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Published in: Digitalization in Supply Chain Management and Logistics
Wolfgang Kersten, Thorsten Blecker and Christian M. Ringle (Eds.)
ISBN 9783745043280, Oktober 2017, epubli

Relational View on Collaborative Supply Chain Disruption Recoveries

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Due to their growing global and complex nature, supply chains are increasingly vulnerable to natural and man-made disasters that disrupt the flow of goods. Today, recovering from supply chain disruptions represents a major challenge for supply chain professionals. In research, most recovery methods suggested are based on redundancy and flexibility. In practice, a different approach gains momentum: companies recover by collaborating with their supply chain partners, especially by temporarily sharing resources. Based on the relational view theory, this paper uses multiple case studies and expert interview to develop a framework which describes the factors promoting collaborative resource sharing as well as the effect on supply chain resilience.

Keywords: Supply Chain Risk Management; Supply Chain Resilience; Supply Chain Collaboration; Shared Resources

1 Introduction

Supply chain (SC) disruptions are “unplanned and unanticipated events that disrupt the normal flow of goods and materials within a supply chain” (Craighead et al., 2007). In 2016, two of Volkswagen’s suppliers halted delivery of transmission and seat parts, following previous unresolved disputes between the parties. This led to stops of series production in seven German Volkswagen production sites. Additionally, several other suppliers were affected as well (Reuters, 2016). This example shows immediate consequences of SC disruptions, such as increasing costs as well as decreasing profitability and net sales. Long-term effects of disruptions are negative stock market reactions, damaged brand image and decreased customer service levels (Bello and Bovell, 2012; Craighead et al., 2007; Hendricks and Singhal, 2005).

The topic of managing SC disruptions becomes increasingly important due to three reasons. First, quantities as well as severities of natural and man-made disasters are expected to continue rising (Munich Re, 2016; SwissRe, 2016). Second, current business trends in the area of supply chain management (SCM), such as reduction of supplier base, just-in-time inventory system, outsourced manufacturing, and global sourcing, create highly interconnected global SC with fewer buffers and more risk exposure points. This increase the potential for and the impact of a SC disruption (Bello and Bovell, 2012; Craighead et al., 2007; Stecke and Kumar, 2006; Thun and Hoenig, 2011; Tukamuhabwa et al., 2015). Third, the recovery from SC disruptions is one of the main concerns of SC managers. However, it seems that companies are not well prepared for a fast recovery (Deloitte, 2013). Thus, there is a need to understand and implement risk management methods that facilitate the recovery of disruptions (Bovell, 2012).

Collaborative recovery as a reactive risk management method is rather new to the field of supply chain risk management (SCRM) and not yet holistically explained in literature. SC partners gain collaborative advantage by sharing their resources during disruption recoveries. This perspective is based on the relational view theory which states that collaborative advantage can be gained by leveraging inter-organizational resources available in the network (Dyer and Singh, 1998). In this research specifically one element of supply chain collaboration (SCC) is analysed, namely the sharing of resources. This paper aims to develop a collaborative recovery framework that encompasses promoting factors of collaborative resource sharing and its effect on supply chain resilience (SCRES). In addition, managerial implications are derived.

The paper is structured as follows. Chapter two covers a literature review of the concepts SCC and SCRES as well as the connection between both. In chapter three the methodology is outlined. In chapter four the developed framework is described in detail. Chapter five covers limitations, suggestions for further research and managerial implications.

2 Literature Review

This research project builds on the relational view as a theoretical foundation. The relational view theory, initially developed by Dyer and Singh (1998), is an extension of the resource-based view. The trend that networks of collaborating companies, instead of individual companies, compete against each other was the basis for its development. Dyer and Singh (1998) state that inter-firm linkages and inter-organizational resources may be a source of relational rents and collaborative advantage. Relational rent refers to “supernormal profit jointly generated in an exchange relationship that [...] can only be created through the joint idiosyncratic contribution of the specific alliance partners” (Dyer and Singh, 1998). One of the determinants of relational rent, and thus of collaborative advantage, is complementary resource endowment. It is defined as “distinctive resources of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner” (Dyer and Singh, 1998). Collaborative advantage refers to joint value creation and benefits gained over competitors in the marketplace through supply chain partnering (Cao and Zhang, 2013).

Within SCRM literature, there are two categories of SC disruption management methods: Preventive methods are used in advance of a disruption to reduce its likelihood. Reactive methods are used if a disruption occurred, thus during the recovery. The focus is to limit the severity of disruptions (Simchi-Levi, Schmidt and Wei, 2014; Stecke and Kumar, 2006). In SCRM literature, reactive measures receive considerably less attention than preventive measures (Tukamuhabwa et al., 2015). Furthermore, most of the existing reactive methods, such as excess inventory, multiple sourcing and rerouting of transports, focus on redundancy and flexibility (Christopher and Peck, 2004; Stecke and Kumar, 2006). These are not in line with the described current business trends as they involve high inventory and coordination costs (Chopra and Sodhi, 2014).

In this research the term SCRES is used to describe reactive methods only. SCRES is defined as the SC's ability to recover from a disruption and restore to normal operations in a timely manner more favourable than competing SC (Christopher and Peck, 2004; Ponis and Koronis, 2012; Ponomarov, 2012; Wieland and Wallenburg, 2013). This definition implies the core idea of the relational view theory by arguing that SC recover better, i.e. faster, than competing SC and can, therefore, gain a collaborative advantage.

SCC is defined by Cao et al. (2010) as a "long-term partnership process where supply chain partners with common goals work closely together to achieve mutual advantages that are greater than the firms would achieve individually". The relational view theory is also reflected in this definition. Long-term SC relationships create value that neither partner would have been able to create independently (Nyaga, Whipple and Lynch, 2010). Companies seek to build collaborative relationships because in this way they can access complementary resources and improve collaborative advantage (Cao and Zhang, 2013; Dyer and Singh, 1998; Mohr and Spekman, 1994).

According to Cao et al. (2010), resource sharing is an element of SCC and defined as "the process of leveraging capabilities and assets and investing in capabilities and assets with supply chain partners". They do not discuss resource sharing in the context of a time-limited event, such as a SC disruption recovery. Rather they discuss resources which are continuously shared. Resources are a key component of the relational view theory (Dyer and Singh, 1998). Lavie (2006) argues that companies can obtain value from resources which are not controlled or fully owned by their internal organization.

The topic of collaborative recovery can be located at the intersection of SCC and SCRES because it is a reactive disruption management method which is based on the effort of multiple companies within a SC. There are a few similar concepts described in literature. The research of Bello and Bovell (2012) as well as Wieland and Wallenburg (2013) focus on relational factors relevant to gain SCRES in collaborative relations. According to Bello and Bovell (2012), a gap exists in disruption recovery literature regarding the attention paid to relational resources that enable collaboration. Bovell (2012) highlight the value of collaborative resource sharing with respect to SCRES. Bode et al. (2011) presents the reactive methods 'bridging' which focuses on collaborative actions, like establishing relationships with influential individuals in partner companies. Furthermore, they find that the levels of trust and dependency are decisive in choosing a reactive method. Whitney et al. (2014) discuss and analyze the method 'temporary sourcing diversification'

which captures the temporary nature of the recovery process. Overall, there is a research gap with regard to reactive risk management methods that focus on relational resources as well as on resources temporarily shared during disruption recoveries. This research attempts to give some insights into this area.

3 Methodology

Developing a theoretical framework is understood as an iterative process. Kubicek (1976) describes the attempt to derive practical knowledge by interacting with practitioners, theoretical processing and reflection of the obtained knowledge in order to derive new questions for practitioners as iterative heuristic. The theoretical framework was continually modified with experience and information from a comprehensive literature review, case studies and expert interviews (for an overview of the executed interviews and case studies see appendix).

Six case studies were conducted based on secondary data (Brüning, Hartono and Bendul, 2014). The method is appropriate for this research because case studies are valuable for rather unexplored topics (Eisenhardt, 1989; Voss, Tsiriktsis and Frohlich, 2002). To ensure validity and reliability, established structured procedures were employed, such as case study protocols and case selection criteria. The case subjects had to have experienced a disruption that had consequences for multiple SC actors and there had to be some kind of SCC during the recovery. For the data collection different types of archival sources were consulted, such as company reports, reports from recognized organizations, newspaper articles, and academic literature.

Eight semi-structured expert interviews were executed. The dialog between interviewer and interviewee reflects the iterative framework development process (Kubicek, 1976). The interviewed experts are practitioners working in manufacturing industry, insurance or consulting, who are either dealing with or are/were affected by SC disruptions. An interview guideline was developed (Flick, 2006) based on the findings from literature review and case studies. The questions mainly focus on the company's experiences with collaboration during disruption recoveries and the general collaboration in their SC. There was sufficient time between the interviews to refine the guideline in between sessions. Eight expert interviews approximately 30 minutes were carried out over a time period of six months. The interviews were held in person or via telephone, depending on the preference of the interviewee. Seven of the interviewees gave permission

for the recording of the interview via digital voice recorder. Each interview was summarized in a protocol. The interviewees reviewed their protocols which, in turn, were improved based on their feedback (Voss et al., 2002).

4 Framework Development

Based on the methods described, a framework was developed that encompasses relevant factors to describe the risk management method collaborative recovery (figure 1).

4.1 Collaborative Resource Sharing

Starting point for the framework development is the central construct 'collaborative resource sharing'. It describes the actual temporary sharing of resources during disruption recoveries. The interviews and case studies were analysed with regard to three topics, namely the types of resources shared, the resources' abilities, and the actors sharing the resources (Brüning, Hartono and Bendul, 2015).

First, human resources (HR) and production resources (PR) are the two identified categories of resources shared during collaborative recoveries. HR include employees, managers and engineers as well as their know-how and skills. In all analysed cases HR were shared. For instance, to support Aisin's recovery, Toyota

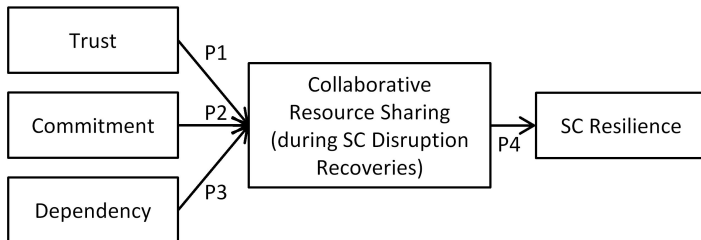


Figure 1: Theoretical Framework

sent around 400 employees from various departments (Nishiguchi and Beaudet, 1998). In the automotive and aerospace industry, original equipment manufacturers (OEM) have task forces which consist of skilled engineers and/or managers (interviews AeroOEM1, AutoOEM1, AutoOEM2). They can be sent on site in case of a SC disruption. PR cover equipment, tools, facilities, machine capacities and warehouse capacities as well as information and know-how, for instance about production processes. There are examples of companies in the food industry that used machine and warehousing capacities of competitors during SC disruption recoveries (interview Funk RMCE).

Second, adaptability, mobility and availability of capacity are the identified abilities which enable resources to be shared during SC disruption recoveries. HR have to be able to adapt to new tasks. For instance, in the case of Aisin, employees from their suppliers and customers could quickly adapt to produce the needed parts (Nishiguchi and Beaudet, 1998). Adaptability of PR refers to the ability of changing tools, machines or warehouses according to new requirements. The ability 'mobility' refers to HR's and PR's ability to move. In the case of Renesas, more than 2,500 engineers from other companies were mobilized and came to the disrupted plant. In order to exchange information, recovery activity team leaders had daily meetings to discuss the progress of the recovery (Renesas, 2011). Resources need to have capacity available (Whitney et al., 2014). With regard to HR, employees need to have capacity to take over new tasks. This may be accomplished with additional shifts or with established task forces (interviews AeroOEM1, AutoOEM1, AutoOEM2, AutoOEM3). For PR, it is required that machines or warehouses have capacity available to take over production processes on short notice (interviews AeroOEM1, Funk RMCE).

Third, the identified involved actors cover intra-organizational, horizontal as well as vertical collaboration. Intra-organizational collaboration exists, for instance, between different subsidiaries of one company (Barratt, 2004). During Nissan's recovery, hundreds of employees from other Nissan plants worldwide were involved in the repair work at the damaged facilities (Nissan, 2012). Vertical collaboration with customers and suppliers (Barratt, 2004; Simatupang and Sridharan, 2002) is most frequently used (interviews AeroOEM1, AutoOEM3, Controllit OHB, Funk RMCE). Customers are the actors that are involved in all analyzed cases. Second tier customers and second tier suppliers may also be involved in collaborative recoveries, like in Aisin's recovery (Whitney et al., 2014). These indirect relationships are activated only for the time of the recovery (interviews AutoOEM1, Funk RMCE). Horizontal collaboration refers to collaboration with competitors or other unrelated organizations (Barratt, 2004; Simatupang and Sridharan, 2002). Collab-

oration with competitors during recoveries happens rarely (interviews AutoOEM1, AutoOEM2) due to antitrust and privacy issues (interview OHB). Also governmental organizations may share their resources. For instance, soldiers and equipment from the Thai Army and Thai Navy supported the recovery of Western Digital (Wai and Wongsurawat, 2013). The relevant roles of logistics service providers and insurance companies were highlighted by some interviewed experts (interviews AutoOEM1, Lampe and Schwartze). They seem to be valuable due to their neutral supervising position within the network.

4.2 Promoting Factors

Three relational resources that promote collaborative recoveries are identified. A collaborative culture among SC partners seems to be beneficial for collaborative recoveries and is characterized by the relational resources ‘trust’ and ‘commitment’. Literature in the field of SCC frequently emphasizes a close connection between the two concepts (Kwon and Suh, 2005; Morgan and Hunt, 1994; Nyaga et al., 2010; Ryu, So and Koo, 2009). Both will be discussed in the following paragraphs. ‘Dependency’ seems to be the main motivation for companies to collaborate during SC disruption recoveries and will be discussed afterwards.

4.2.1 Trust and Commitment

Trust is defined by Rousseau et al. (1998) as “the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another”. The concept of trust is composed of two main dimensions (Bode et al., 2011; Cao and Zhang, 2013; Kumar, Scheer and Steenkamp, 1995; Nyaga et al., 2010; Sheu, Yen and Chae, 2006). According to Doney and Cannon (1997), credibility is the “expectancy that the partner’s word or written statement can be relied on” and benevolence is the “extent to which one partner is genuinely interested in the other partner’s welfare and motivated to seek joint gain”.

Several studies found strong associations between SC partners’ trust and relationship success. For instance, Sheu et al. (2006) point out the criticality of trust for supplier-retailer collaboration. According to Mohr and Spekman (1994), trust is a primary characteristic of partnership success. Relationships with a high level of trust are willing to take risks between partners (Kwon and Suh, 2005; Li et al., 2015). According to McEvily et al. (2003), trust can be a mobilizer that motivates

companies to contribute and combine their resources in joint activities to achieve their goals and to resolve problems.

Morgan and Hunt (1994) define commitment as “an exchange partner believing that an ongoing relationship with another is so important as to warrant maximum efforts at maintaining it; that is, the committed party believes the relationship is worth working on to ensure that it endures indefinitely”. Commitment generally encompass three dimensions, namely affective commitment (“the desire to continue a relationship because of positive affect toward the partner”), expectation of continuity (“the firm’s perceptions of both its own and its partner’s intent to remain in the relationship, which, thereby, reflect the relationship’s stability”), and willingness to invest in the relationship (“the intention to become more deeply involved in the relationship through investments of capital and effort”) (Kumar et al., 1995).

A large amount of studies stress the relevance of commitment in collaborative relationships. The results of Mohr and Spekman’s study (1994) indicate that one primary characteristics of partnership success is commitment. This is because commitment creates a context in which parties can achieve their long-term individual and joint goals without being concerned about opportunistic behaviour. Ryu et al. (2009) argue that commitment foster the integration of partnerships among SC partners. The studies of Nyaga et al. (2010) show that trust and commitment leads to improved satisfaction and performance in collaborative relationships between SC partners.

The analysed cases show a high degree of trust and commitment between partners that collaborated during SC disruption recoveries. For example, Aisin was one of the most trusted of Toyota’s suppliers and main Japanese supplier of P-valves, the critical part of which the SC was disrupted (Nishiguchi and Beaudet, 1998). During Western Digital’s recovery, the customers expressed their trust and commitment in agreeing upon special provisions that deviate from normal contractual agreements (Wai and Wongsurawat, 2013). Many interviewees confirmed that high levels of trust and commitment lead to higher willingness to collaborate during disruption recoveries (interviews Lampe and Schwartze, OHB). For example, OHB treat their suppliers as partners that share risk and solve problems jointly as they work towards a common goal (interview OHB). Based on the described literature that emphasizes the key role of trust and commitment in collaborative interorganizational relationships as well as the results of the case study analysis and interviews, the following propositions are derived:

Proposition 1: A high level of trust between SC partners leads to a high level of collaborative resource sharing during disruption recoveries.

Proposition 2: A high level of commitment between SC partners leads to a high level of collaborative resource sharing during disruption recoveries.

4.2.2 Dependency

“Dependence exists when one party does not entirely control all of the conditions necessary for achievement of an action or a desired outcome” (Handfield and Bechtel, 2002; Monczka et al., 1998). In literature, several authors suggest a positive effect of dependency on SCC. Sheu et al. (2006) show that interdependence between parties is one essential factor for interorganizational relationships because it motivates to share key information and participate in joint efforts. According to Monczka et al. (1998), interdependence as an attribute of supplier alliances was found to be significantly related to partnership success. As stated by Hudnurkar et al. (2014), the structure of dependency relationships is highly relevant for successful collaborations as it has essential implications for joint efforts, including problem solving.

The dependency on a partner is often connected to the relevance of a product which is characterized by high levels of customization, supply scarcity, technical complexity and/or novelty of technology (De Leeuw and Francoo, 2009; Whitney et al., 2014). According to De Leeuw and Fransoo (2009), the more the products are relevant, the more close SCC is expected. Nokia depends on Philips' production because only they can supply specific components needed for producing a type of cell phone chip (Sheffi, 2005). Similarly, Renesas' microcontrollers are custom-made which makes switching to another supplier difficult (Pollack, 2011). However, the interviews and case studies show that also other forms of dependency exist. The disruption of one supplier can lead to strategic problems for other suppliers. In the case of Aisin, hundreds of suppliers, local electricity, gas and transportation companies had to wait for Aisin to reopen the plant in order to resume deliveries (Nishiguchi and Beaudet, 1998). In addition, the current SCM business trends, especially single sourcing, leads to a high level of dependency. The importance of dependency with regard to collaborative recovery was stressed by all interviewed experts. The interviewees of Lampe and Schwartze said that during disruption recoveries, they and their partners are “all in the same boat”. Dependency seems to be the main trigger that motivates actors to get involved in collaborative recoveries, which is reflected in the following proposition:

Proposition 3: A high level of dependency between SC partners leads to a high level of collaborative resource sharing during disruption recoveries.

4.3 Supply Chain Resilience

Following the relational view line of argumentation, SCRES is achieved if a SC recovers better than its competing SC, thus if a collaborative advantage is derived. The success of a recovery is derived from its so-called time to recover (Simchi-Levi et al., 2014). This is the time period between the occurrence of the disruption and the complete restoring of the SC. Several authors stress the competitive positioning role of resilience. For example, based on an extensive literature review, Tukamuhabwa et al. (2015) conclude that companies that respond to a disruption better than its competitors can improve their market position. Rice and Caniato (2003) state that in case of disruptions, companies can compete on their resilience capabilities.

In the analysed cases, companies' time to recover was shorter compared to their competitors. Unfortunately, the cases do not always provide sufficient information about the time to recover of competing SC or companies. Instead, the expected and the real time to recover were analysed. For instance, Western Digital could successfully recover within two months. In comparison, four months after the flood that caused the disruption, only about half of the 90 affected factories in the area resumed production (Wai and Wongsurawat, 2013). The restart of Renesas' limited production was three months faster than initially anticipated by its engineers (Olcott and Oliver, 2014; Renesas, 2011). With regard to Riken's recovery, multiple sources state that the support of its customers enabled the company to restart production much quicker than it would have without their help (Global Risk Miyamoto, 2007; Whitney et al., 2014).

As outlined by existing research and supported by the relational view theory, there is a positive relation between the concepts SCC and SCRES (Bello and Bovell, 2012; Bovell, 2012; Brüning and Bendul, 2015; Wieland and Wallenburg, 2013). For example, Christopher and Peck (2004) state that "building resilience to SC risks requires a high degree of collaboration". Based on the analyses and literature results, the following proposition can be derived:

Proposition 4: A high level of collaborative resource sharing during disruption recoveries leads to a high level of supply chain resilience.

5 Conclusion

Several companies applied the sharing of resources during disruption recoveries. However, the method of collaborative recovery was not yet holistically explained in literature. Collaborative recovery is based on the idea of the relational view theory and which states that collaborative advantage can be derived from inter-organizational resources (Dyer and Singh, 1998). It is suggested that by collaborating during SC disruption recoveries, a SC can be more resilient than their competing SC. A framework to describe the promoting factors for collaborative resource sharing and its effect on SCRES was developed. Based on a literature review, case studies and expert interviews, three promoting factors were defined, namely trust, commitment and dependency. The developed propositions indicate that collaborative SC recovery has the potential to be a promising reactive risk management method.

Based on the results presented in this paper, some managerial implications can be derived. First, adaptability, mobility and availability of capacity are the identified abilities which enable resources to be shared during SC disruption recoveries. SC managers can prepare for fast recoveries by taking care that large amounts of resources (HR and PR) have these abilities. For example, interorganizational training can improve the adaptability and mobility of HR. Second, collaboration took place between different SC actors. When planning for collaborative recovery actions, SC managers may consider also collaborating with their indirect partners, for instance second-tier suppliers. In addition, companies can take advantage of logistics service providers or insurance companies and their neutral coordinating roles in SC. Third, commitment and trust were identified as the relational resources that promote collaborative recoveries. Thus, investing in strong, long-term partnerships seems to pay off during SC disruption recoveries.

The methods employed in this research have several limitations. The amount of cases and interviews conducted was limited. In addition, the cases were based solely on secondary data. Further research could aim at triangulating the information gathered. In general, case studies have limitations regarding the attainable level of generalizability (Eisenhardt, 1989).

This paper is part of a larger research project. The next steps are the operationalization of the identified constructs, the execution of a large-scale survey, and the statistical analysis of the data gathered to test the developed propositions.

Appendix: Overview of Interviews

Table 1: Overview of Interviews

Name of Interviewee	Position	Company	Industry	Date/ Type of Interview
Anonymous	Manager Production Logistics	AutoOEM 1	Automotive	04.06.2015/ face-to-face
Anonymous	Quality Sales	AutoOEM 2	Automotive	30.07.2015/ phone
Anonymous	Manager Logistics Planning	AutoOEM 3	Automotive	06.08.2015/ phone
Anonymous	Senior Manager, Procurement	AeroOEM 1	Aerospace	07.05.2015/ face-to-face
Mr. Heinrich	Director Procurement	OHB	Aerospace	18.02.2015/ face-to-face
Mr. Löffler	Managing Director	Funk RMCE	Insurance	02.06.2015/ phone
Mr. Viethen; Mr. Bening	Management Assistant	Lampe and Schwartz	Insurance	18.02.2015/ face-to-face
Mr. Rosenberg	Managing Director	Controllit AG	Consulting	29.05.2015/ phone

Appendix: Overview of Case Studie

Table 2: Overview of Case Studies

Company description	Disruption description	Recovery description SC actors (resources shared during SC disruption recoveries)
Case: Western Digital Leading electronics company; headquarter in the US; several subsidiaries in Asia	October 2011: heavy flooding in Bang Pa-In Industrial Estate, Thailand; precision equipment and supplies of material were destroyed (Wai and Wongsurawat, 2013); affected customers worldwide, as the price of external hard drives increased at least by 10% (Fuller, 2011)	<ul style="list-style-type: none"> - Customers (monetary resources (MR)) - Navy, army (human resources (HR), production resources (PR)) - Intra-organizational actors (employees of Western Digital's national and international plants) (HR)
Case: Renesas Leading electronics and automotive company, world market, share of 44% (Olcott and Oliver, 2014); headquarter in Japan	March 2011: the Great East Japan Earthquake severely damaged Renesas', Naka manufacturing plant; cleanrooms were destroyed; just-in-time, production resulted in production shortages at major automotive,customers (Pollack, 2011)	<ul style="list-style-type: none"> - Customers (HR, PR) - Competitors (MR) - Governmental agencies (MR) - Intra-organizational actors (HR)
Case: Nissan One of Japan's largest automotive manufacturers	March 2011: the Great East Japan Earthquake hit two assembly plants; loss of production capacity of about 270,000 cars; about 50 suppliers of Nissan were directly affected by the disaster as well (Greenway, 2014)	<ul style="list-style-type: none"> - Customers/competitors (HR) - Suppliers (HR) - Competitors (HR) - Intra-organizational actors (HR, PR)

Continued on next page

Table 2: Overview of Case Studies (continued)

Company description	Disruption description	Recovery description SC actors (resources shared during SC disruption recoveries)
Case: Riken Japan's largest supplier of piston rings in the automotive industry (50% market share) (Whitney et al., 2014)	July 2007: Niigata Chuetsu off-shore earthquake affected one main plant and nine satellite companies (Whitney et al., 2014); operations at main plant were suspended for two weeks (Global Risk Miyamoto, 2007; Whitney et al., 2014); several automobile manufacturers (e.g. Toyota and Mitsubishi) interrupted their operations (Global Risk Miyamoto, 2007)	<ul style="list-style-type: none"> - Customers (automotive manufacturers, equipment manufacturers) (HR, PR) - Intra-organizational actors (HR)
Case: Philips Worldwide operating electronics company; headquarter in the Netherlands	March 2000: plant in Albuquerque, New Mexico, caught a fire because of lightning; cleanrooms were ruined and millions of chips were contaminated by smoke and water (Mukherjee, 2008)	<ul style="list-style-type: none"> - Customer (Nokia) (HR) - Nokia's suppliers (PR) - Intra-organizational actors (PR)
Case: Aisin Supplies mostly automotive parts, headquarter in Aichi, Japan	February 1997: fire in the factory in Aichi destroyed specialized equipment; it's customer Toyota announced a shut-down of its production lines on the following day (Nishiguchi and Beaudet, 1998; Whitney et al., 2014)	<ul style="list-style-type: none"> - Customers (HR, PR) - Suppliers (HR, PR) - Toyota's suppliers (HR, PR)

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