Boundaries as opportunities: A multilevel investigation of resilience

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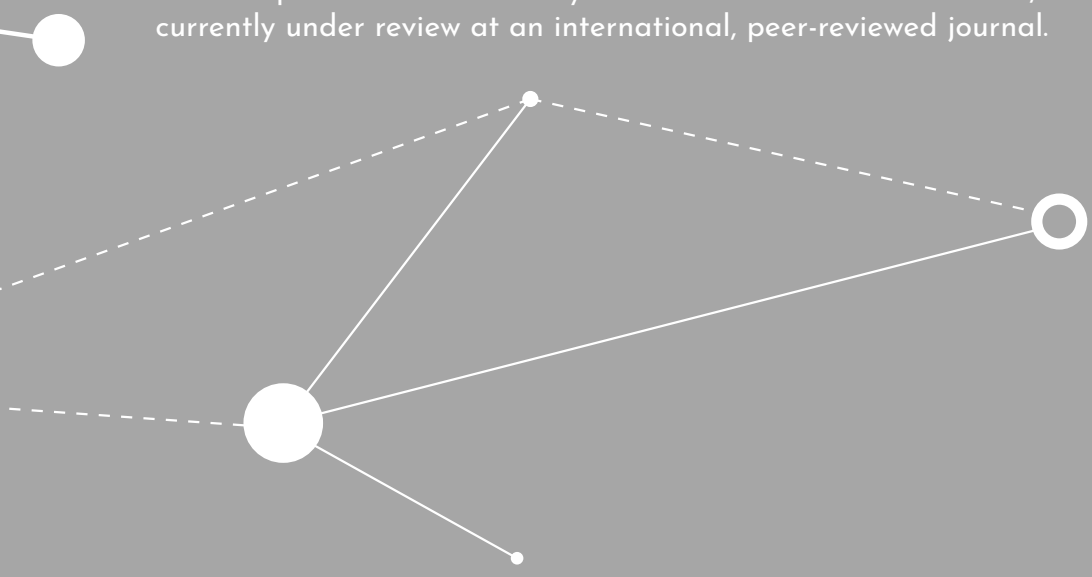
CHAPTER 3

MANAGING SUPPLIER-INDUCED DISRUPTIONS:
The importance of disruption and supplier-relationship characteristics for firm resilience[1]

[1]This chapter is co-authored by T.A. de Vries and D.P. van Donk, and is currently under review at an international, peer-reviewed journal.



Abstract

Contemporary resilience literature largely ignores an important duality regarding the role of suppliers in ensuring firm resilience. A firm's suppliers are, on the one hand, one of the most notorious sources of supply chain (SC) disruptions and, therefore, a significant potential threat to the firm's resilience. Intense collaboration with these very suppliers is, on the other hand, considered to facilitate the firm's resilience by enabling it to deal with SC disruptions more successfully. This study advances an integrated conceptual framework that brings these distinct perspectives together. We draw from event system theory to propose that supplier-induced disruptions are particularly harmful for the focal firm when they represent unfamiliar events. Combining event system theory and social capital research, we further assert that the adverse consequences of such novel supplier-induced disruptions may be mitigated when the focal firm maintains a relationship with the supplier that is characterized by either high breadth or high depth. These notions are largely supported in a sample of 1,980 supplier-induced disruptions across 171 supplier relationships of an order-driven assembler of high-tech products. Our findings illustrate how combining insights from different theoretical perspectives can enhance academic understanding of suppliers' apparent duality within existing resilience literature.

3.1 | Introduction

Supply chain (SC) disruptions are nearly unavoidable for a firm (Bode & Wagner, 2015; Lu & Shang, 2017). Often, such disruptions originate at the firm's suppliers (Reimann et al., 2017; Wang, Craighead, & Li, 2014). Indeed, nearly half of the SC disruptions that firms experienced in 2019 (prior to the appearance of COVID-19) emerged from their first-tier suppliers, with an additional one-fourth of disruptions emerging from their second-tier suppliers (Elliott, Thomas, & Muhammad, 2019). Relevant examples of such supplier-induced disruptions range from quality issues and delivery failures to equipment breakdowns and even plant fires. However, although suppliers are often the cause of SC disruptions, there is also evidence that they may enable a firm to deal with SC disruptions more successfully (Blackhurst et al., 2011; Bode et al., 2011). Specifically, prior research concludes that high levels of collaboration with suppliers is beneficial for a firm's ability to restore its performance levels after an SC disruption (i.e., increase its resilience; Jüttner & Maklan, 2011; Revilla & Saenz, 2017; Scholten & Schilder, 2015). The benefits of such collaboration are so pronounced that several scholars recommend collaborative supplier relationships over and above alternative strategies such as engaging in multiple sourcing and switching suppliers in case of an SC disruption (Pereira, Christopher, & da Silva, 2014; Tomlin, 2006). Taken together, the above perspectives suggest that suppliers, on the one hand, can induce SC disruptions and diminish a firm's resilience, while, on the other hand, the same suppliers may enhance a firm's resilience by assisting the firm in dealing with SC disruptions. Remarkably, resilience research has so far ignored this duality of suppliers, resulting in an incomplete understanding of the role of suppliers in firm resilience.

To help elucidate and manage this duality, we advance a conceptual framework that integrates insights from event system theory (Morgeson, Mitchell, & Liu, 2015) and social capital theory (Nahapiet & Ghoshal, 1998). Event system theory helps to explain why some disruptions have more severe consequences than others (Crawford, Thompson, & Ashforth, 2019; Reimann et al., 2017). Applying insights from this theory, we propose that suppliers lower a firm's resilience when they expose the firm to an unfamiliar SC disruption of which the firm has little relevant prior experience (Morgeson, 2005; Morgeson et al., 2015). Event system theory, however, provides limited insights into how a firm may obtain support from its suppliers in order to enhance firm resilience (Morgeson et al., 2015). Therefore, we extend event system theory, with insights from social capital theory, to identify mechanisms that may enable a firm to alleviate the adverse consequences of unfamiliar or novel supplier-induced disruptions by collaborating with its suppliers (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998). Social capital theory suggests that more diverse connections (i.e., breadth) and

feelings of reciprocity and respect (i.e., depth) within the relationship between a firm and its supplier enable the buying or focal firm to access unique resources for resolving SC disruptions (Fan & Stevenson, 2018; Johnson, Elliott, & Drake, 2013). Integrating both theoretical perspectives, we propose that a focal firm can mitigate the detrimental effects of novel supplier-induced disruptions when it maintains a broad or deep relationship with that supplier.

We test our theoretical framework using objective, quantitative data on nearly 2,000 supplier-induced disruptions to an order-driven assembler of high-tech products, covering over five years and involving almost 200 different suppliers. In doing so, we develop a more complete understanding of suppliers' influence on a firm's resilience. We illustrate that a firm may benefit more from broader and deeper supplier relationships in case of novel supplier-induced disruptions, than from narrower and shallower supplier relationships (as are typical for multiple sourcing). We further complement the focus of current resilience literature on exceptionally large disastrous events by providing empirical insights into a firm's management of the smaller SC disruptions that occur on a nearly daily basis (cf., Pournader et al., 2020; Tukamuhabwa et al., 2017; van den Adel, de Vries, & van Donk, 2021). Moreover, our insights reveal a potential dark side to collaborative supplier relationships that has largely been overlooked in existing resilience literature. Theoretically, we illustrate how integrating predictions from event system theory and social capital theory complements both perspectives and offers a fruitful framework for future research. We extend event system theory by theorizing how a firm may structure its supplier relationships in order to proactively minimize the adverse consequences of a novel supplier-induced disruption, thereby answering calls to expand the theory's "'reactive' view of events" (Morgeson et al., 2015, p. 523). Furthermore, we complement social capital theory by studying when a firm's social capital with its suppliers is more or less beneficial, thus addressing calls for more research on the relative returns of social capital across different situations (e.g., Holloway & Parmigiani, 2016; Pillai, Hodgkinson, Kalyanaram, & Nair, 2017; Villena, Revilla, & Choi, 2011). Practically, the findings of this study may prove valuable for firms aiming to manage the duality of suppliers in regard to supplier-induced disruptions, providing new insights into the benefits of increasing relationship breadth and depth for reducing the impact of such disruptions.

3.2 | Theoretical background

3.2.1 | Firm resilience and suppliers' duality

Resilience refers to a firm's ability to quickly respond to, and recover from, SC disruptions to its operations. This ability is typically manifested in a firm's

recovery time, i.e., the time that a firm requires to develop and implement a response to a given SC disruption and, subsequently, to fully restore its operational processes and performance levels to pre-disruption levels (e.g., Brandon-Jones et al., 2014; Habermann et al., 2015; Wieland, 2021). A shorter recovery time indicates that a firm has quickly identified and implemented a countermeasure to contain the adverse consequences of the SC disruption (Manhart et al., 2020; Ponomarov & Holcomb, 2009). By contrast, a longer recovery time indicates that a firm faced difficulty in developing or implementing an appropriate response, thereby allowing the SC disruption to persist and damage the firm's operations for an extended period (Ambulkar et al., 2015; van den Adel et al., 2021). Correspondingly, we define firm resilience as "the amount of time the [firm] takes to recover to its pre-[disruption] level of performance after experiencing a drop off in performance" (Britt, 1988, p. 60).

Empirical resilience research shows that SC disruptions often originate at a firm's suppliers (e.g., Blackhurst et al., 2011; Lu & Shang, 2017; Reimann et al., 2017). A firm typically has only limited insight into its suppliers' operations and may, as such, be impacted by a sudden disruption at one of these suppliers (Brandon-Jones et al., 2014; Kim et al., 2015), especially when the firm has few alternative suppliers in place and is critically dependent upon the supplier for materials and services. When it comes to a firm's continuance of operations, suppliers are thus the "number one worry" for the firm's managers (Blackhurst et al., 2011, p. 382). Advocates of engaging in multiple sourcing to alleviate some of this worry further acknowledge that managing multiple suppliers is complicated and expensive, where switching suppliers during a supplier-induced disruption is even more challenging, especially when the disruption involves customized goods or components (e.g., Pereira et al., 2014; Tomlin, 2006; Treleven & Schweikhart, 1988).

Alternatively, recent reviews of resilience research conclude that more intense collaboration with a firm's current suppliers can similarly—or even better—support the firm's ability to contain the impact of an SC disruption (e.g., Hohenstein, Feisel, Hartmann, & Giunipero, 2015; Manhart et al., 2020; Tukamuhabwa, Stevenson, Busby, & Zorzini, 2015). Such collaboration enables a firm to access information, resources, and support from suppliers and, subsequently, to use that support to resolve an SC disruption faster than it could on its own (Jüttner & Maklan, 2011; Revilla & Saenz, 2017; Scholten & Schilder, 2015). Combined, these insights illustrate an important duality, suggesting that suppliers may both hinder and facilitate a firm's resilience. Following the stipulated difficulty of switching suppliers during a supplier-induced disruption, we aim to increase our academic understanding of how a firm may build upon its

current suppliers in ensuring the firm's resilience to supplier-induced disruptions by integrating insights from event system theory and social capital theory.

3.2.2 | An integrated framework for understanding suppliers' duality

Event system theory (Morgeson et al., 2015) offers a theoretical perspective for explaining suppliers' potential detrimental impact on a firm's resilience. As an influential recent theoretical development that is increasingly adopted in SC literature (e.g., Craighead, Ketchen, & Darby, 2020; Huq, Chowdhury, & Klassen, 2016; Reimann et al., 2017), event system theory provides a conceptual framework for understanding how, and to what degree, events, such as supplier-induced disruptions, may impact firms. The theory conceptualizes an event as comprising three interacting components (event strength, event time, and event space) that collectively determine how likely the event is to impact or disrupt behaviors, organizational routines, or cause subsequent events. Event strength concerns how salient the event is for a firm, event time refers to the timing and stability of the event, and event space to the origin and trajectory of the event through the firm (Langley, Smallman, Tsoukas, & Van De Ven, 2013; Morgeson et al., 2015). Event system theory suggests that event strength determines an event's initial impact, wherein the strength of the event is shaped by the event's novelty, its salience, and whether it results in a discontinuity in normal operations (Crawford et al., 2019; Morgeson et al., 2015). Considering that (supplier-induced) disruptions are, by definition, both disruptive and deserving of a focal firm's attention (i.e., salient), disruptions primarily differ from one another in terms of their novelty. Consequently, we focus on the novelty of a supplier-induced disruption as a key factor that may determine a supplier's potential detrimental impact on a focal firm's resilience.

Event system theory, however, does not consider whether the potential detrimental consequences of novel disruptions actually materialize, because this perspective "neglects more 'proactive' views of events, especially ways that negative outcomes may be anticipated and managed" (Morgeson et al., 2015, p. 533). By itself, event system theory can thus insufficiently explain suppliers' duality, as it overlooks suppliers' potential to help alleviate the adverse effects of novel disruptions and, as such, contribute their capacities toward enhancing the focal firm's resilience. We therefore integrate event system theory with social capital research (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998) to develop a more in-depth understanding of the duality of suppliers in regard to firm resilience. Social capital theory is among the most well-established theoretical perspectives on interfirm relationships (Inkpen & Tsang, 2005; Villena et al., 2011), and is widely used to identify relational attributes that enable firms to draw on other firms' information, knowledge, and support in dealing with

complex tasks (Gölgeci & Kuivalainen, 2020; Holloway & Parmigiani, 2016; Pillai et al., 2017). A social capital approach can, as such, complement event system theory by uncovering key characteristics of a firm's supplier relationship that may enable the firm to obtain support from its supplier for enhancing its resilience to SC disruptions induced by the very same supplier.

Social capital theory posits that a firm may elicit resources and support from another firm by maintaining a relationship characterized by structural and relational social capital[1]. Structural social capital refers to the way in which partnering firms organize their relationship (Inkpen & Tsang, 2005; Nahapiet & Ghoshal, 1998). Relationships can be characterized, in this respect, by the number of, and diversity in, contacts between two firms. Structural social capital is, as such, also referred to as the breadth of the relationship (Lawson, Tyler, & Cousins, 2008; Payne, Moore, Griffis, & Autry, 2011). Relational social capital—or relationship depth—refers to the mutual respect, trust, and feelings of reciprocity that develop between partnering firms as a result of repeated transactions (Granovetter, 1992; Tsai & Ghoshal, 1998). In an SC setting, such repeated transactions are often a reflection of the willingness or commitment of a focal firm to invest more deeply in a single supplier relationship as opposed to having more 'shallow' relationships with multiple alternative suppliers for the same materials or products (i.e., multiple sourcing; Kim & Choi, 2015; Pereira et al., 2014; Treleven & Schweikhart, 1988; Tsai, 2016). We build on these two dimensions of social capital in order to study how the characteristics of a supplier relationship may enable the focal firm to recover more quickly from novel supplier-induced disruptions (i.e., enhanced firm resilience). In particular, we examine relationship breadth (structural social capital) and depth (relational social capital) as important characteristics of a firm's supplier relationship that determine how quickly a firm can recover from novel disruptions within that same relationship (see Figure 3.1). The following section will further develop and explain the examined relationships.

[1]There is also a cognitive dimension that refers to the presence of a common understanding and congruency in languages and cultures in a longstanding relationship (Tsai & Ghoshal, 1998). Such cognitive social capital facilitates the development of collective visions and ideologies that foster coordination processes and the ease of information exchange (Villena et al., 2011). Nahapiet and Ghoshal (1998) recognized, however, that this cognitive dimension of social capital is challenging to operationally separate from the structural and relational dimensions.

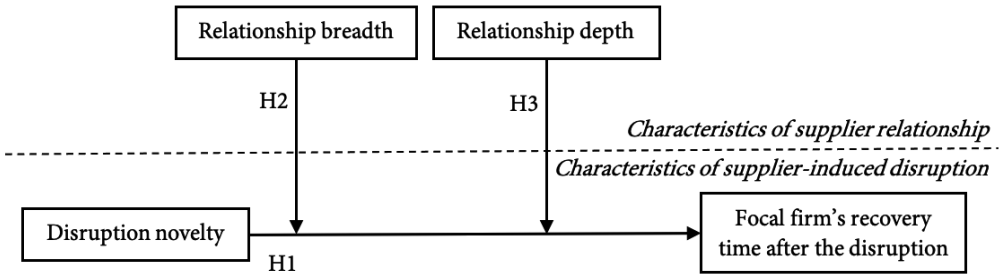


Figure 3.1 | Conceptual framework

3.3 | Hypotheses development

3.3.1 | Disruption novelty and firm resilience

Disruption novelty refers to a firm's familiarity with a particular type of SC disruption induced by a supplier (Hult, Ketchen, & Slater, 2004; Morgeson, 2005). Supplier-induced disruptions typically result in longer delivery times or unavailability of specific raw materials or components that are normally provided by the disrupted suppliers. Subsequently, the focal firm lacks these raw materials and components needed for completing its customers' orders, resulting in disruption to the focal firm's operations as well. However, when the firm has encountered SC disruptions in the delivery of such specific materials or components before, it is likely to be familiar with the causes of such disruptions and their consequences for its operations. Moreover, the focal firm is likely to be familiar with the options available for effectively mitigating the impact of the supplier-induced disruption (Bode et al., 2011; Chen et al., 2021). For example, if the delivery of a certain component has been disrupted several times in the past, the firm may build on its previously developed insights on how to reorganize its own production processes in order to minimize down-time (e.g., by switching production steps or adapting equipment; Morgeson et al., 2015; van den Adel et al., 2021). Similarly, the firm may draw from previously acquired knowledge of the disrupted component to assist the involved supplier in making small modifications to the component or to the supplier's production processes to more quickly resolve the supplier-induced disruption. Hence, we suggest that a firm generally needs little time to recover from relatively familiar supplier-induced disruptions because it can draw from relevant prior experiences (Ambulkar et al., 2015; Scholten, Sharkey Scott, & Fynes, 2019).

By contrast, a firm encounters novelty when its suppliers expose it to an unprecedented SC disruption that affects the supply of materials or components that are usually reliably available (Morgeson et al., 2015; Reimann et al., 2017). In such situations, a firm may have no relevant prior experience with the supplier-

induced disruption and therefore be unlikely to be aware of how to mitigate the detrimental effects of the disruption effectively (Chen et al., 2021; Haunschild & Sullivan, 2002; van den Adel et al., 2021). Because of its lack of experience with the supplier-induced disruption, the firm needs to gather, collate, and interpret new information that enable it to handle the disruption effectively (Crawford et al., 2019; Morgeson, 2005). Ultimately, this requires the firm to allocate considerable time and effort to "step back from the situation at hand, […] reframe the situation, [and] recombine existing procedures and routines into alternative responses" (Rudolph & Repenning, 2002, p. 25). Indeed, the focal firm may need a considerable amount of time to figure out, for example, how to reorganize its production processes so that its operations can continue while it faces a disrupted supply of certain raw materials or components. Consequently, the adverse effects of the supplier-induced disruption persist while the firm develops a countermeasure, and the firm's resilience thus decreases (Ambulkar et al., 2015; Scholten et al., 2019). We therefore predict:

> Hypothesis 1. There is a positive relationship between the novelty of a supplier-induced disruption and the focal firm's recovery time after the disruption.

3.3.2 | Interactive relationship between disruption novelty and relationship breadth

Combining event system theory with insights from social capital research, we propose that relationship breadth weakens the positive association between the novelty of a supplier-induced disruption and the focal firm's recovery time after the disruption. When a focal firm has a narrow relationship with a supplier, the firm maintains few and little diverse connections with the supplier, and generally acquires only one specific type of components from it (Lawson et al., 2008). Typically, the focal firm will primarily deal with only a few employees from a single product or component division within the supplier. Although maintaining such few contacts might be adequate for coordinating day-to-day matters when the component is reliably available, it limits the focal firm's resilience when the supply of the component is unexpectedly disrupted. In order to devise a solution for such a novel supplier-induced disruption, the focal firm requires a broad understanding of the causes and consequences of that disruption (Hult et al., 2004; Morgeson et al., 2015). This knowledge is, however, typically widely distributed among different employees and divisions within the affected supplier. Hence, the focal firm in a narrow relationship with only few connections will be largely unable to access and apply this information to deal with the supplier-induced disruption (Fan & Stevenson, 2019; Lawson et al., 2008). Furthermore, the lack of a broad relationship with the focal firm's operations may result in the

supplier being unaware of the type of information or support that the firm might need to be able to continue functioning while it faces a disrupted supply of the component (Chen, Liu, Wei, & Gu, 2018; Chowdhury, Lau, & Pittayachawan, 2019). Limited insight into the focal firm's broader operations prohibit the supplier, for example, from pinpointing small modifications to the focal firm's production processes that would allow the firm to maintain functionality. As a result of the lack of access to such information and support, the focal firm may, in turn, hesitate to act or implement ineffective solutions that prolong its recovery time (Bode et al., 2011; Fan & Stevenson, 2018; Rudolph & Repenning, 2002).

When a focal firm has multiple and diverse connections with a supplier, however, the breadth of the relationship "may offer some functional substitution for past experience in learning" (Uzzi & Lancaster, 2003, p. 393). In particular, these connections are typically spread across multiple employees from several product or component divisions within the supplier, thereby offering the firm a greater diversity of potential sources of information and support. Although the supplier may not have a definitive solution, these various sources of information make it more likely that the supplier can offer pieces of information the focal firm needs to deal with the unfamiliar supplier-induced disruption at hand (Hartmann & Herb, 2015; Villena et al., 2011). Being more connected to a supplier by, for instance, sourcing more types of components from it, further provides both the focal firm and the supplier a broader awareness of each other's additional operations. When the supply of one type of component is disrupted, the focal firm can, subsequently, use this awareness to seek and obtain relevant information from contacts within the supplier beyond those that are directly involved with only the disrupted component. Similarly, the supplier is more familiar with the overall activities of the focal firm and is, therefore, better aware of the information that the firm might need to successfully deal with the supplier-induced disruption (Rowley, Behrens, & Krackhardt, 2000; Uzzi & Lancaster, 2003). Besides better access to more diverse information, the multiple employees connected within a broader relationship additionally enable the focal firm to analyze and approach the supplier-induced disruption from different perspectives from within the supplier (Moran, 2005; Reagans & McEvily, 2003), and to confirm the accuracy of the obtained information across these perspectives (i.e., employees; Lawson et al., 2008; Payne et al., 2011). Both of these possibilities benefit the focal firm's resilience by reducing the time required for identifying an effective response to the novel supplier-induced disruption (Gölgeci & Kuivalainen, 2020; Scholten & Schilder, 2015). Thus, we hypothesize:

Hypothesis 2. The breadth of the buyer-supplier relationship moderates the relationship between the novelty of a supplier-induced disruption and the focal firm's recovery time after the disruption. This positive relationship is accentuated when relationship breadth is lower and attenuated when relationship breadth is higher.

3.3.3 | Interactive relationship between disruption novelty and relationship depth

We further predict that relationship depth mitigates the positive effect of the novelty of a supplier-induced disruption on the focal firm's recovery time after the disruption. When a focal firm maintains a shallow relationship with a supplier, it has limited commitment and a short-term perspective toward that supplier. Consequently, the supplier in such a relationship faces a considerable risk of being replaced by alternative suppliers if it exposes the focal firm to an SC disruption (Pereira et al., 2014; Tsai, 2016). Aware of this risk, the supplier may not be willing to share (sensitive) information about the supplier-induced disruption with the focal firm because the firm is likely to switch suppliers after resolving the disruption (Lawson et al., 2008; Rowley et al., 2000; Uzzi & Lancaster, 2003). In addition, within the extent to which information is shared about the supplier-induced disruption, the affected supplier may prioritize sharing such information with other, more committed buyers (Fan & Stevenson, 2018). For example, the supplier might share (sensitive) information about the disruption's cause with these more committed buyers and offer only them the limitedly available alternatives for the disrupted component. Ultimately, the withholding of information by the supplier may cause the focal firm to under- or overreact to the novel supplier-induced disruption because it has insufficient information to develop an effective, well-informed response (Christopher & Lee, 2004; Johnson et al., 2013). The firm might, for instance, decide to rely on routines that are not necessarily useful for restoring the supply of the disrupted component, thereby wasting valuable time (Bode et al., 2011; Rudolph & Repenning, 2002). The focal firm's recovery time is thus likely to be prolonged.

By contrast, when a focal firm has a deeper relationship with a supplier and demonstrates commitment and long-term perspective, the supplier is more motivated to share high-quality information and support, even when the supplier itself is the source of the SC disruption (Johnson et al., 2013; Lawson et al., 2008; Wang et al., 2014). Irrespective of whether its content may be sensitive, the supplier is also willing to share such information more quickly because it believes that the information will be used for the mutual benefit of both partners and not to assess whether the supplier should be replaced by a substitute supplier upon resolving the supplier-induced disruption (Chowdhury et al., 2019; Villena et al.,

2011). The supplier's sense of reciprocity, which characterizes a deep relationship, may further motivate it to "share risks and cost, or pool complementary skills" with the focal firm (Rowley et al., 2000, p. 371), allowing both partners to intensively collaborate to resolve a novel supplier-induced disruption (Chen et al., 2021; Hult et al., 2004; Morgeson, 2005). Moreover, the ease of information sharing increases because of the stable communication patterns that develop over time between partnering firms (Lawson et al., 2008; Yan & Nair, 2016). These patterns avoid the need for a supplier and focal firm to spend considerable time reconciling differences and overcoming communication barriers (Gölgeci & Kuivalainen, 2020; Mishra, Chandrasekaran, & Maccormack, 2015), thus making available more time for exchanging useful information during a supplier-induced disruption. Taken together, the supplier's greater willingness to collaborate and the focal firm's improved access to high-quality information shorten the time that the firm requires to understand and mitigate a supplier-induced disruption that it has not dealt with before (Bode et al., 2011; Morgeson et al., 2015). Accordingly, we hypothesize:

> Hypothesis 3. The depth of the buyer-supplier relationship moderates the relationship between the novelty of a supplier-induced disruption and the focal firm's recovery time after the disruption. This positive relationship is accentuated when relationship depth is lower and attenuated when relationship depth is higher.

3.4 | Research methodology

3.4.1 | Research setting and data collection

We collected data from a medium-sized electronics company that specializes in the assembly of high-tech products for international and highly reputed customers across industries such as healthcare, defense, and security. The company exclusively assembles following a make-to-order policy because products are customer-specific and subject to rapid technological changes.

The electronics company provides a suitable research context for our study for two reasons. First, the company uses an exceptionally large and diverse collection of components for its products, which makes it vulnerable to supplier-induced disruptions. Specifically, each product consists of dozens or more unique components, such that the company processes up to 14.000 distinct components annually, all of which are sourced externally from more than 200 different suppliers. Prior to assembling an order, each component must be available. Consequently, any supplier-induced disruption immediately affects the company's ability to assemble an order in time. Each year, the company faces

more than 800 such disruptions to its inflow of components, which amounts to approximately 5 percent of its orders for components with suppliers. These disruptions range from components that malfunction or have been damaged in transit, to entire orders that are not delivered according to the agreed quality or specifications (e.g., too few or the wrong type of components). Second, nearly all the components that the electronics company sources are only used for particular customer orders, or even specifically developed in collaboration with selected suppliers according to customers' specifications. As such, the company only maintains component buffers for the very few standard components that it sources. Therefore, to resolve a supplier-induced disruption in a timely manner, the company is almost entirely dependent upon its ability to develop a solution together with its current supplier. The supplier relationship thus plays a profound role in resolving supplier-induced disruptions in the present context, because the company considers maintaining buffers of raw materials or finished products unfeasible.

To examine our conceptual framework, we obtained access to the company's detailed records of the nature and impact of supplier-induced disruptions for a period of five years (2014 to early 2019). In particular, we obtained objective data from the information system that the company uses to monitor and register information about such disruptions to its inflow of components. The disruptions and correspondingly obtained data are thus detailed at the component level. Supplier-induced disruptions to the very few standard components for which the company maintains material buffers are not monitored in this information system. The resulting data comprised a unique and large sample of supplier-induced disruptions and enabled us to objectively and quantitatively test our hypothesized relationships, even if its size also inhibited us from collecting more detailed data using more elaborate data gathering approaches (e.g., interviews) to examine the mechanisms underlying these relationships.

In consultation with the company, we used a priori screening criteria to select relevant supplier-induced disruptions from the data. We disregarded incidents with particularly short durations (i.e., less than one day), because these are too small to be classified or treated as disruptions by the company. We further excluded incidents with a duration of more than six months, because they were exceptionally long in duration, and were assigned a lower priority by the company's management. The remaining disruptions each required a targeted response and resulted in the rescheduling of assembly planning, such that they directly affected the company's functioning. Our final dataset comprised 1,980 supplier-induced disruptions distributed across 171 different suppliers.

3.4.2 | Measures

Recovery time. We measured the recovery time following a supplier-induced disruption by calculating how many days the company required to resolve the disruption and continue assembly as planned prior to the disruption (Habermann et al., 2015; Hohenstein et al., 2015; Wieland, 2021). In particular, we calculated the difference in days between the start and end day of the supplier-induced disruption, as registered in the information system. The start day represents the day on which the company first discovered that the component was disrupted; the end day corresponds to the day on which assembly of the disrupted component could resume. The average recovery time across the included supplier-induced disruptions was about 20 days. Because recovery time was, however, also positively skewed across these disruptions, we followed the recommendations of Hair et al. (2013) and log-transformed the values of this outcome measure.

Disruption novelty. To operationalize the novelty of a specific supplier-induced disruption, we ascertained how many times such disruptions had occurred to the same component in the preceding two years (Morgeson, 2005; Morgeson et al., 2015). This type of frequency measure is the prevailing approach for gauging a firm's experience or familiarity with (i.e., the novelty of) a specific kind of event or situation (cf., Bode et al., 2011; Haunschild & Sullivan, 2002; Hult et al., 2004; Rudolph & Repenning, 2002; van den Adel et al., 2021). Considering that the value of prior experience declines over time, and the prevalence of supplier-induced disruptions in the current research setting is relatively high, we followed best-practice recommendations and considered a recall period of two years appropriate (Baum & Ingram, 1998; Haunschild & Rhee, 2004; Haunschild & Sullivan, 2002). Using component-level data from the information system, we computed the frequency of supplier-induced disruptions involving the respective component over the two preceding years. Importantly, because this measure is at the component level, the company's experience with supplier-induced disruptions to a component accumulates even though the disruptions may have involved different suppliers (i.e., a component can be delivered by multiple suppliers). We reverse-coded this measure, so that a low score (i.e., a recurring supplier-induced disruption) indicates low novelty, and a high score (i.e., an uncommon supplier-induced disruption) indicates high novelty. Because we used a recall period of two years, the first two years from the obtained dataset (2014 and 2015) were used to compute our novelty measure starting from 2016, and could, therefore, not be used for testing our hypotheses.

Relationship breadth. We measured the breadth of a supplier relationship by counting the number of different categories of components that the company sources from that supplier (Lawson et al., 2008; Mishra et al., 2015; Payne et al., 2011). In particular, the company broadly distinguishes components into

four categories based upon the purpose, availability, and production method of the component. Each category contains unique components that often require specialized suppliers, dedicated personnel, and specific routines and procedures. As such, when a supplier provides the company with components from more than one category, the corresponding relationship covers a larger and more diverse collection of know-how, responsibilities, and people (i.e., connections) than a relationship with a supplier that only provides components from a single category. Using available archival data, we thus computed this number of different component categories that each supplier relationship covers as a measure of the relationship's breadth (Lawson et al., 2008; Villena et al., 2011).

Relationship depth. There is consensus in the literature that a supplier relationship that evolves around single sourcing is typically characterized by greater relationship depth than one that evolves around multiple sourcing (e.g., Elfenbein & Zenger, 2014; Olcott & Oliver, 2014; Treleven & Schweikhart, 1988; Villena et al., 2011). Specifically, the feelings of trust, commitment, and reciprocity that characterize relationship depth accumulate to a greater extent, and more quickly, in a single source situation because the corresponding transactions are embedded within a single relationship as opposed to spread out across multiple suppliers (Chowdhury et al., 2019; Kim & Choi, 2015; Krause, Handfield, & Tyler, 2007). Correspondingly, in accordance with Mishra et al. (2015), we measured the depth of a supplier relationship as how intensively the company has depended or relied on the respective supplier for sourcing particular components. Specifically, we first computed the number of different suppliers that had supplied a particular component to the company within the period included in our dataset, thus creating a multiple source measure at the component level (i.e., components can sometimes be delivered by more than one supplier). Next, we aggregated this component-level information to the supplier level by averaging the number of alternative 'sources' per component that a supplier had provided to the company. This measure thus reflects whether alternative sources have been used for components that a supplier provides, rather than the overall availability of alternative sources in the industry. We reverse-coded this measure, such that a low score (i.e., multiple alternative sources per supplier) reflects low relationship depth, and a high score (i.e., no or a few alternative sources per supplier) reflects high relationship depth. As in any industry, switching between suppliers is neither easy nor desirable for the electronics company once a relationship has been established. Accordingly, this measure reflects the company's commitment to, and repeated transactions with, a single supplier over time when the score is high, or the absence thereof when the score is low (Pereira et al., 2014; Rowley et al., 2000; Tsai, 2016).

3.4.3 | Control variables

In line with prior resilience research (e.g., Rudolph & Repenning, 2002; Sahebjamnia, Torabi, & Mansouri, 2018; Zobel & Khansa, 2014), event system theory recognizes that "multiple (different) events can occur closely in space and time" and that this may draw attention and efforts away from resolving an individual supplier-induced disruption, prolonging the time that the disruption harms a firm's functioning (Morgeson et al., 2015, p. 531). To rule out such temporal workload as a potential confounder, we included this measure as a covariate in our analyses. We operationalized *temporal workload* by counting for each supplier-induced disruption in our dataset the number of other supplier-induced disruptions that were ongoing at the same time. That is, using the begin and end days recorded in the information system, we counted the number of other supplier-induced disruptions that were active on the day that the focal supplier-induced disruption emerged (excluding supplier-induced disruptions that started or ended on that respective day).

3.4.4 | Data analysis and model development

We tested our conceptual framework using hierarchical linear modeling (HLM) with random coefficients to account for the nested structure of our data. Specifically, our framework specifies two levels of analyses: the supplier-induced disruption (Level 1) and the supplier relationship (Level 2). The two variables of disruption novelty and recovery time are specific to an individual supplier-induced disruption and, therefore, measured at that level (Level 1). Relationship breadth and depth are, however, only unique for a supplier relationship and measured accordingly (Level 2), such that supplier-induced disruptions that occur within the same supplier relationship score identical on these two variables (i.e., nesting). Indeed, the 1,980 supplier-induced disruptions included in our final dataset are nested in only 171 distinct suppliers, indicating that some suppliers may have exposed the electronics company to multiple SC disruptions. HLM separates the effects at the level of the supplier-induced disruption (Level 1) and the supplier relationship (Level 2), thereby allowing us to test for the cross-level interaction effects predicted in Hypotheses 2 and 3 (Raudenbush & Bryk, 2002; Snijders & Bosker, 2012). That is, the interaction effects that we predicted in these hypotheses implicate variables at both levels of analyses and are, as such, cross-level. An additional benefit of using HLM is that it controls for supplier-level effects on the intercept and tested relationships that can be attributed to unobserved supplier characteristics (Lu et al., 2018; Preacher, Zhang, & Zyphur, 2016). Indeed, the intraclass correlation (ICC) value of 0.098 (see Model 0, Table 3.2) indicates that such supplier-level effects explain about ten percent of the variation in recovery time following a supplier-induced disruption.

In our application of HLM, we followed best-practice recommendations of Aguinis et al. (2013) and Preacher et al. (2016) for testing cross-level interaction effects. First, we centered our disruption-level predictor variable (i.e., disruption novelty) using the group (supplier) mean, and our supplier-level variables (i.e., relationship breadth and relationship depth) using the grand (sample) mean. Such centering avoids the possibility of spurious cross-level interaction effects (Hofmann & Gavin, 1998). Subsequently, we ran five multilevel models in a stepwise manner to test our hypotheses. In the first step, we examined a null model that only included a random intercept for recovery time (see Model 0, Table 3.2). In this random intercept model, the intercept (or starting value) for recovery time is allowed to vary across suppliers to capture the fact that supplier-induced disruptions may take longer or shorter to resolve for the focal company, depending on the specific supplier involved. In the following model, we added our study covariate temporal workload as a fixed effect. This fixed term represents the overall, sample-level relationship between the covariate and recovery time that is held constant across suppliers (see Model 1, Table 3.2). That is, a comparison of the respective fixed and random effects showed that the relationship between our study covariate and recovery time did not significantly differ across suppliers, such that we only needed to include its fixed effect in our analyses. Next, we added the fixed term of all three study variables simultaneously (disruption novelty, relationship depth, and relationship breadth; see Model 2, Table 3.2) to avoid conflation of the disruption-level effect by the supplier-level characteristics while testing for Hypothesis 1 (Preacher et al., 2016).

In the fourth step, we assessed whether the strength of the direct relationship between disruption novelty and recovery time (Hypothesis 1) also varied depending on the supplier involved. To do so, we added the so-called random slope for the coefficient of disruption novelty, as well as an estimate for the covariance between the random slope and the random intercept (see Model 3, Table 3.2). In the final step, we examined the hypothesized cross-level interaction effects by regressing the random slope of disruption novelty on relationship depth and relationship breadth (see Model 4, Table 3.2). In other words, in the final step, we assessed whether the supplier-level variance in the relationship between disruption novelty and recovery time that we tested for in the preceding model (i.e., the degree to which novel supplier-induced disruptions are associated with longer or shorter recovery times for certain suppliers) can be explained by the characteristics of the relationships (i.e., relationship breadth and relationship depth) that the focal firm maintains with those suppliers.

To evaluate the fit of each of our models relative to our null model (i.e., the model including only a random intercept) and the number of estimated parameters, we computed the -2 log likelihood ratio (i.e., deviance). This deviance

value is used to evaluate model fit for HLM with random coefficients, where the smallest deviance value among a set of competing models indicates better fit (Aguinis et al., 2013; Snijders & Bosker, 2012). We conducted our multilevel analyses using M*plus* 8.5 (Muthén & Muthén, 1998-2017).

3.5 | Results

3.5.1 | Descriptive statistics

Table 1 shows the descriptive statistics (prior to centering) and bivariate correlations of the included variables. The direct association of temporal workload with recovery time is significant ($r = .05$, $p < .05$), underlining its relevance as a covariate in our analyses. In light of the nested structure of the data, however, these correlations should be studied with restraint (Snijders & Bosker, 2012).

	Mean	s.d.	1	2	3	4
1 Recovery time[a]	2.24	1.29				
2 Temporal workload	35.18	14.99	.05*			
3 Disruption novelty[b]	−5.06	8.54	.03	−.01		
4 Relationship breadth	2.36	0.97	−.09**	−.03	−.04	
5 Relationship depth[b]	−1.44	0.39	−.07**	−.06**	.22**	−.04

Notes: $N = 1{,}980$ supplier-induced disruptions. * $p < .05$, ** $p < .01$ (two-tailed).

[a] Log-transformed.

[b] Reverse-coded (resulting in a negative mean).

Table 3.1 | Means, standard deviations, and correlations

3.5.2 | Hypothesis testing

Table 3.2 provides the results of our multilevel analyses, as described above. The -2 log likelihood scores denote that each of our estimated models fits significantly better than its preceding model (Aguinis et al., 2013; Snijders & Bosker, 2012). The significant improvement (i.e., decrease) in the -2 log likelihood from Model 2 to Model 3 further indicates that the strength of the relationship between disruption novelty and recovery time indeed differed depending on which supplier was involved, providing support for adding the random slope for the coefficient of disruption novelty. Accordingly, we tested Hypothesis 1 in the model that included this random slope to control for the observed supplier-level variance. Specifically, Hypothesis 1 predicted a positive association between disruption novelty and recovery time. We find no support for this hypothesis ($B = 0.023$, $SE = 0.031$, n.s.; see Model 3, Table 3.2).

Hypothesis 2 posited that the relationship between disruption novelty and recovery time is moderated by relationship breadth. Our results support this hypothesis ($B = -0.024$, $SE = 0.008$, $p < .01$; see Model 4, Table 3.2). In the simple slope analyses depicted in Figure 3.2, we plotted the relationship between disruption novelty and recovery time at lower (−1 s.d.) and higher (+1 s.d.) levels of relationship breadth (Cohen et al., 2014). At lower levels of relationship breadth, the relationship between disruption novelty and recovery time is non-significant ($B = 0.016$, $SE = 0.012$, n.s.). By contrast, at higher levels of relationship breadth, disruption novelty is significantly and negatively associated with recovery time ($B = -0.022$, $SE = 0.008$, $p < .01$). These results indicate that, in comparison to lower relationship breadth, higher relationship breadth is associated with a shorter recovery time (i.e., higher firm resilience) under high disruption novelty.

Hypothesis 3 posited that the relationship between disruption novelty and recovery time is moderated by relationship depth. Our results support this hypothesis ($B = -0.081$, $SE = 0.024$, $p < .01$; see Model 4, Table 3.2). In the simple slope analyses depicted in Figure 3.3, we plotted the relationship between disruption novelty and recovery time at lower (−1 s.d.) and higher (+1 s.d.) levels of relationship depth (Cohen et al., 2014). At lower levels of relationship depth, disruption novelty is significantly and positively associated with recovery time ($B = 0.038$, $SE = 0.013$, $p < .01$). By contrast, at higher levels of relationship depth, the relationship between disruption novelty and recovery time is significant and negative ($B = -0.044$, $SE = 0.016$, $p < .01$). These results indicate that relationship depth attenuates the positive association between disruption novelty and recovery time (i.e., higher firm resilience).

Table 3.2 | Results of multilevel regression analyses

	Recovery time[a]				
	Model 0	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Level 1 (L1)					
Intercept (γ_{00})	2.367 (0.058)**	2.368 (0.058)**	2.370 (0.060)**	2.371 (0.060)**	2.371 (0.060)**
Disruption novelty (DN) (γ_{10})			0.004 (0.004)	0.023 (0.031)	−0.003 (0.008)
Temporal workload (γ_{20})		0.005 (0.002)*	0.005 (0.002)*	0.004 (0.002)*	0.004 (0.002)*
Level 2 (L2)					
Relationship breadth (RB) (γ_{01})			−0.068 (0.064)	−0.068 (0.066)	−0.067 (0.064)
Relationship depth (RD) (γ_{02})			−0.178 (0.108)	−0.179 (0.111)	−0.183 (0.108)
Cross–level interactions					
DN × RB (γ_{11})					−0.024 (0.008)**
DN × RD (γ_{12})					−0.081 (0.024)**
Variance components					
Within–supplier (L1) variance (σ^2)	1.549	1.545	1.547	1.520	1.531
Intercept (L2) variance (τ_{00})	0.168	0.168	0.143	0.148	0.147
Slope (L2) variance (τ_{11})				0.010	0.001
Slope-intercept covariance (τ_{01})				0.000	−0.011
Additional information					
ICC	0.098				
-2 log likelihood (FIML)	6,561.388	6,556.300*	6,551.094*	6,541.236**	6,533.132**
Number of estimated parameters	3	4	7	9	11

Notes: FIML = full information maximum likelihood estimation. N = 1,980 supplier-induced disruptions (Level 1) across 171 suppliers (Level 2). Unstandardized regression coefficients are shown; standard errors are noted within parentheses.

* $p < .05$, ** $p < .01$ (two-tailed).

[a] Log-transformed.

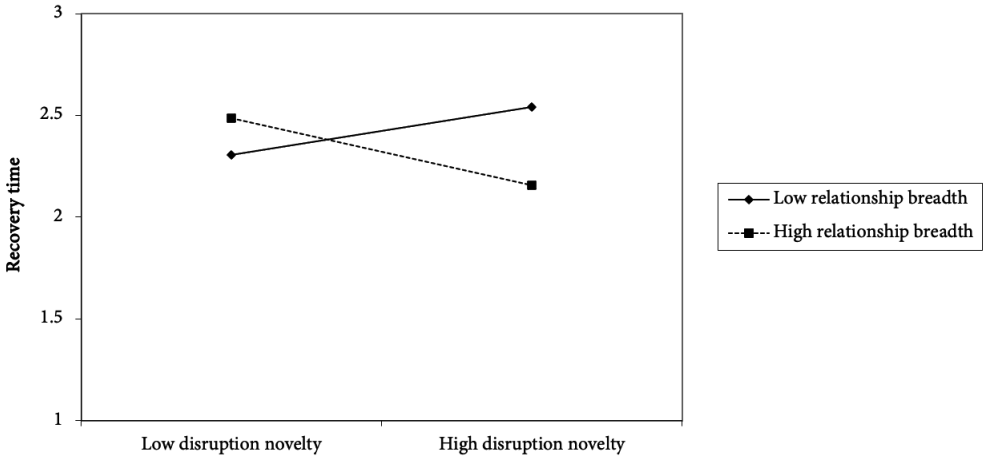


Figure 3.2 | Interaction between relationship breadth and disruption novelty (H2)

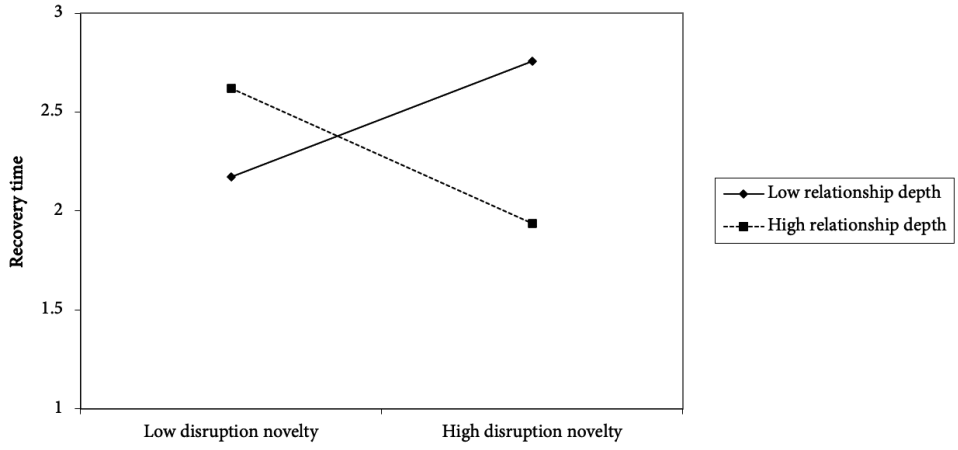


Figure 3.3 | Interaction between relationship depth and disruption novelty (H3)

3.5.3 | Supplementary analyses

In accordance with other studies adopting a social capital perspective (e.g., Chakkol, Finne, Raja, & Johnson, 2018; Fan & Stevenson, 2018; Villena et al., 2011), we examined the effects of relationship breadth and depth independent of each other (within the same model). Others, however, have argued that the dimensions of social capital may reinforce one another (e.g., Carey, Lawson, & Krause, 2011; Johnson et al., 2013; Preston, Chen, Swink, & Meade, 2017). In supplementary analyses, we therefore tested whether relationship breadth and depth augmented each other in a three-way interactive relationship with isruption novelty. The results show that this three-way interactive relationship

was non-significant (B = −0.154, SE = 0.091, n.s.). Combined with the results from our hypotheses testing, this indicates that the effects of relationship breadth and depth are additive rather than multiplicative.

Previous research further asserts that particularly strong or deep inter-firm relationships speed up the transfer of more complex information, such as is required in case of novel supplier-induced disruptions (Hansen, 1999; Levin & Cross, 2004). Accordingly, we followed the procedure described by Porck et al. (2019) and tested whether the individual effect sizes significantly differed between relationship breadth and depth. First, we standardized these two relationship-level variables to make their effect sizes directly comparable. Next, we computed the difference between the coefficients of these variables' cross-level interactions with disruption novelty, which is significant and positive in favor of relationship depth ($B = -0.022$, $SE = 0.011$, $p < .05$). Indeed, this denotes that, compared with relationship breadth, relationship depth attenuates the positive relationship between disruption novelty and recovery time (i.e., increases resilience) more strongly.

Regarding these effect sizes, we additionally used binomial effect size displays to assess our results' practical significance (Rosenthal & Rubin, 1982; see also de Vries et al., 2016; Firth et al., 2015). That is, we assessed the implications of the "most optimal" supplier relationship configuration that we put forward for dealing with novel supplier-induced disruptions (i.e., a supplier relationship characterized by high breadth and/or high depth) for the focal firm's recovery time. First, we selected all supplier-induced disruptions that had not occurred before (i.e., the worst-case scenario). Within these nearly 1,000 highly novel disruptions, we then selected the 100 disruptions with the shortest recovery time (i.e., the "best" 10%) and the 100 disruptions with the longest recovery time (i.e., the "worst" 10%). We subsequently compared the share of the "most optimal" supplier relationship configuration within the full sample, the 100 shortest highly novel disruptions, and the 100 longest highly novel disruptions.

In our full sample of 1,980 supplier-induced disruptions, 33.7% (i.e., 668 disruptions) occurred within supplier relationships with relationship breadth and/or depth at one standard deviation or more above the mean. This "most optimal" configuration was overrepresented in the 100 shortest highly novel disruptions, with 40% of these disruptions occurring within such "optimally configured" supplier relationships. In fact, highly novel disruptions that occurred within supplier relationships with high breadth and/or high depth were 1.2 times more likely to be among the 100 shortest disruptions than those that occurred within differently configured supplier relationships. Moreover, "optimally configured" supplier relationships were underrepresented among the 100 longest highly novel disruptions, representing only 26% of these disruptions. Hence, highly novel

disruptions that occurred within supplier relationships with high breadth and/or high depth were 1.3 times less likely to be among the 100 longest disruptions than those that occurred within differently configured supplier relationships. These findings reveal that our results are not only statistically significant but also have practical relevance.

Finally, in line with Helmuth et al. (2015), we excluded the covariate from our analyses to check robustness. After excluding temporal workload, the relationship between disruption novelty and recovery time remained non-significant (Hypothesis 1; $B = 0.023$, $SE = 0.031$, n.s.). Likewise, relationship breadth (Hypothesis 2; $B = -0.019$, $SE = 0.006$, $p < .01$) and depth (Hypothesis 3; $B = -0.042$, $SE = 0.012$, $p < .01$) continued to moderate the relationship between disruption novelty and recovery time. These results show strong consistency with our main analyses and, as such, confirm the robustness of the analyses.

3.6 | Discussion

3.6.1 | Theoretical implications

This study offers several important theoretical implications. First and foremost, we advance a theoretical framework to better understand and manage the duality of suppliers evident in existing resilience literature. We combine arguments from previous research that either suggests that suppliers have a generally negative influence on a focal firm's resilience (by exposing the firm to SC disruptions), or a positive influence (by helping the firm to deal with SC disruptions). In doing so, this study paints a more nuanced picture of the role of suppliers by examining the association between supplier-induced disruptions and the focal firm's resilience. Our findings illustrate that a supplier can potentially both damage or bolster the firm's resilience, depending on the match between the characteristics of the supplier-induced disruption and the supplier relationship. Moreover, contrary to our predictions, we did not find support for a direct negative association between the novelty of a supplier-induced disruption and the resilience of the focal firm. This might be an indication that the relationship between disruption characteristics and the focal firm's resilience is critically contingent upon the nature of the relationship between the firm and the supplier involved in the disruption. Taken together, we believe these findings contribute to integrating diverging insights on suppliers and resilience within the field of SC management and, in doing so, advance a more comprehensive view on the role of suppliers for a firm's resilience.

Beyond providing a better understanding of suppliers' duality, our integrated framework may be valuable for scholars studying related phenomena pertinent to resilience. Our framework combines two well-established theories to advance

a better understanding of how characteristics of both the supplier-induced disruption and the firm's relationships interact and influence the firm's resilience following the disruption. In doing so, we illustrate how insights from social capital research may supplement event system theory's more "'reactive' view of events" (Morgeson et al., 2015, p. 523), providing fertile ground for further integration of these two theories and offering additional support for event system theory's relevance for resilience research (cf., Craighead et al., 2020; Lu, Kaufmann, & Carter, 2021; Timmer & Kaufmann, 2019). The mechanisms described in our integrated framework may, for example, prove instrumental in answering recent calls to explore when relational conflict (e.g., dissatisfaction, blame, anger) may arise following a supplier-induced disruption, and how such conflict, in turn, affects the type and effectiveness of the disruption response (e.g., Eckerd & Girth, 2017; Reimann et al., 2017; Wang et al., 2014). Supplier-induced disruptions higher in novelty may, for instance, lead to more dissatisfaction or blaming due to the associated uncertainty, while the adverse consequences thereof may be mitigated in broader or deeper relationships because of higher commitment. By drawing attention to important disruption and relationship characteristics, our framework may similarly be valuable for recent advances in exploring how the role of established resilience strategies differs between buyer-induced or demand-side disruptions and supplier-induced or supply-side disruptions (cf., Habermann et al., 2015; Reimann et al., 2017). Furthermore, broader SC management research may benefit from adopting our framework in exploring, for instance, how the outcomes of important events such as the introduction of a new technology or product are shaped by the relationship between the affected firms (cf., Tokar & Swink, 2019; Xiao, Petkova, Molleman, & van der Vaart, 2019). Alternatively, our framework may help address recent requests for more research on the relative returns of social capital across different situations or events (cf., Holloway & Parmigiani, 2016; Pillai et al., 2017). The implications of the integrated framework presented in this study, therefore, extend beyond the duality of suppliers apparent within contemporary resilience literature.

We further contribute to broader resilience research in two ways. First, we provide detailed and empirically validated insights on the effectiveness of resilience strategies in firms' management of the smaller SC disruptions that occur on an almost daily basis. Resilience studies have predominantly studied infrequent, but particularly harmful disasters (Tenhiälä & Salvador, 2014; Tukamuhabwa et al., 2017), such as the global financial crisis (Jüttner & Maklan, 2011), Hurricane Katrina (Scholten et al., 2014), or exceptionally large transportation accidents (Johnson et al., 2013). Although these studies provide detailed accounts of firms' responses to one specific type of SC disruption, they do not empirically test the comparative effectiveness of responses across different situations and in relation

to one another (e.g., Ambulkar et al., 2015; Bode et al., 2011; van der Vegt et al., 2015). Such a comparison is, however, particularly relevant for resilience research, because of the high frequency of less high-profile SC disruptions that are daily concerns for managers (e.g., Pournader et al., 2020; Scholten et al., 2020; van den Adel et al., 2021). Therefore, this study complements previous resilience research by considering how firms can effectively handle SC disruptions that occur on a more regular basis. In the context of such smaller, more recurring SC disruptions, we demonstrate that disruption novelty and relationship breadth and depth jointly determine a firm's recovery time following the disruption. Additionally, our supplementary analyses show that, in comparison with a broader relationship, a deeper relationship may enable a shorter recovery time in case of a novel supplier-induced disruption. Our findings, therefore, underline the importance of examining both the intricacies of smaller, more recurring SC disruptions, and the comparative effectiveness of established resilience strategies across these disruptions and in relation to one another.

Second, we point toward a potential dark side of social capital for a firm's recovery time that previous resilience research has largely overlooked. In particular, we show that the reduction in recovery time associated with relationship breadth and depth diminishes as disruption novelty decreases. It seems that relationship depth may even prolong recovery time for supplier-induced disruptions that are low in novelty. Broader social capital research is generally aware of this dark side of social capital, as evidenced by studies illustrating that high levels of social capital may reduce a focal firm's ability to remain objective and make effective decisions, as well as increase suppliers' opportunistic behavior (e.g., Holloway & Parmigiani, 2016; Pillai et al., 2017; Villena et al., 2011). In a resilience context, however, Fan and Stevenson (2019) only recently demonstrated how social capital may have unintended consequences that harm a firm's resilience. The time that a firm requires in order to develop a disruption response may, for example, be increased as a result of restrictive or unnecessary information gathering and redundant consensus seeking. Although the nature of our collected data prevented us from observing these micro-level mechanisms, our findings seem to support Fan and Stevenson's (2019) line of reasoning. It seems, therefore, both theoretically and practically important to further examine the possibility that relationship breadth and depth may not be unequivocally beneficial for a firm's resilience, and that, in fact, their associated dark side may protract rather than shorten a firm's recovery time.

3.6.2 | Practical implications

Our findings have important practical implications for managers. We provide managers with empirical evidence on how the design of their supplier

relationships shapes their ability to deal with the SC disruptions that suppliers may inflict on their firms. Our findings, therefore, point toward an important element that managers need to consider when deciding on the type of relationship to engage in with a new supplier, or when evaluating the relationship with a current supplier. Although numerous other elements are important for managers to consider in establishing a new supplier relationship, managers that seek to strengthen their firms' resilience should pay particular attention to the novelty of the supplier-induced disruptions that will likely occur within the relationship. When managers foresee novel supplier-induced disruptions with respect to a certain type of component or product (e.g., because of market or environmental instability), their firms' resilience may benefit from initiating multiple connections with different people within the new supplier, allowing for a broader relationship. Alternatively, managers may source the products or components from a current supplier, thereby broadening an already established relationship. Managers should additionally demonstrate commitment to the respective supplier and refrain from engaging in dual or multiple sourcing, which typically discourages deeper relationships. Although both broad and deep relationships can strengthen firms' resilience to novel supplier-induced disruptions, our findings illustrate that, in particular, deep relationships may enable firms to recover more quickly from such disruptions.

By contrast, when managers foresee that the supply of the component or product will mostly be subject to familiar supplier-induced disruptions, it might be more beneficial for their firms' resilience to establish supplier relationships that involve few connections and little commitment or long-term perspective. To mitigate the adverse consequences of the predominantly familiar supplier-induced disruptions within these relationships, managers will have sufficient own prior experience and typically not require access to the information that relatively broader and deeper relationships allow for. In case familiar supplier-induced disruptions do occur within such broader and deeper relationships, we show that firms' recovery time may even increase. This illustrates that managers should also be aware of the novelty of supplier-induced disruptions in evaluating current supplier relationships, because broader and deeper relationships may fail to offer the desired resilience benefits when the firm is repeatedly exposed to familiar supplier-induced disruptions. In such situations, managers can decide to switch the sourcing of the respective product or component to a supplier with which their firm has a narrower and shallower relationship. In sum, our study provides valuable insights for managers by revealing how they may leverage their firms' supplier relationships to strengthen their firms' resilience to novel supplier-induced disruptions.

3.6.3 | Limitations and future research

Despite that this study has a number of important strengths (e.g., a unique and large sample of supplier-induced disruptions), several limitations should be noted. First, the study design prevented us from establishing causality, as we used natural variance rather than manipulated study variables. Given, however, that our conceptual framework is in line with previous research that positions the novelty of an SC disruption as a critical determinant of its duration (e.g., Bode et al., 2011; van den Adel et al., 2021), and with theoretical frameworks identifying closer collaboration with suppliers as a strategy to mitigate SC disruptions' impact (e.g., Jüttner & Maklan, 2011; Scholten & Schilder, 2015), we have some confidence in the directions of our predicted relationships. Nevertheless, we recognize that further experimental or longitudinal research is required to justify causal inference.

A second potential concern relates to our use of archival data to develop objective measures. This measurement approach allowed us to overcome important limitations associated with research approaches that are more subjective, such as surveys or observational studies that may be limited by, for example, common method bias and recall and response bias (cf., Helmuth et al., 2015). However, this approach also inhibited us from capturing the more detailed, micro-level mechanisms and processes that underlie our hypothesized relationships. Specifically, we theorized that disruption novelty compels a firm to search for new and relevant information, and that broader and deeper supplier relationships help the firm to obtain such information more quickly and effectively. The objective data collected relate to the outcomes of this information search (i.e., changes in recovery time) and, as such, preclude us from drawing detailed conclusions on which specific kinds of decisions or collaborative behavior within the firm's supplier relationships facilitated these changes. Supplementary studies employing alternative research approaches (e.g., observation, experiment, case study) may be useful for exploring the fine-grained mechanisms underlying the relationships our study demonstrates.

Third, we measured relationship depth by quantifying how committed the focal firm has been to a supplier in the past years. Previous research has proposed other constructs and measures for gauging relationship depth, such as measures of trust and friendship, that were unavailable to us because of the archival nature of our collected data. Hence, our measure and conceptualization of relationship depth may not be entirely comparable to those used in other research. Importantly, however, commitment is typically considered to be the central element of relationship depth (e.g., Elfenbein & Zenger, 2014; Olcott & Oliver, 2014; Treleven & Schweikhart, 1988; Villena et al., 2011). Moreover, this measure reflects a central element of how the electronics company in our research

context itself appraises its own supplier relationships; therefore, we believe that it adequately captures relationship depth in this context. Nonetheless, we recognize that additional research using alternative measures for relationship depth is necessary to validate our results.

A final potential limitation relates to our research context. This context was unique and highly relevant for the purposes of our study. The extensive and diverse collection of components and corresponding high number of supplier-induced disruptions offered a large dataset for empirically testing our hypotheses with sufficient statistical power. Nonetheless, it is uncertain whether our results can be generalized to other contexts. The prominence of the role of supplier relationships in resolving disruptions in the present context may, for example, be partially determined by the infeasibility of raw material buffers, giving suppliers more importance and power than in contexts where such buffers are feasible. Buffers, however, are expensive to maintain and often will not entirely absorb the impact of disruptions (van der Vegt et al., 2015); thus, supplier relationships may offer some resilience benefits in any context involving (novel) disruptions. Moreover, as the unavailability of components in our research context was critical because this interrupted assembly, our findings may generalize well to other contexts where disruptions similarly affect critical input material. Nevertheless, we encourage future research to replicate our study in other field settings in order to ascertain whether our findings generalize to other non-assembly contexts.

Besides addressing these limitations as suggested above and extending on our contributions, future research could broaden our conceptual framework to examine how relationship breadth and depth may help prevent supplier-induced disruptions from occurring. Although we contribute by exploring how relationship breadth and depth may assist a firm in managing the adverse consequences of novel supplier-induced disruptions, we do not explore how these relationship characteristics may help anticipate such disruptions or even prevent them from occurring. Scholten and Schilder (2015) illustrated, for example, that through joint knowledge creation in deeper relationships (see also Moran, 2005; Reagans & McEvily, 2003), firms may be able to prevent SC disruptions that would otherwise occur when only a single firm's knowledge is relied on. Therefore, we recommend that future research aims to explore more closely how relationship breadth and depth may not only help a firm mitigate the adverse consequences of supplier-induced disruptions more effectively, but also assist in preventing these disruptions from occurring in the first place.

3.7 | Conclusion

The present study integrates insights from event system theory and social capital theory to examine the suppliers' duality within resilience literature. We demonstrate that the role of a supplier in ensuring a focal firm's resilience is contingent both upon the novelty of the SC disruption that the supplier inflicts on the firm, and upon the breadth and depth of the relationship that the firm maintains with the supplier. In doing so, we present a unified framework that reconciles the findings of previous studies examining the distinct roles of suppliers, independent of each other, in harming or strengthening firm resilience. This framework can advance the way scholars think about the role of suppliers in firm resilience, and complements both event system theory and social capital theory. The insights that our study offers may additionally prove valuable for firms seeking to strengthen their resilience against the supplier-induced disruptions that they are frequently confronted with. We hope that this study will stimulate further research on the intricacies of suppliers' duality in the context of disruptions, and assist managers in managing their supplier relationships accordingly.