleviate an unexpected disruption. Virtual negotiation and multilingual skills are particularly valuable with geographically distant suppliers.*

6. Theoretical contributions, managerial implications, and future research

6.1 Theoretical and managerial contributions

This paper contributes to the literature on supply chain risk and resilience and buyer-supplier relationships using an empirical approach. First, this study contributes to the supply chain risk and resilience literature by establishing the importance of cognitive capital embedded in a buying firm's relationships with suppliers (e.g., Johnson et al., 2013) in its SCRES capabilities. While the existing literature is heavily geared towards the structural and relational aspects of social capital, this paper extends the understanding of the role of cognitive capital by identifying its underlying relevant elements and their interrelationship with the four SCRES capabilities of prepare, respond, recover, and learn (e.g., Hendry et al., 2019; Ponomarov and Holcomb, 2009). In particular, drawing data from a unique supply chain disruption context caused by the COVID-19 pandemic, this study extends the previous literature by unpacking the role of cognitive capital in the temporal SCRES capabilities observed to be at play as the disruption events unfolded. Also, the study of a disruption resulting in global fluctuations in both supply and demand enabled the identification of two contingencies (the impact of disruption on category demand in terms of demand increase vs. decrease and supplier geographical proximity) that affect the relationships between different aspects of cognitive capital and SCRES capabilities. This study further adds to the buyer-supplier relationship literature by identifying new elements of cognitive capital that are embedded in buyer-supplier relationships. New cognitive capital elements include kinesics language, strengthening relationships before the disruption, and shared values such as integrity and empathy, which are helpful in avoiding tensions. Business approaches like remote working, virtual communication and virtual negotiation enable information sharing and business continuity, while multilingualism clarifies communication with suppliers more comfortable in their native language. The supply chain risk and resilience literature has been highly analytical favoring mathematical reasoning over empirical approaches obtained from data and observation. Indeed, a high proportion of simulation and modeling papers examines contract optimization minimizing supply chain risks (Daghar et al., 2021), while empirical studies based on surveys and case studies remain limited (Ali et al., 2017; Tukamuhabwa et al., 2015). Daghar et al. (2021) in their review specifically note the dearth of work looking at the role of cognitive capital in supply chain resilience and call for qualitative work to understand it more fully. This paper is a response to that call.

The results of this study offer practitioners several practical implications. First, the insights of this study can help practitioners capitalize on and/or develop various facets of cognitive capital that are embedded in their relationships with their suppliers to enhance their organization's ability to prepare for, respond to, recover, and learn from supply chain disruptions. Indeed, for example, practitioners can use this study to examine particular cognitive capital elements that influence negatively their ability to prepare, respond, recover, and learn with their suppliers. Furthermore, this study brings to the fore two contextual factors (categories with increased vs. decreased demand as well the geographical proximity of suppliers with the buying firm) that managers need to be aware of when analyzing the various facets of cognitive capital in relation to their SCRES capabilities. Analyzing these different aspects of cognitive capital episodically with the demand pattern and suppliers' geographical proximity can help contextualize how cognitively aligned partners are for every SCRES temporal capability. This can enable professionals to make more informed decisions when considering SCRES capability opportunities such as partner selection and relationship arrangements, sourcing strategies, governance mechanisms including contracts, process development and improvement, or any collaborative activities. This study provides managers with an analytical tool to manage the potential harmful effects arising from misalignments between parties in terms of interpretations and meanings, values, and goals. Procurement and supply chain management professionals may need to reconsider or even disengage from cognitively misaligned suppliers, as unshared values, assumptions, goals, approaches, experiences, and languages can add to the complexity of supply chain relationships and reduce their effectiveness in achieving resilience in supply chains.

6.2 Future research agenda

Clarifying theoretical concepts in practice, this paper cannot establish statistical generalizations, but is an invitation for future research on cognitive capital's operationalization, and interaction with other social capital dimensions (i.e., structural, relational) and SCRES. Theoretical lenses (e.g., social network analysis, social psychology), and different units of analysis consisting of multi-level studies (i.e., individual level, organizational level) could assist in the investigation.

First, cognitive capital's nature is difficult to decipher in context because of its richness and entanglement with other social capital dimensions (Nahapiet and Ghoshal, 1998). Indeed, shared codes and language, and shared narrative elements are part of any supply chain ecosystem, but remain diverse, contextual, and thus hard to collect. Cognitive capital has been examined with the rest of the other social capital dimensions, mostly in surveys and a few qualitative studies. Yet, cognitive capital remains misunderstood throughout the literature, rendering its full operationalization challenging. Some cognitive capital elements could require several studies to grasp the full extent of their meaning in context such as shared values (e.g., honesty, fairness, gratitude, empathy, or

integrity), kinesics or face-to-face language, and training. Scarcely noted in the literature, specific cognitive capital elements such as shared identity and management styles need assessment, especially because of their day-to-day practicality.

Second, the interaction of cognitive capital's elements on their own, but also with other social capital dimensions (i.e., structural, relational) and SCRES has been underexplored throughout the literature. Indeed, some cognitive element levels might trigger other cognitive elements to intensify or decline. For example, shared assumptions could facilitate shared goals or vice-versa, and shared values like integrity could increase empathy. This study invites the analysis of how cognitive capital develops, accumulates, cancels, decreases, or counteracts with other evolving social capital dimensions. Despite research calls on cognitive capital (Daghar et al., 2021), and some of its elements such as organizational culture (Revilla and Saenz, 2017) or national cultures (Gupta and Gupta, 2019), cognitive capital elements' interaction with each other's and SCRES remain superficial in the literature. Qualitative work could delineate the relationships between cognitive capital and SCRES, while quantitative research could assess how cognitive capital accounts for the variation of the SCRES' most cited enablers (i.e., collaboration, flexibility, visibility, velocity) (Jüttner and Maklan, 2011) for every SCRES temporal capability (i.e., prepare, respond, recover, learn). Further research could also examine interrelationships between social capital, particularly cognitive capital and the concept of antifragility or the ability to go beyond resilience by embracing and learning from disorder rather than avoiding it (Nikookar et al., 2021; Taleb, 2012).

Third, using different perspectives of analysis could enrich SCRES research, notably with the social network analysis and social psychology lenses. The extant literature largely adopting a dyadic approach, qualitative or quantitative approaches have yet to be examined in network contexts. Social network analysis using position and connectedness indicators could be a valuable tool to grasp better how cognitive capital influences SCRES for both buyers and suppliers. The social psychology literature could also open in-depth investigation of cognitive capital in SCRES. For example, social cognition concerned with how social information is processed, stored, and applied, notably through thought or behavior patterns called schemas could be an intriguing area to study. Moreover, examining the role of attitude, but also self and social identity could improve the understanding of how emotions, beliefs, behaviors, and self-perceptions affect social interactions and SCRES. Finally, group behaviors, dynamics, leadership, disagreement, persuasion, peer pressure, or conformity are other interesting social psychology topics. Furthermore, despite the great volume of scholarly work on interorganizational relationships in buyer-supplier settings, existing studies have not investigated social capital and how it develops across levels of analysis (i.e., individual level, organizational level). Organizations and relationships are embedded in one another, and can

influence each other (Lumineau and Schilke, 2018). As such, there is a need for multi-level studies (Lumineau and Schilke, 2018) examining the ramifications of both individual and organizational levels.

Data availability statement: due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data are not available.

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