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KENYTH ALVES DE FREITAS

Navigating Together Through Seas of Uncertainties:
An Extended Inter-organizational View of Supply Chains

SÃO PAULO

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Dissertation presented to the School of Business Administration of Sao Paulo, Fundação Getulio Vargas, to fulfill the requirements to obtain a Doctoral degree in Business Administration.

Research Line: Operations Management and Sustainability

Supervisor: Prof Ely Laureano Paiva, Dr.

Co-supervisor: Prof Barbara Bechler Flynn, Ph.D.

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*To the interviewees, who shared with us
two of the most important resources that they possess:
time and knowledge.
Thank you for your generosity!*

Some possess what others lack, and what lacks in some, others possess, and this goes on successively. But the major issue is that nobody wants to give the other what he possesses claiming that what he has is better than what he lacks and what the other possesses.

[Uns têm o que falta a outros, e o que a uns falta, outros têm; e assim sucessivamente. Mas o grande problema reside em que ninguém quer dar ao outro o que tem, porque pretende que o que tem seja melhor do que o que lhe falta e o outro tem].

Carlos Bernardo González Pecotche

An Introduction to Logosophical Cognition

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At the end of this journey, I am very grateful for the path I took, for the experiences that I lived, and for the friendships that I built. Someone recently told me that if you looked back at the end of a cycle and realized that you had not created any bond with anyone, something very wrong happened in this experience. The bonds we create, along with the changes we make in ourselves, are the elements that remain with us throughout our lives. Therefore, my Ph.D. at Fundação Getulio Vargas was a lifetime experience for everything it has allowed me to learn and grow.

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Navigating Together Through Seas of Uncertainties: An Extended Inter-organizational View of Supply Chains

ABSTRACT

Supply chains from different industries have expanded their activities worldwide in the last decades, seeking low-cost sourcing and supplying products to new markets. As their operations enlarged distinct continents and countries, additional and growing threats emerged from those environments affecting supply chain performance. In other words, the same process that led supply chains to global expansion also raised uncertainties, risks, and disruptions for companies. However, the external environment could not see only as a source of threats. Government institutions, cross-sector partners, competitors, and society possess resources that could be employed in inter-organizational responses beyond supply chain boundaries. This dissertation focuses on understanding how companies respond to external threats and, simultaneously, enhance other agents in the environment in collaborative efforts. Therefore, I question: *How do companies and their supply chains interact with the environment under uncertainty?* This dissertation investigates the influence of the external environment as a source of threats and, simultaneously, support for supply chains under uncertainty. I approached this dynamic through three essays focusing on understanding the dynamic between supply chains and the external environment under institutional uncertainties, cargo theft risks, and disruptions from the Coronavirus [COVID-19] pandemic, respectively. Those essays reveal that companies developed mechanisms to respond to threats, enhance inter-organizational support in collaborative responses, and improve their knowledge to operate under uncertainty. I contribute to the Operations and Supply Chain Management literature by exploring the dynamic between supply chains and their environment from different theoretical lenses and levels of threats.

Keywords

Uncertainty; Inter-organizational relationships; Collaboration; External environment.

Navegando Juntos por Mares de Incertezas:

Uma Visão Interorganizacional Estendida das Cadeias de Suprimentos

RESUMO

As cadeias de suprimentos de diferentes setores expandiram sua atuação em todo o mundo nas últimas décadas, buscando fontes de baixo custo e fornecendo produtos para novos mercados. À medida que suas operações incluíram novos continentes e países, novas e crescentes ameaças emergiram desses ambientes afetando o desempenho das cadeias. Em outras palavras, o mesmo processo que levou as cadeias de suprimentos à expansão global também aumentou as incertezas, os riscos e as rupturas para as empresas. No entanto, o ambiente externo não pode ser encarado apenas como uma fonte de ameaças. Instituições governamentais, parceiros de demais setores, concorrentes e sociedade possuem recursos além dos limites das cadeias de suprimentos que podem ser empregados em respostas conjuntas para ameaças em comum. Esta tese se concentra em compreender como as empresas respondem às ameaças externas e, simultaneamente, criam relações com outros agentes do ambiente em esforços colaborativos. Portanto, eu questiono: *Como as empresas e suas cadeias de suprimentos interagem com o meio ambiente sob a incerteza?* O objetivo desta tese é investigar a influência do ambiente externo como fonte de ameaças e, simultaneamente, suporte para cadeias de suprimentos sob incerteza. Abordei essa dinâmica por meio de três ensaios focados na compreensão da dinâmica entre as cadeias de suprimentos e o ambiente externo sob incertezas institucionais, risco de roubo de carga e rupturas da pandemia de Coronavírus [COVID-19], respectivamente. Esses ensaios revelam que as empresas desenvolveram mecanismos para responder às ameaças, construindo suporte interorganizacional em respostas colaborativas e aprimorando seus conhecimentos em operar sob incertezas. Eu contribuo para a literatura de Operações e Gerenciamento da Cadeia de Suprimentos, explorando a dinâmica entre as cadeias de suprimentos e seu ambiente de diferentes lentes teóricas e níveis de ameaças.

Palavras-chave

Incerteza; Relações interorganizacionais; Colaboração; Ambiente externo.

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1. CHAPTER ONE - GENERAL INTRODUCTION

If there's one thing that's certain in business, it's uncertainty

Stephen Covey (American educator)

Overview and motivations

After over a century of operating in Brazil, Ford Motor Company announced the shutdown of its three factories on January 11, 2021. In the press release, the company blamed the unfavorable economic scenario aggravated by the Coronavirus [COVID-19] pandemic, leading to its business restructuring in South America. Since five to twelve thousand jobs will be lost in the closure, this decision was extensively discussed by the Brazilian media and authorities. The Brazilian president, Jair Bolsonaro, accused the company of trying to obtain additional tax incentives from South American countries: “I’m sorry, but I will no longer keep spending your money to support their factories” (Rosati & Wanzeller, 2021). The Ministry of Economy, Paulo Guedes, reinforced the need for improvement in the national business environment to avoid new shutdowns. On the other hand, the Chamber of Deputies President, Rodrigo Maia, accused the government of increasing uncertainty for business, blaming “the Brazilian government’s lack of credibility, clear rules, legal certainty, and a rational tax system” (Toueg, 2021). Despite those narratives’ political content, they brought to light how the external environment can influence supply chain decisions.

Since global supply chains have expanded worldwide in the last decades, companies are under constant uncertainties that emerged from the different environments in which they operate (Flynn, Koufteros & Lu, 2016; Kelling, Sauer, Gold & Seuring, 2020; Schneier, 2019). The closure of Ford’s plants in Brazil highlighted the importance of recognizing threats beyond supply chain boundaries, such as the lack of efficient institutions (Lee, Abbey, Heim & Abbey, 2016; Zhou, Su, Yeung & Viswanathan, 2016), the volatile business environment (Fiksel, Polyviou, Croxton & Pettit, 2015; Schneier, 2019), and long-term impact of the COVID-19 pandemic’s outbreaks (Craighead, Ketchen & Darby, 2020; Gunessee & Subramanian, 2020; Hoek, 2020; Ivanov, 2020; Ivanov & Dolgui, 2020). Therefore, operations and supply chain management [OSCM] scholars and practitioners should recognize supply chains as complex networks embedded in a larger set of inter-organizational relationships, addressing social, environmental, and institutional threats to long-term sustainability (Dmitrijeva, Schroeder,

Bigdeli & Baines, 2020; Liu, Aroean & Ko, 2019; Macdonald, Zobel, Melnyk & Griffis, 2018; Nair & Reed-Tsochas, 2019). Ignoring the external environment implies that threats that emerged from it have no significant impact on supply chains (Dmitrijeva et al., 2020; Macdonald et al., 2018; Liu et al., 2019), which the pandemic showed how dangerous this assumption can be.

Recent literature points to the need to reconsider supply chains as an extended and more complex inter-organizational set of relationships (Ivanov, 2020; Liu et al., 2019; Mollenkopf, Ozanne & Stolze, 2021), including mutual interactions between supply chains, competitors, cross-sector organizations, non-governmental organizations [NGOs], regulative institutions, society, and the natural environment. However, most studies have only considered the relationship established within supply chain boundaries to respond to common threats, specifically buyer-supplier relationships (Daghar, Alinaghian & Turner, 2021; Durach & Machuca, 2018; Fan & Stevenson, 2018; Friday, Ryan, Sridharan & Collins, 2018). Those studies have ignored the potential resources that can emerge from relationships with different agents in the environment (Gabler, Richey & Stewart, 2017; Lawton, Dorobantu, Rajwani & Sun, 2020), as presented in Figure 1.1.



Figure 1.1. Extended Inter-organizational View of Supply Chain

I consider that the external environment has a dual role with respect to supply chains, as a simultaneous source of threats and resources. Companies tend to rely more on their supply

chain partners under uncertainty and risk (Kreye, 2017), accessing needed resources from inter-organizational relationships to improve their performance (Gabler et al., 2017; Medel, Kousar & Masood, 2020; Roscoe et al., 2020). For example, cargo theft response requires police protection and legal power from regulative institutions to dismantle criminal groups. However, those relationships can be embedded in opportunistic, unfair, and unlawful behavior (Collier & Sarkis, 2021; Crane, 2013; Huq & Stevenson, 2018), increasing relational uncertainty (Kreye, 2017). In the cargo theft example, police officers could be part of the theft scheme, leading the company to restrain its information sharing and reducing its collaboration with the police over time (Collier & Sarkis, 2021; Fawcett, Jones & Fawcett, 2012). Understanding the set of complex relationships in the environment is an opportunity for OSCM researchers and practitioners to better anticipate, respond, and recover from threats that emerge from the external environment. Moreover, I consider that incorporating commercial and non-commercial inter-organizational relationships in supply chain research could increase its realism, leading to better contributions to both the literature and practical business settings.

This dissertation is structured in five chapters. In this first chapter, I introduce supply chains as complex networks embedded in a more extensive and uncertain environment, followed by the main research question and objectives, an overview of the sampling and data gathering, and a description of how I frame the three essays in this dissertation. I present the essays in chapters two, three, and four. The last section presents the main conclusions and suggestions for future studies.

Main research question and objectives

The following research question guided this dissertation: *How do companies and their supply chains interact with the environment under uncertainty?* The three essays of this dissertation aim to investigate the influence of the external environment as a source of threats and, simultaneously, support for supply chains under uncertainty. I approached this dynamic through the following three chapters/essays, respectively, aiming:

1. To understand how companies adapt their operations strategy to uncertainties caused by weak institutions and how they can influence institutions (Chapter Two, first essay).

2. To understand how companies respond to cargo theft under weak institutions, employing relational governance to build social capital in distrusting inter-organizational relationships (Chapter Three, second essay).
3. To understand how supply chains employ social capital to build resilience, addressing how they enhanced relationships within and beyond their supply chains during the COVID-19 pandemic (Chapter Four, third essay).

Sampling and data gathering overview

To address those objectives, I followed an inductive multiple case study approach for each essay (Eisenhardt, 1989; Ketokivi & Choi, 2014). The OSCM literature describes multiple case studies as a suitable approach for investigating contextually rich phenomena (Barratt, Choi & Li, 2011; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Ketokivi & Choi, 2014). In total, I selected eleven companies, leaders in the domestic market, from seven industries: automotive (3 companies), beverages (2 companies), food (2 companies), cosmetics, electronics, pharmaceutical, and tobacco (1 firm each).

I adopted a theoretical sampling approach to select the cases (Eisenhardt, 1989; Miles & Huberman, 1994), using different criteria to identify suitable companies for each essay. As a result, I selected seven multinational companies for the first essay, based on their domestic and global manufacturing leadership and their experience in operating in a weak institutional environment. For the second essay, I selected nine companies based on their target product value and perceived risk level. Last, I selected nine companies for the third essay, based on how essential their products were during the pandemic and their dependence on global suppliers.

I employed interviews as my primary data collection approach, applying a semi-structured questionnaire (Barratt et al., 2011). The initial contacts were made in two stages, based on personal contacts from family, friends, colleagues, and professors, snowball sampling with the prior companies' interviewees, and through LinkedIn. I got in touch with approximately 600 to 700 managers during the two stages. In the first stage, I interview 29 managers between August 2017 and February 2019. Those interviews were analyzed in the first essay, and 14 of them provide relevant data about cargo theft that I used as an exploratory stage in the second essay. In the second stage, I collected 57 interviews from managers and two interviews from public security agents between July and November 2020. I used those

interviews in the second and third essays. In sum, I collected and analyzed 88 interviews for this dissertation, presented in Appendix 1A.

Framing the essays

In this dissertation, I contribute to the OSCM literature by addressing recent calls for understanding supply chains from a broader perspective, including other agents from the external environment (Gabler et al., 2017; Lawton et al., 2020). Companies can face various threats to their supply chain in a volatile external environment (Rezaei, Shokouhyar & Zandieh, 2019; Singh & Singh, 2019). This study highlights how companies respond to different threats under uncertainty, including institutional uncertainty, cargo theft risks, and disruptions from the COVID-19 outbreak.

The concept of uncertainty and risk are highly related, however, there is a long debate about the distinctions between those terms (Chen, Sohal & Prajogo, 2016; Ekwall, Bröls & Wyer, 2015). This dissertation defines uncertainty as “the lack of knowledge which arises from not definite, not known or reliable information” (Kreye, 2017, p.1722). On the other hand, risks are potential adverse consequences derived from uncertainties, defined as “the possible effect of an uncertain event or situation” (Benedettini, Neely & Swink, 2015; Kreye, 2019, p. 77). Disruption is defined as a category of risk with catastrophic impact to supply chains, stopping and/or reducing the normal flow of products and material (Rezaei et al., 2019; Singh & Singh, 2019), as presented in Figure 1.2.

In the first essay, “Strategic Choice under Institutional Uncertainties: How do MNCs Interact with Weak Regulative Institutions?”, I employed the lenses of institutional and co-evolutionary theories to develop a broader understanding of institutional uncertainty in MNCs’ operations strategy. The results highlighted the dynamics of interactions between companies and a weak institutional environment involving suppliers, markets, and industry associations. Weak institutions generate different uncertainties that affect companies directly; moreover, those uncertainties are sources of relational uncertainty reflected in their supply chains and markets. I proposed that this interaction occurs directly and indirectly, based on the characteristic of uncertainty and the companies.

In the second essay, “Can We Go on Together with Suspicious Minds? Achieving Cargo Theft Resilience through Collaborative Risk Response under Weak Institutions”, I applied institutional and social capital theories to understand the role of institutions as an essential

element in supply chain risk resilience in a cargo theft response. Due to its violent nature, companies' response to the threat of cargo theft involves inter-organizational relationships, including with government institutions and cross-sector partners. The results reveal that relational governance is crucial to building social capital in inter-organizational relationships under distrust.

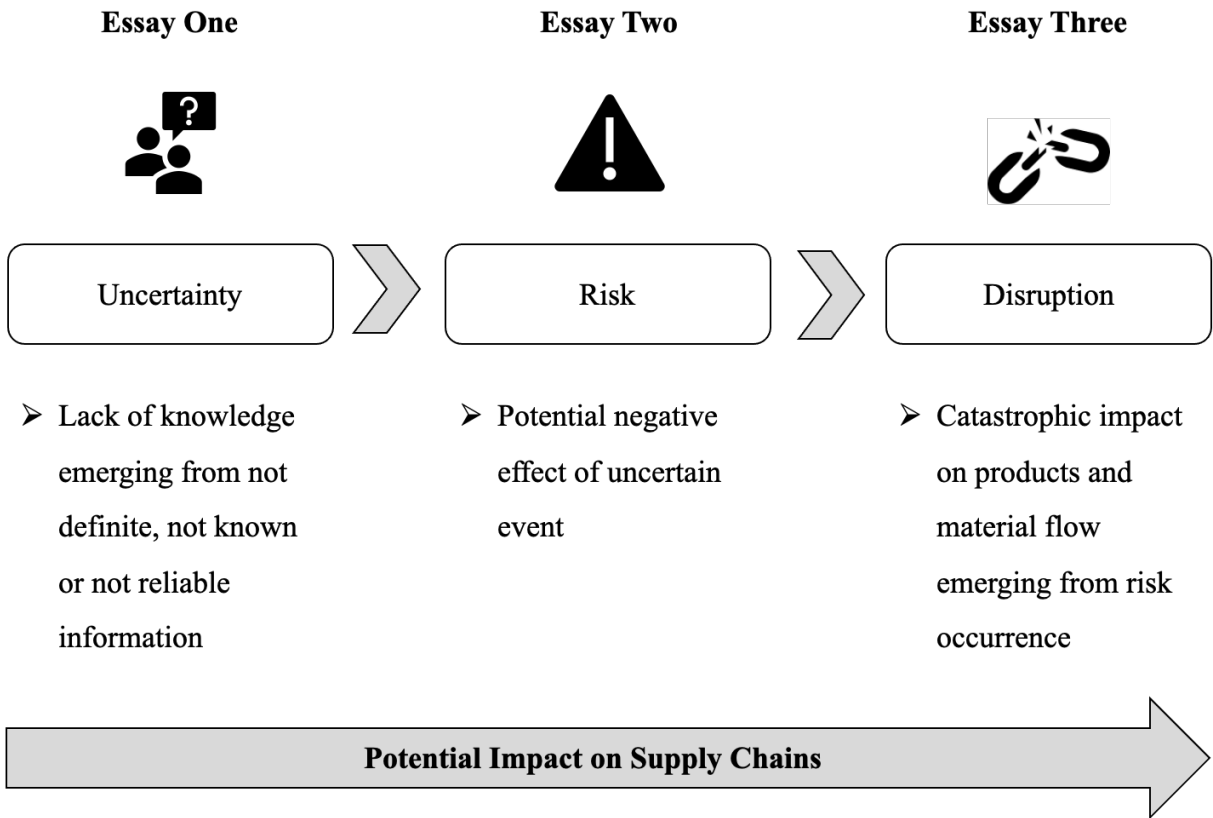


Figure 1.2. Conceptualization of Threats

In the third essay, “Help Yourself by Helping Others: Building Collective Resilience through Social Capital”, I investigate how companies help other companies in their recovery from the COVID-19 pandemic outbreak. The results suggest that companies relied on social capital to compensate for their lack of prior knowledge about disruptions and strategy during the pandemic, establishing relationships within and beyond supply chain boundaries to access resources for resilience. These relationships allowed them to develop capabilities to anticipate threats, develop early protection, built collective responses, and recover quickly. Due the fact that the pandemic was long-term, widespread, and had a growing socio-economic impact, I highlight engagement in disaster relief efforts as part of companies' supply chain resilience processes.

I summarize the description of the essays in Table 1.1, including their research questions, theories and concepts, information about the case studies, overall contribution, and main objective and conclusion. In the following sections, more details are given in each chapter.

Table 1.1 - Research Design

Navigating Together Through Seas of Uncertainties: An Extended Inter-organizational View of Supply Chains			
Main objective	To investigate the influence of the external environment as a source of threats and, simultaneously, support for companies and their supply chains under uncertainty		
Essays	Strategic Choice under Institutional Uncertainties: How do MNCs Interact with Weak Regulative Institutions?	Can We Go on Together with Suspicious Minds? Achieving Cargo Theft Resilience through Collaborative Risk Response under Weak Institutions	Help Yourself by Helping Others: Building Collective Resilience through Social Capital
Threats	Institutional uncertainties	Cargo theft risk	Disruptions from the COVID 19 outbreak
Research questions	(RQ1) How do multinational companies adapt their operations strategies to an uncertain institutional environment? (RQ2) How do MNCs build influence over weak institutions through their strategic choices?	(RQ1) How do companies respond to cargo theft in a weak institutional environment? (RQ2) How do companies adopt relational governance mechanisms to build social capital in an environment characterized by mistrust?	(RQ1) How do companies employ their social capital to build supply chain resilience in a pandemic context? (RQ2) How do companies employ disaster relief as part of their supply chain resilience process?
Theories	Institutional theory Co-evolutionary theory	Institutional theory Social capital theory	Social capital theory
OSCM concepts	Supply chain ambidexterity	Supply chain risk management Relational governance	Supply chain resilience
Case study information	Seven companies Four industries	Nine companies Six industries	Nine companies Six industries
Overall contribution	I contribute to the OSCM literature by highlighting the dynamics of interactions between companies and the institutional environment, including suppliers, markets, and industry associations. I propose that this interaction occurs directly and indirectly, based on characteristics of uncertainty and the companies.	I contribute to the OSCM literature by highlighting institutions as simultaneous sources of risks and resources. The results reveal that relational governance is a crucial ingredient to build social capital in inter-organizational relationships under distrustfulness.	I contribute to the OSCM field by introducing the concept of “collective supply chain resilience”, which help understand resilience in this type of outbreak.

**Navigating Together Through Seas of Uncertainties:
An Extended Inter-organizational View of Supply Chains**

Main conclusion	This dissertation expanded the OSCM literature by presenting the potential support for companies that know how to operate with other agents in the environment under uncertainty
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Appendices One

Appendix 1A - Overview of Interviews

Case	ID	Functional area of the interviewee	Essay 1	Essay 2	Essay 3
AUTO1	AUTO1E1	Projects and Product Development	X		
	AUTO1E2	Projects and Product Development	X		
	AUTO1E3	Logistics and Transportation	X	X	
	AUTO1E3*	Logistics and Transportation		X	
	AUTO1E4	Information Technology	X		
	AUTO1E5	International Trade			X
	AUTO1E6	Projects and Product Development			X
	AUTO1E7	International Trade		X	X
	AUTO1E8	Supply chain		X	X
	AUTO1E9	Supply chain		X	X
	AUTO1E10	Projects and Product Development		X	
	AUTO1E11	Logistics and Transportation	X	X	
	AUTO1E12	Projects and Product Development		X	
AUTO2	AUTO2E1	Projects and Product Development	X		
	AUTO2E1*	Projects and Product Development			X
	AUTO2E2	Procurement	X	X	
	AUTO2E3	Procurement	X	X	
	AUTO2E4	Logistics and Transportation	X	X	
	AUTO2E5	Logistics and Transportation	X		
	AUTO2E6	Sales and Distribution			X
	AUTO2E7	Manufacturing			X

Case	ID	Functional area of the interviewee	Essay 1	Essay 2	Essay 3
	AUTO2E8	Projects and Product Development			X
	AUTO2E9	Logistics and Transportation		X	X
	AUTO2E10	Sales and Distribution			X
	AUTO2E11	Logistics and Transportation		X	
AUTO3	AUTO3E1	Planning	X		
	AUTO3E2	Planning	X		
	AUTO3E3	Projects and Product Development	X		
BEER1	BEER1E1	Logistics and Transportation	X	X	
	BEER1E1*	Logistics and Transportation		X	X
	BEER1E2	Sales and Distribution	X	X	
	BEER1E3	General Management	X		
	BEER1E4	General Management			X
	BEER1E5	Logistics and Transportation		X	X
	BEER1E6	Logistics and Transportation		X	X
	BEER1E7	Logistics and Transportation		X	X
	BEER1E8	Logistics and Transportation		X	X
	BEER1E9	Logistics and Transportation		X	X
BEER2	BEER2E1	Logistics and Transportation	X	X	
	BEER2E2	Sales and Distribution	X	X	
	BEER2E3	Sales and Distribution	X	X	
	BEER2E3*	Sales and Distribution		X	X
	BEER2E4	Sales and Distribution	X	X	
	BEER2E4*	Sales and Distribution		X	X
	BEER2E5	Process Management	X		

Case	ID	Functional area of the interviewee	Essay 1	Essay 2	Essay 3
	BEER2E6	Process Management	X		
	BEER2E7	Process Management	X		
	BEER2E8	Sales and Distribution		X	X
	BEER2E9	Security and Risk Management		X	X
	BEER2E10	Sales and Distribution			X
	BEER2E11	Operations Management		X	X
COSM1	COSM1E1	Projects and Product Development	X		
	COSM1E2	Supply chain	X		
	COSM1E3	Supply chain	X		
ELTR1	ELTR1E1	Manufacturing		X	X
	ELTR1E2	Sales and Distribution		X	X
	ELTR1E3	Logistics and Transportation		X	X
	ELTR1E4	Logistics and Transportation		X	X
	ELTR1E5	Logistics and Transportation		X	X
FOOD1	FOOD1E1	Sales and Distribution		X	X
	FOOD1E2	International Trade		X	X
	FOOD1E3	Supply chain		X	X
	FOOD1E4	Logistics and Transportation		X	X
	FOOD1E5	Security and Risk Management		X	
	FOOD1E6	Security and Risk Management		X	
	FOOD1E7	General Management			X
FOOD2	FOOD2E1	Projects and Product Development		X	X
	FOOD2E2	Logistics and Transportation		X	X
	FOOD2E3	Procurement		X	X

Case	ID	Functional area of the interviewee	Essay 1	Essay 2	Essay 3
PHRM1	FOOD2E4	Sales and Distribution		X	X
	FOOD2E5	Sales and Distribution		X	X
	PHRM1E1	Sales and Distribution		X	X
	PHRM1E2	Supply chain		X	X
	PHRM1E3	Manufacturing		X	X
	PHRM1E4	Procurement			X
	PHRM1E5	Supply chain		X	X
	PHRM1E6	Supply chain		X	
TOBC1	TOBC1E1	Logistics and Transportation	X	X	
	TOBC1E1*	Logistics and Transportation		X	X
	TOBC1E2	Logistics and Transportation	X	X	
	TOBC1E3	Logistics and Transportation	X	X	
	TOBC1E3*	Logistics and Transportation		X	X
	TOBC1E4	Security and Risk Management	X	X	
	TOBC1E4*	Security and Risk Management		X	X
	TOBC1E5	Security and Risk Management		X	X
N/A	PBSC1	Public agent		X	
	PBSC2	Police inspector		X	

Note. *Second interview of the same informant.

2. CHAPTER TWO – FIRST ESSAY

Strategic Choice under Institutional Uncertainties: How do MNCs Interact with Weak Regulative Institutions?

ABSTRACT

Purpose: Our research aims to understand how multinational corporations [MNCs] adapt their operations strategy to uncertainties caused by weak institutions and how they can influence institutions.

Design/methodology/approach: We conducted a multiple case study with seven leading MNCs from four representative industries in Brazil: automotive, beverage, cosmetics, and tobacco.

Findings: Our findings suggest that companies identified different threats that emerged from the same institutional environment. Although institutional uncertainty can affect them directly, it also serves as a source of relational uncertainty reflected in their supply chains and markets. Besides, we reveal that higher uncertainty can result in internal resource improvement, causing an MNC to have a significant influence over its supply chain members and their institutional environments. Last, the findings show how market composition can determine an MNC's channels of influence over its institutions, directly by the MNC or indirectly by industry associations.

Originality: We contribute to the OSCM literature by highlighting the dynamics of interactions between MNCs and their institutional environment, involving suppliers, markets, and industry associations. Besides, we proposed that this interaction occurs directly and indirectly based on MNC's characteristics.

Research limitations/implications: This research does not consider the difference between host and home country MNCs or two subsidiaries operating under different countries' institutional environments. Also, we did not monitor an MNC's response during a longitudinal period, understanding how strategic choice can change over time.

Keywords

Institutional uncertainty; strategic choice; ambidexterity; co-evolutionary theory.

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*We do not include those who work in the case companies.

INTRODUCTION

*We have more lawyers working in the legal department [to respond to labor processes]
than engineers in your factory*
(Manager from innovation – AUTO2E1)

Charles Darwin (1859) mentioned a reciprocal evolutionary process between insects and flowering plants in his book “On the Origin of Species”. Bees are attracted to nectar from pollen, positively affecting this new source of food. On the other hand, they cross-pollinate these plants in return. That dynamic favored bees and plants, changing the entire forest landscape. Mutual interactions between two or more species can result in joint evolution, affecting not only each other’s evolutionary path but including the entire environment as well (Ehrlich & Raven, 1964). Since global supply chains expand across multiple national environments, companies constantly face vulnerabilities (Flynn, Koufteros & Lu, 2016; Schneier, 2019) that emerge from the institutional environment in which they operate (Kelling, Sauer, Gold & Seuring, 2020; Lee, Abbey, Heim & Abbey, 2016). Those institutions can impact business performance, determining and limiting opportunities through regulations and contradictory public policies (Kelling et al., 2020; Zhou, Su, Yeung & Viswanathan, 2016).

The role of the institutional environment is to reduce uncertainty by establishing formal rules and informal norms (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008); however, the absence or weakness of more stable institutions can have the opposite effect, increasing the level of uncertainty for MNCs (Bachmann & Inkpen, 2011; Kreye, 2017; Zhou et al., 2016). Consequently, those companies doing business in a country with weak regulative institutions may suffer from opportunistic, unfair, or unlawful behaviors by their supply chain partners (DiMaggio & Powell, 1983; Su, Peng & Xie, 2016). Emerging markets, such countries in Latin America, have those institutional idiosyncrasies that led them to uncertainty (Mair, Marti & Ventresca, 2012). However, since formal rules can be absent, MNCs in countries of weak institutions tend to rely on relationships and networks more intensely, forcing them to develop joint strategies to face uncertain and institutional idiosyncrasies (Collier & Sarkis, 2021; Kreye, 2017).

Co-evolutionary theory presents a broad view of this dynamic, considering a firm’s environment as a complex set of relationships amongst its supply chain partners, competitors,

industry associations (McKelvey, 1997), as well as the institutions that help reshape its corporate strategy, such as the government, laws, social norms, education, religion, among others (Khavul, Chavez & Bruton, 2013; Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008). By improving their internal resources, multinational corporations [MNCs] can build influence over their competitors, partners, and even institutions (Cantwell, Dunning & Lundan, 2010; Duarte & Rodrigues, 2017). However, how this process happens in an environment characterized by weak institutions is still uncharted. This study was guided by the following questions using the framework of co-evolutionary theory: *(RQ1) How do MNCs adapt their operations strategies to an uncertain institutional environment?* *(RQ2) How do MNCs build influence over weak institutions through their strategic choices?* Thus, this research aims to understand how MNCs develop their operations strategies to adapt to uncertainty caused by weak institutions and how they can build influence over those institutions.

To address those questions, we follow a multiple case study approach (Eisenhardt, 1989). The use of case studies is appropriate because the phenomenon of co-evolution in an environment characterized by weak institutions is not very well understood and is characterized by complex relationships (Ketokivi & Choi, 2014). We studied seven MNCs, leaders in their domestic and global markets, in the automotive, beverage, cosmetic, and tobacco industries in Brazil.

Our study addresses recent calls for applying new theories to establish operations and supply chain management [OSCM] topics (Anand & Gray, 2017; Ketokivi, 2016; Mayer & Sparrowe, 2013). The lenses of institutional and co-evolutionary theory lead to a broader understanding of institutional uncertainty in an MNC's operations strategy. Moreover, this research expands understanding of the role of institutions in strategic choice in the OSCM field (Kelling et al., 2020; Lee et al., 2016; Spring, Hughes, Mason & McCaffrey, 2017; Turkulainen, Kauppi & Nermes, 2017; Wu & Jia, 2018), highlighting the mutual relationships between MNCs and weak regulative institutions.

We make theoretical contributions to the OSCM literature as well. First, we highlight the importance of managing uncertainties under weak regulative institutions, not only within an MNC but also through its suppliers and markets. Institutional theory has shown that weak institutions can be a source of uncertainty for companies (Kelling et al., 2020). We introduce how institutional uncertainty can be spread as relational uncertainty throughout supply chain relationships in an environment characterized by weak institutions (Kreye, 2017; Wang et al.,

2018). Second, our study contributes to co-evolutionary theory by understanding its response through ambidexterity (March, 1991; Volberda & Lewin, 2003), highlighting the decision based on the impact of the institutional uncertainty on costs, performance, potential disruptions, and relational uncertainty.

Third, we contribute to understand the influence of MNCs over weak institutions. Institutional theory addressed that companies tend to shape the institutions in their environment to their own benefits (Meyer & Rowan, 1977; Powell & DiMaggio, 1991), our study expands that knowledge by proposing that they seek greater influence under higher uncertainties. Fourth, we examine MNCs' influence over weak institutions, suggesting it could be done directly, when they assume costs, risks, and potential benefits associated with this influence, or indirectly, through industry associations. Our study contributes to both institutional and co-evolutionary theories by suggesting the importance of the role played by other agents in the environment in the MNCs' co-evolution (Duarte & Rodrigues, 2017; Kolk & Tsang, 2015; Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Rodrigues & Child, 2003; Scott, 2008).

The following section presents a literature review of institutional and co-evolutionary theoretical lenses. We focus on weak institutions as a source of uncertainty for companies, which affects their operations strategy. The third section describes the methodological steps used in the case studies of seven MNCs operating in an environment characterized by weak institutional support. The fourth section presents the within-case and cross-case analyses results, describing the mutual interaction between MNCs and regulative institutions. In the following section, we discuss our findings and synthesis with the literature. Last, the main conclusions, theoretical contributions, managerial implications, and suggestions for future studies are presented in the final section.

THEORETICAL FRAMEWORK

Institutional Environment as a Source of Uncertainty

Institutionalization is the process by which social interactions and routines take on a rule-like status (Meyer & Rowan, 1977); institutions are “[...] assumptions and values, usually implicit, about how to interpret organizational reality, what constitutes appropriate behavior and how to succeed” (Thornton, 2004, p. 70), including social and cultural norms, laws, religion, education, the government, among others (Meyer & Rowan, 1977; Powell &

DiMaggio, 1991; Scott, 2008). Therefore, institutions can reduce uncertainty (DiMaggio & Powell, 1983) by sharing convergent thinking (Moxham & Kauppli, 2014).

Neo-institutional theory (DiMaggio & Powell, 1983) groups these forces into regulative, normative, and social institutions (Scott, 2008). Regulative institutions, which are the focus of this research, are based on a government's ability to monitor the actions of firms in its jurisdiction (Campbell, 2007). This ability strongly influences the institutional environment, defined as the "rules, norms, and belief systems [which] undergird all stable social systems, including economic systems" (Scott, 2008, p. 429), and can influence firms by both determining and limiting their opportunities for new business.

Although institutional theory provides a useful lens for understanding external pressures in the OSCM field (Dobrzykowski, 2019; Friday, Ryan, Sridharan & Collins, 2018; Kelling et al., 2020; Zhou et al., 2016), most empirical studies have been based in relatively stable and efficient institutional environments (Friday et al, 2018; Spring et al., 2017). Over the past decades, MNCs have rushed to expand their operations globally, seeking, especially, lower costs in emerging economies (Jung, 2020). However, emerging economies are often characterized by weak law enforcement, bribery, and superficial audits by overburdened inspectors (Crane, 2013; Huq & Stevenson, 2020).

Uncertainty is defined as "the lack of knowledge which arises from not definite, not known or reliable information" (Kreye, 2017, p.1722). It can be classified by its source (Benedettini, Neely & Swink, 2015; Reim, Parida & Sjödin, 2016). External uncertainty, or environmental uncertainty, originates outside a firm's boundaries, such as uncertainty generated by institutions, the MNC's market, society, or stakeholders (Milliken, 1987). Internal uncertainty, or organizational uncertainty, is generated within a firm's boundaries and is generally associated with a lack of capabilities (O'Connor & Rice, 2013). Our focus in this research is on external uncertainties, specifically in regulative institutional uncertainties. Institutional uncertainty originates from "contexts that are composed of institutions that are not well institutionalized [...] the low degree of institutionalization results in a high degree of ambiguity and therefore a greater degree of institutional uncertainty" (Phillips, Tracey & Karra, 2009, pp. 340-341). For example, sudden changes in regulation affects long-term planning, making investors stay away. However, institutional uncertainties do not only affect MNCs but also influence a firm's relationship with other agents in its environment (Daghar, Alinaghian, & Turner, 2021; Fan & Stevenson, 2018; Kelling et al., 2020; Kreye, 2017).

Although the relationship between supply chain members is a key factor in supply chain performance (Gabler, Richey & Stewart, 2017; Medel, Kousar & Masood, 2020; Roscoe, Skipworth, Aktas & Habib, 2020; Wynstra, Spring & Schoenherr, 2015), it can also be a source of substantial uncertainty in an environment of weak regulative institutions (Collier & Sarkis, 2021; Kelling et al., 2020). Relational uncertainty “arises because the actions of a partnering organization cannot be predicted or explained due to lacking knowledge regarding their abilities and intentions” (Kreye, 2017, p. 1723). Therefore, although an MNC develops relationships with supply chain members to reduce its supply uncertainty, it can introduce new types of uncertainty (Kreye, 2017) in an environment characterized by weak regulative institutions (Kelling et al., 2020; Wang et al., 2018).

Many researchers have recognized uncertainty as an issue in the OSCM literature (Ojha, Acharya & Cooper, 2018; Selviaridis, 2016; Jung, 2020; Tan, Feng & Chen, 2016); however, few papers focus on institutions as its source (Flynn et al., 2016; Kelling et al., 2020; Wang et al., 2018; Wang, Zhang, Wang & Sheng, 2016). Therefore, the institutional environment can be a direct source of uncertainty for MNCs, and it can indirectly affect the relationship between MNCs and other agents in their environment. However, companies are not passive agents in an environment of weak institutions; they can proactively influence the entire environment. In other words, companies evolve together with the institutions in their environment.

Co-evolutionary Perspective of Strategic Choice

Co-evolutionary theory was developed to understand the selection and adaptation of firms' strategies to a competitive environment shaped by a large and complex process of joint development involving the influence of different levels of management (Braguinsky & Hounshell, 2016; Duarte & Rodrigues, 2017; Lewin & Volberda, 1999; McKelvey, 1997). It is based on interdependent interaction amongst managerial decisions, partners, industry competitors, and institutions (Lewin & Volberda, 1999; McKelvey, 1997), so it is appropriate for examining the relationship between supply chains and institutional environments (Jiang, Gong, Wang & Kimble, 2016; Khavul et al., 2013; Spring et al., 2017; Wu & Jia, 2018).

MNCs actively interact with their institutional environment and the pressures they exert (DiMaggio & Powell, 1983; Khavul et al., 2013; Oliver, 1991). However, the extent of the co-evolution differs based on the embeddedness of a firm in its environment and its relationship with those players. Co-evolutionary patterns can be synthesized into four distinct mechanisms,

based on managers' intentions, the interaction of the firm with its external environment, and the outcomes of this process (Volberda & Lewin, 2003), described in Table 2.1.

Table 2.1 – Co-evolutionary Mechanisms

Mechanisms	Managers' intention	Interactions with the environment	Outcomes
Naive Selection	Top managers are detached from operations	Little connection with the institutional or competitive environments	Exploitation
Managed Selection	Top managers are limited engage from operations	Anticipation of practices and routines within supply chain and industry environments	Exploitation
Hierarchical Renewal	Managers consider operations as a strategic element of the business	Purposeful sharing information and resources	Exploitation and exploration
Holistic Renewal	Top-down and bottom-up managers are connected from operations	There is collective learning and interacting with the external environment	Exploration

Note. Source: Adapting from Paiva, E. (2019). Ambidestria e coevolução em operações: integrando teoria e prática. *RAE-Revista de Administração de Empresas*, 59(2), 144-148. Volberda, H., & Lewin, A. (2003). Co-evolutionary dynamics within and between firms: From evolution to co-evolution. *Journal of Management Studies*, 40(8), 2111-2136.

Firms make strategic choices at the micro, meso, and macro levels, creating the possibility of broadening the in understanding of the different strategies adopted in their operations management. Through this analysis, we can understand how a firm's competitive and institutional environments influence its strategy and, simultaneously, how the firm can affect its external environment through developing a new strategy, capability, or resource (Rodrigues & Child, 2003). Therefore, firms' strategies both adapt themselves to institutions and influence them (Cantwell et al., 2010; Duarte & Rodrigues, 2017).

While co-evolutionary theory researchers suggest mutual adaptation mechanisms for engaging companies and their institutional environment (Khavul et al., 2013; Lewin & Volberda, 1999; McKelvey, 1997), little attention has been given to how MNCs adapt their strategy to operate in weak institutional environments (Duarte & Rodrigues, 2017). Also, it remains unclear how MNCs interact with the weak regulative institutions in these environments.

Although co-evolutionary theory offers a useful theoretical lens for understanding firm-external environment dynamics, it presupposes that the mobilization of resources and the creation of competencies are unevenly distributed (Lampel & Shasie, 2003). Therefore, the opportunities that a firm chooses to explore will depend on the outcomes and capabilities

associated with them. The research on ambidexterity brings a new perspective in this discussion by considering that resource exploration can result in two distinct (March, 1991) and simultaneous processes (Li, 2013; Kortmann, 2015; Parikh, 2016): exploitation and exploration. Exploitation is the refinement of the existing knowledge to foster efficiency, related to productivity and variation decrease. On the other hand, exploration involves the search for new options to achieve organizational flexibility based on creativity, innovation, and variation increase (March, 1991).

OSCM researchers have used the ambidexterity lens to understand how firms engage exploitation and exploration practices in the supply chain context (Bravo, Ruiz-Moreno & Montes, 2018; Ojha et al., 2018; Souza-Luz & Gavronski, 2020; Turner, Aitken & Bozarth, 2018). Supply chain exploitation is a “set of practices that refine and extend existing skills and resources”, which include reducing costs and improving prior practices and technologies. On the other hand, supply chain exploration is composed of “practices that develop new supply chain solutions” (Kristal et al., 2010, p. 415), including experimenting and acquiring new resources and competencies. These two approaches can offer both current gains and anticipation of future changes by acting together (Birkinshaw & Gupta, 2013), and they are essential in contexts characterized by environmental uncertainty (Ossenbrink, Hoppmann & Hoffmann, 2019).

Uncertain environments call for adaptative practices and strategies (Vahlne & Jonsson, 2017); therefore, seeking both exploitation and exploration could lead to “[an] important learning capability that may enhance a firm’s response to environmental uncertainty” (Patel et al., 2012, p. 204). The essence of ambidexterity is both the extension of existing capabilities (exploitation) and, simultaneously, the development of new ones (exploration) (Bandeira-de-Mello, Fleury, Aveline & Gama, 2016).

Although scholars argue that ambidexterity is critical for firms to adapt to changes in the environment (O’Reilly & Tushman, 2004; Salvador, Chandrasekaran & Sohail, 2014), the role of weak regulative institutions in this dynamic remains unknown. Our research uses exploitation and exploration processes as key concepts to understand co-evolutionary mechanisms (Volberda & Lewin, 2003), by understanding the non-firm influences in a firm operations strategy, developing a broader perspective of this dynamic.

The Co-evolution of Institutions

Co-evolutionary theory was past applied in emerging economies, suggesting the relevance of their regulative institutions in business strategic choice (Duarte & Rodrigues, 2017; Kolk & Tsang, 2015; Rodrigues & Child, 2003). However, most of the OSCM studies assume that the institutional environment is composed of strong regulative institutions (Darkow, Weidmann & Lorentz, 2015), ignoring the possible uncertainty that emerged from weak institutions. Moreover, few of those studies considered the mutual relationships between companies and institutions (Dobrzykowski, 2019; Jiang, Gong, Wang & Kimble, 2016; Spring et al., 2017; Wu & Jia, 2018), focusing only on how companies adapt to regulations or industrial policies in their institutional environments.

Institutional theory researchers recognized the influence of different agents over institutions (Thornton, 2004), describing this dynamic over time (Besharov & Smith, 2014). Like describe by co-evolutionary theory, institutional theory proposed that the institutional environment co-evolves through “[...] a dynamic and interactive process that occurs over time with actors both being shaped by and shaping the institutional environment” (Khavul et al., 2013, p. 32). The institutional theory established that MNCs can employ their social and political resources to intentionally change institutions for their own benefit (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008).

Institutions can change in a complex process that leads the original status quo to new or adapted institutions, changing the “rules of the game” (Giddens, 1984). Those changes occur when agents in the environment consider that the results of institutions are unsuitable for economic, business, or social development, making efforts to influence them (Khavul et al., 2013). For example, companies could identify regulations that affect business conditions in their institutional environment (Chen, Yao & Zhu, 2020). Thus, they may elaborate a set of recommendations to political agents, formulating a public policy that changes the original regulations (Arikan, Reinecke, Spence & Morrell, 2017; Espinosa, 2021; Zeng, 2021).

Our research combines institutional and co-evolutionary theory to better understand an expanded mutual dynamic in an environment characterized by uncertainty, including MNCs, their supply chain partners, and weak regulative institutions. Institutional theory provides a useful less to understand institutional uncertainty (Kelling et al., 2020) and the changes in the institutional environment (Khavul et al., 2013). On the other hand, co-evolutionary theory offers a better understanding of mutual and complex relationships in MNCs, supply chain, industry, and institutional levels. Therefore, we combine both theories to increase realism to our research, making better contributions.

RESEARCH METHODS AND PROCEDURES

This study aims to understand how MNCs interact with regulative institutions in an uncertain environment. Since our research investigates a contextually rich phenomenon, we use an inductive multiple case study approach (Barratt, Choi & Li, 2011; Eisenhardt, 1989; Ketokivi & Choi, 2014). We build our research questions based on institutional and co-evolutionary theories. Although the existing theories offer a sufficient basis for the formulation of the research questions, they have not been applied together to understand this phenomenon, allowing us to develop more precise theoretical insights. Therefore, we used a theory elaboration approach because “the context is not known well enough to obtain sufficiently detailed premises that could be used in conjunction with the general theory to deduce testable hypotheses” (Ketokivi & Choi, 2014, p. 236). This section is structured by the five stages of a case study proposed by Eisenhardt (1989). They include developing the research questions (presented in the introduction), case selection, data gathering, data analysis, and replication.

Case Selection

We take a theoretical sampling approach to select our cases (Eisenhardt, 1989), using four criteria to identify suitable companies (Table 2.2). First, given the study’s focus, we use MNCs as the unit of analysis to better integrate the set of distinct environments and contexts in the context of co-evolutionary theory (Madhok & Liu, 2006). Second, we selected a country known for its weak regulative institutions. According to the Global Competitiveness Index (World Economic Forum [WEF], 2017), the Brazilian institutional performance was ranked in one of the lowest positions, as 109 in 137 countries. Its performance was particularly bad in areas of the burden of government regulations, transparency of government policymaking, and the business costs of crime and violence. Third, we selected industries that are representative of Brazilian manufacturing and global industries in what Brazil plays a significant role: automotive, beverages, chemistry (including cosmetics), and tobacco (Brazilian Institute of Geography and Statistics [IBGE], 2019). Fourth, we selected representative companies in each of the selected industries. All seven cases are leaders in their national and global markets (Bloomberg, 2021).

According to Eisenhardt (1989), a multiple case study that includes between four and ten cases is considered adequate. We selected seven companies in the automotive (3

companies), beverages (2 companies), cosmetics (1 firm), and tobacco (1 firm) industries. After identifying a group of suitable companies to fulfill our research purposes, we invited the managers of these companies to participate and sent a confidentiality agreement, indicating that we would not disclose the companies' or the participants' names.

Table 2.2 - Case Selection Criteria

Criteria	Selection	Details
The unit of analysis must be embedded in the environment	We selected seven home and host MNCs with operations in Brazil and at least one other country as the unit of analysis	Co-evolutionary theory researchers consider MNCs as an ideal unit of analysis because they are embedded in distinct environments and contexts (Madhok & Liu, 2006)
The country must have weak regulative institutions	We selected Brazil based on its institutional performance on the Global Competitiveness Index (WEF, 2017)	Global Competitiveness Index is composed of 11 pillars, including the pillar of institutions. Of 137 countries, Brazilians' institutions were ranked as the 109 th worst performance. Their performance was particularly bad in: <ul style="list-style-type: none"> • Efficiency of government spending (133rd) • Burden of government regulation (136th) • Transparency of government policymaking (127th) • Business costs of crime and violence (132nd) • Efficiency of the legal framework in challenging regulations (98th)
The industry must be representative	We selected four industries that are both representatives of Brazilian manufacturing, and in what Brazil is a global producer	Brazilian manufacturing is the world's 9 th largest (third among emerging countries) (United Nations Industrial Development Organization [UNIDO], 2020). We selected industries in what Brazil is in the top ten world's producers: <ul style="list-style-type: none"> • Automotive - 8th • Beverages - 6th • Chemicals (including cosmetics) - 7th (UNIDO, 2016) • Tobacco: 3rd (Food and Agriculture Organization [FAO], 2016)
The company must be representative in the industry	We selected leaders of the Brazilian market in each industry	We selected cases that are in the top five largest producers in each industry

Data Gathering

We collected data between August 2017 and February 2019. Our primary data source was in-depth interviews using the semi-structured interview guide in Appendix 2A (Barratt et al., 2011). We spoke with at least three and as many as seven informants in each company (see Table 3). To obtain a broader view of the companies' operations areas, the interviewees were from several functional areas. This resulted in reliability in the information collected, reducing the risk of limited understanding of the areas of performance or by subjective factors influence on the interviewee.

We interviewed a total of 29 managers, with an average duration of approximately 40 minutes per interview. To be consistent in collecting data, we conducted each interview in Portuguese, the interviewees' native language. We were allowed to record 24 of the interviews. The other five did not allow recording, so we relied on our field notes for them. After the data collection, we transcribed the recorded interviews and translated representative quotes to English (Appendix 2B).

Data Analysis

We developed a set of propositions based on the evidence collected from the case studies following an inductive approach (Barratt et al., 2011; Eisenhardt, 1989; Gioia et al., 2013; Ketokivi & Choi, 2014). All transcriptions and field notes were coded and analyzed (Corbin & Strauss, 2008) using an open coding strategy in Atlas TI software for the within- and cross-case analysis (Eisenhardt, 1989). The inductive approach allows us to focus theorization on the emergence of constructs from the field (Gioia et al., 2013; Randall & Mello, 2012).

We began by identifying codes based on the terminology used by the informants (Gioia et al., 2013; Corbin & Strauss, 2008). Second, the codes were grouped into 21 first-order categories, and those categories were then grouped into six second-order categories expressed in theoretical terms. We focus on identifying the major institutional uncertainties in each case and understand how the companies deal with them, as presented in the within-case analysis. Third, this microanalysis of relationships and meanings was the basis for synthesized the phenomena into their three overarching dimensions, as presented in the cross-case analysis. We compared our findings with the OSCM literature, leading to the development of our four propositions.

Table 2.3 - Overview of Interviews

Industry	Case	Global revenue*	Facilities	ID	Functional areas of the interviewee	Time (minutes)
Automotive	AUTO1	US\$100-150 billion	Over 30 countries	AUTO1E1	Product development	60
				AUTO1E2	Product development	70
				AUTO1E3	Logistics	40
				AUTO1E4	Information management	40
	AUTO2	US\$100-150 billion	Over 30 countries	AUTO2E1	Product development	60
				AUTO2E2	Purchasing	40
				AUTO2E3	Purchasing	40
				AUTO2E4	Logistics	40
				AUTO2E5	Logistics	30
	AUTO3	US\$200-300 billion	Over 30 countries	AUTO3E1	Planning	30
				AUTO3E2	Planning	50
				AUTO3E3	Product development	70
Beverage	BEER1	US\$10-20 billion	Over 15 countries	BEER1E1	Logistics	40
				BEER1E2	Transport management	40
				BEER1E3	Manufacturing	30
	BEER2	US\$20-30 billion	Over 70 countries	BEER2E1	Distribution	40
				BEER2E2	Distribution	40
				BEER2E3	Logistics	40
				BEER2E4	Process management	60
				BEER2E5	Process management	60
				BEER2E6	Process management	60
				BEER2E7	Distribution	40

Industry	Case	Global revenue*	Facilities	ID	Functional areas of the interviewee	Time (minutes)
Cosmetics	COSM1	US\$10-20 billion	Over 10 countries	COSM1E1	Supply chain management	40
				COSM1E2	Logistics	30
				COSM1E3	Product development	30
Tobacco	TOBC1	US\$30-50 billion	Over 40 countries	TOBC1E1	Logistics	60
				TOBC1E2	Logistics	40
				TOBC1E3	Transport management	40
				TOBC1E4	Security management	60

Note. **Bloomberg L.P.* (2021). Stock price graph. Retrieved Jan. 19, 2021, from Bloomberg database.

Replication

We applied four quality criteria to ensure quality rigor to set the foundation for replication (Lincoln & Guba, 1985), described in Table 2.4. First, internal validity was addressed by selecting companies from different industries that are representative of the Brazilian economy, by interviewing at least three informants per case from different functional areas by developing propositions and frameworks related to the phenomena in question. Second, we addressed external validity by specifying the unit of analysis and describing the context of each case in the within-case analysis. Therefore, our findings can be transferred and compared to other similar settings.

Table 2.4 - Quality Criteria

Criteria	Definition	Application
Internal Validity	“The degree to which findings correctly map the phenomenon in question”	Seven leading MNCs from four important industries Interviews with professionals from different functional areas, with at least three interviews per firm Proposition The theoretical framework
External Validity	“The degree to which findings can be generalized to other settings similar to the one in which the study occurred”	Specification of the unit of analysis and the context Dense context description (within-case analysis)
Reliability	“The extent to which findings can be replicated or reproduced by another investigator”	Semi-structured questionnaire (Appendix 2A) Documentation of all procedures performed during the case studies Transcription of the interviews
Objectivity	“The extent to which findings are free from bias”	Raw material presented, including interviewee quotations Created case selection criterion

Note. Source: Adapted from Lincoln, Y. S., & Guba, E. G. (1985, pp. 42-43). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications.

Third, we addressed reliability by provided the semi-structured questionnaire in Appendix 2A, documenting procedures, transcribing interviews, and caring out the data analysis. These procedures assured consistency across the data analysis between informants. Forth, objectivity was addressed by the case selection criterion and interviewee quotations.

RESULTS

Following the procedure by Eisenhardt (1989), we conducted our analysis in two steps. First, we conducted a within-case analysis, where each of the seven cases was deeply analyzed.

In this step, we identified the main institutional uncertainties in each company, the strategy adaptation in each uncertainty, and the supply chain partners involved, summarized in Table 5. Second, we conducted a cross-case analysis based on evaluating the main categories and subcategories that emerged from the interviews. Also, we build an analytical model and interaction between constructs following Gioia et al. (2013), presented in Figure 2.1. The quotations of the respondents are listed in Appendix 2B.

Within-Case Analysis

AUTO1

AUTO1 is a host automotive MNC that operates in over 30 countries. Historically, AUTO1 has established its operations in less developed regions of Brazil, based on tax benefit policies offered by local governments. Unlike other companies that set up operations in more industrialized regions, AUTO1 needed to create a supplier base capable of mitigating disruptions.

Industrial policy

We identified three industrial policies that have generated uncertainties for AUTO1 in the last decade. First, the Brazilian government offered tax benefits for companies to build facilities in less developed regions to reduce national geographic inequalities. That led this company to open a new facility that was more distant facility from the traditional industrialized region of the country and far from its suppliers. AUTO1 built facilities for its suppliers within its plant to reduce disruption uncertainty because of the lack of regional infrastructure. That strategy led AUTO1 to have a close relationship with its local suppliers, integrate them within its production process, and control their inventories and financial health:

It [supplier] is here on your side, it stays inside our park. [...] So, it is very easy to solve a problem. If it gave a problem, you automatically in 2 minutes had it in the supplier's factory to solve it. He has a great relationship (AUTO1E1).

Second, the Brazilian government reduced taxes to mitigate the 2008 economic crisis. That policy increased car sales and encouraged automotive companies to invest in new facilities or expand their preexisting ones. A few years later, however, the policy was discontinued because of Brazil's national economic crisis, which affected the spending power of AUTO1's final consumers. The market dropped, and AUTO1 faced idle capacity. There was been a

steeper decline for cheaper products, with the luxury goods segment being more robust during this crisis. This led to internal changes related to valuing product quality over reduced costs.

Third, the Brazilian government developed a national industrial policy, Inovar-Auto, to increase the automotive industry's energy efficiency by reducing carbon emissions and increasing investments in clean technologies. However, this policy limited auto parts importation and required that imported cars cope with its parameters. Thus, Inovar-Auto was accused, in the World Trade Organization [WTO], by other countries that considered to be protectionist, which led to the discontinuity of the Inovar-Auto policy and AUTO1's investments in cleaner energy.

Public security

The lack of public security affects AUTO1 through cargo theft, specifically, hijacking. Although AUTO1's cars are expensive, the target product for criminals is specific auto parts, which are expensive and much easier to sell to the black market. AUTO1 raised its stock safety level of these parts to cope with this uncertainty as well as hire armed escorts for vulnerable routes.

Regulations

We identified two sources of uncertainties in government regulation for AUTO1. First, to reduce the rate of deaths in traffic accidents, the Brazilian government created stricter safety regulations. Although the new models could cope with these new regulations, AUTO1 had to end production of its older models, which affected its sales. To avoid new shut-downs, AUTO1 started to consider possible safety changes during the new product development process. New models are now developed to cope with the more restricting regulations to adapt to future changes. Second, the information technology team spends 25% of their time dealing with government regulation changes: "[...] the legislation changes, literally speaking, every day" (AUTO1E4). AUTO1 has created systems and routines to mitigate these changes; however, they have not improved its competitiveness.

AUTO2

AUTO2 is a host automotive MNC that operates in more than 30 countries. AUTO2 was greatly affected by the 2008 economic crisis, causing it to undertake a long global restructuring process of its processes, products, and costs in all its subsidiaries. Since the Brazilian national economic crisis, AUTO2 has taken the lead in production and has already announced several

new investments in Brazil. Despite this, it still viewed the institutional instability in Brazil with caution.

Industrial policy

Although tax benefits could lead to cost reductions, AUTO2 evaluated building facilities in distant regions, which could lead to higher risks for its production flow. However, some of its suppliers move to those regions, increasing logistics complexity and other challenges. In response, AUTO2 began monitoring these suppliers' delivery and inventory increases, simultaneously, promoting those suppliers that decided to stay in its cluster. The drop of the market by approximately 70% during the national economic crisis increased the risks of disruption through suppliers' bankruptcy.

Regulation

All AUTO2 products are developed in a unique portfolio of cars after undertaking a global restructuring process. For instance, a car that sells in Brazil must cope with regulations from all countries prior defined for its commercialization. Therefore, the new product development process had to monitor regulation changes in several countries, which assisted AUTO2 to cope better with sudden changes in regulations in Brazil: "[...] we buy more than 6, 7 thousand pieces to make a car. So, we have (different legislation in) several countries around the world including here from Brazil, and in Brazil states that have different legislation" (AUTO2E4).

Public security

The lack of public security affects AUTO2 through hijacking also. As with the incidents described for AUTO1, the product target is auto parts and raw materials, such as resin or iron. AUTO2 monitors its trucks using satellite technology, has reduced the amount of cargo in each truck, and has hired armed escorts to reduce this uncertainty and rising transportation costs.

Trade union relationship

AUTO2 has a good relationship with unions in its facilities, except for one plant in the traditional industrial region. During the economic growth of Brazil in the 2000 decade, AUTO2 looks after a facility to expand its production. Although the plant with troubled union relationships was the best candidate in terms of area and buildings, AUTO2 chose another factory to receive this investment because there was a threat of production stoppages due to trade union negotiations.

When we must expand, we don't choose that facility, which has a much larger area, a much larger building. We produce almost nothing (in there). It is a kind of "phantom plant" because of the union. [...] it was difficult to work with the union there (AUTO2E2).

AUTO3

AUTO3 is a host automotive MNC that operates in over 30 countries. AUTO3 was one of the first automotive MNCs to build facilities in Brazil in 1950 and still has operations in the most industrialized region of Brazil. Despite the tax benefits for building new facilities in distant regions, AUTO3 considers this too risky because of the potential performance decline.

Industrial policy

The financial health of its domestic suppliers is also considered a great pressure for AUTO3. Several of its suppliers have built new facilities in distant regions based on tax benefits to accommodate the growth in sales within government actions to reduce cars' prices. After the economic crises, those suppliers had problems sustaining several facilities. AUTO3 raised a new credit line in the Brazilian Development Bank [BNDES] for suppliers having financial problems, lending its own money for suppliers' materials, and developed mechanisms to monitor suppliers' financial health: "recently, AUTO3 even promoted a meeting between suppliers and the Brazilian Development Bank to encourage it to grant credit to those suppliers [with financial problems]" (AUTO3E3).

Infrastructure

Brazil has a lack of quality roads, which implies a fast deterioration in cars and trucks. AUTO3 improved new product development to accommodate new and rigorous tests simulating poor paving to maintain its quality standards. Although these tests initially implied new costs, the result was a portfolio more adapted to real Brazilian conditions and raised the quality perception of AUTO3's customers: "our products undergo the most rigorous tests here, and some of them simulating rough and/or poor paving, and the idea is always to have a product fit to work with the real conditions of Brazil" (AUTO3E1).

Public security

The interviewees did not consider cargo theft a threat because AUTO3 takes measures to avoid it, such as armed escorts for transportation of auto parts. However, the increase of hijacking in some parts of the country has led some customers to demand different vehicle types, which implies AUTO3 has lost sales in trucks.

BEER1

BEER1 is a Brazilian beverage MNC with operations competence in costs based on its standardized process and the logistics of distribution within Brazil. The risk of production stoppages caused by suppliers has increased over time, mainly because of the low quality of raw materials. Also, BEER1 needs to adapt to the institutional instability in Brazil.

Industrial policy

The alcoholic beverage industry pays higher taxes in Brazil. To reduce its tax costs, BEER1 builds facilities in small cities relatively close to main markets that offer tax benefits. Unlike the automotive companies, there is an intense product flow that does not allow long distances between BEER1's facilities and markets.

Public security

BEER1 faces threats related to poor public security in Brazil, inducing cargo theft and counterfeiting. To deal with cargo theft threats, BEER1 contracts insurance and monitors delivery trucks through systems and practices that were initially used to improve transportation performance and reduce costs. No other measure has been taken to mitigate this threat, due to BEER1's vast distribution network and the costs associated with strategies such as armed escorts. To deal with counterfeiting, BEER1 did not take any measure to mitigate it because of its lower level of occurrence and the difficulty of tracking counterfeited products: "I know that this happens, that [criminals] exchange labels and caps. This harms the brand a lot, but it is difficult to track" (BEER1E1).

BEER2

BEER2 is a host beverage MNC operating in over 70 countries that has aggressively entered the Brazilian domestic market in the last five years. The firm's strategy was to buy local breweries and bring its original brands to Brazil's domestic market. Compared with its direct competitors, BEER2 produces high-quality products. Mergers have given rise to some pressures concerning its brand, processes, and quality levels; BEER2 faces problems common to the domestic beverage market.

Industrial policy

Like BEER1, BEER2 seeks to reduce costs by building facilities in cities close to its main markets that offer tax benefits. However, logistics costs do not allow BEER2 to seek tax benefits from distant states in Brazil because of its intense product flow.

Public security

Cargo theft emerges as an important threat for BEER2 because its product is easily sold in the black market. BEER2 adapted current technologies, such as planning route systems, adapted current practices, hired armed escorts in higher incidence routes, and replaced its logistics providers with local companies in higher-crime regions. This last measure is considered the best solution to mitigate this threat; however, it is difficult to check the trustworthiness of local companies beforehand. Another threat emerging from poor public security is counterfeiting, which BEER2 perceived as a lower occurrence pressure. Thus, BEER2 has not adapted any practices or systems for mitigating counterfeiting: “yes, but I think it is not in such a large proportion [counterfeiting of products]. We have already seen some seizures here and it is not a volume that justifies so much action on this” (BEER2E3).

COSM1

COSM1 is a domestic cosmetics MNC, whose products are sold globally, known for acting with high levels of sustainability. With suppliers located in several regions of Brazil, COSM1 faces strong pressures related to climate change. These pressures affect the probability of disruption of COSM’s production flow and its distribution system, which is based on direct sales.

Industrial policy

COSM1 sought to open a facility near its suppliers in the Amazon rainforest, seeking tax benefits from the local government because the Amazon region has a low level of development and a large demand for investment and employment. The result was that COSM1 gained prestige in the market by using supplies from the Amazon rainforest produced by local communities and gaining more control of suppliers’ sustainability standards: “so, we went to the [state] government and said: ‘Look, we have this strategic vision of a factory in [an Amazonian city], near the forest, then minister, what profit do we get?’” (COSM1E2).

Public security

COSM1 faces two threats related to poor public security: cargo theft and counterfeiting. Cargo theft emerged as a threat because of the higher price and lower volume of its products. Also, the stolen cosmetics products are easily sold on black markets because most of COSM1’s products are commercialized by direct selling. COSM1 mitigates this threat by monitoring trucks and hiring local companies in higher-crime regions to distribute its products. However, to mitigate counterfeiting, COSM1 has adapted its new product development process to market

it more difficult to copy by using new elements and sophisticated steps of production. Also, COSM1 adapted its packages to make reuse of its packages by perfume counterfeiters difficult.

TOBC1

TOBC1 is a tobacco MNC that bought a Brazilian tobacco firm over one hundred years ago. It is the national leader in the tobacco industry; however, its legal market represents less than 60% of tobacco sales in Brazil. The black market is sourced by criminals that smuggle cheaper and less unhealthy products from Paraguay, on the border of Brazil, and cargo theft. Thus, TOBC1 needs to adapt its practices, technologies, and relationships with supply chain partners and institutions to operate in this uncertain environment.

Industrial Policy

The Brazilian government overtaxes the tobacco industry because of its policy to discourage its consumption. Consequently, according to an interview, taxes accounts for almost 90% of the TOBC1's cost: "today, when TOBC1 build a facility, the first factor that was considered was taxes" (TOBC1E1). To reduce its cost, TOBC1 has built facilities in Brazilian states that offer tax benefits, raising its logistics complexity and carbon emissions.

Public security

Cargo theft has started to increase in this industry, particularly in Rio de Janeiro and São Paulo. This pressure led TOBC1 to develop new security systems and new routines for dealing with this pressure. Also, TOBC1 hired armed escorts to deliver cigarettes to its distribution centers and retailers' outlets. However, there have been conflicts between criminals and their security agents from armed escorts that resulted in TOBC1's employees deaths. Additionally, TOBC1 includes cross-sector partners and government institutions in its strategy, sharing information and resources. These strategies have improved TOBC1's positioning against its competitors: "we visit the police stations [...] present what we have done for safety and what we need (from them) to support it" (TABC1E4).

Regulation

Besides the higher tax level, the Brazilian government established a minimum price for a pack of cigarettes within this regulation to discourage consumption. However, this measure had the unintended consequence of leading to a rise in the smuggling of cheaper and unhealthy cigarettes produced in Paraguay. Thus, TOBC1 has worked alongside the government to share information about criminals and exclude suppliers who sell tobacco to illegal companies: "so,

we fight the illicit market through a very strong engagement with the government, the Federal Police Office, and the Federal Revenue Office [...]” (TOBC1E1).

Table 2.5 - Within-case Summary

Institutional Uncertainties	AUTO1	AUTO2	AUTO3	BEER1	BEER2	COSM1	TOBC1
Industrial policy							
<i>Threats</i>							
Supplier uncertainty	X	X	X				
Demand uncertainty	X						
Technological uncertainty	X						
Production uncertainty			X				
Taxes cost uncertainty				X	X	X	X
<i>Strategies</i>							
Engaging strategic or local suppliers	X					X	
Valuing quality over costs	X						
Postponing investments	X						
Ranking and classifying suppliers	X	X	X				
Building industrial policy	X	X	X				
Reducing costs by tax benefits	X			X	X	X	X
<i>SC partners involved</i>							
Suppliers	X	X	X			X	X
Industry association			X				
None				X	X		
Infrastructure							
<i>Threats</i>							
Product uncertainty			X				
<i>Strategies</i>							

Institutional Uncertainties	AUTO1	AUTO2	AUTO3	BEER1	BEER2	COSM1	TOBC1
Reviewing the NPD process			X				
Coping with poor quality infrastructure	X	X	X	X	X	X	X
<i>SC partners involved</i>							
Suppliers			X				
None	X	X	X	X	X	X	X
Public security							
<i>Threats</i>							
Inbound logistics	X	X					
Demand uncertainty			X	X	X		
Production uncertainty				X	X		
Last mile delivery						X	X
<i>Strategies</i>							
Reconfiguring practices	X			X	X	X	X
Reconfiguring technologies	X	X		X	X	X	X
Enhancing regulative institutions in cargo theft response					X	X	X
Coping with pressure			X	X	X		
<i>SC partners involved</i>							
Suppliers	X	X					
3PL providers				X	X	X	X
Clients			X				
Local companies					X	X	
None				X	X		
Regulations							

Institutional Uncertainties	AUTO1	AUTO2	AUTO3	BEER1	BEER2	COSM1	TOBC1
<i>Threats</i>							
Production	X	X					
Regulations	X	X					
Competition							X
<i>Strategies</i>							
Reviewing the NPD process	X	X					
Coping with regulations changes	X						
Sharing information with the government							X
<i>SC partners involved</i>							
Suppliers	X	X					
3PL providers							X
None	X						
Trade unions							
<i>Threats</i>							
Production uncertainty		X					
<i>Strategies</i>							
Postponing investments		X					
<i>SC partners involved</i>							
None		X					

Note. 3PL providers – third-party logistic providers. NPD – new product development.

Cross-Case Analysis

After analyzing the cases individually, we developed a final model based on the initial coding with three main dimensions, six second-order categories, and 20 first-order categories (Corbin & Strauss, 2008; Gioia et al., 2013), as presented in Figure 2.1. Also, we analyzed these three primary dimensions with propositions developed in the following section.

Identifying Uncertainty from Weak Institutions

The institutional environment is the source of several types of uncertainty for companies located in emerging economies (DiMaggio & Powell, 1983; Zhou et al., 2016), resulting in a corporate strategy defined by the influence of those uncertainties (Lewin & Volberda, 1999). Our findings reveal that weak institutions can cause uncertainties for MNCs, but their impact is different in each industry, presented in Table 2.5. Poor public security, for example, affected the cases in different ways related to profitability for criminals and assimilation by the black market. Therefore, products such as beverages, cigarettes, and cosmetics tend to be targeted rather than cars. Nevertheless, even the automotive industry is not free from this uncertainty; however, the theft target shifts from the final product to specific components, which the black market can easily assimilate: “nowadays, I have an armed escort in this type of cargo [specific auto parts] at a high cost. For example, to escort an engine load for 150 km I pay US\$ 300,00” (AUTO1E3). Therefore, uncertainty is perceived as distinct by each industry because it generates different pressures.

Also, uncertainties can affect MNCs not only directly but also through the market and/or suppliers. Uncertainty can arise from industrial policy, which affects both the market and suppliers simultaneously. For example, the Brazilian automotive industry has traditionally received tax benefits to increase its production capacity. However, after the national economic crisis began, the government could not continue with this policy. Demand dropped, and Brazilian automotive companies are now overcapacity. Additionally, this market drop had a powerful impact on suppliers in the automotive industry, which arose from uncertainty about their financial strength:

Let's suppose that I sell 200,000 cars a year today and, suddenly, the market drops and I'm going to sell only 100,000 cars a year. So, I'm going to buy half of the components too. What happens is that the companies [suppliers] will have financial problems and will ask us for price adjustments (AUTO2E2).

Our findings suggest that weak institutions lead to relational uncertainty by building incentives for companies that have unintended consequences of resulting in operations challenges. For example, some Brazilian states and the national government attracted MNCs and/or suppliers' factories through tax benefits for developing lower-income regions. Infrastructure uncertainty greatly affected all these cases by increasing the distance to their consumer markets and the lack of quality infrastructure in those regions. Therefore, both distance and poor infrastructure quality have generated further challenges maintaining production flow: "the infrastructure here [in the state in which we have a facility] is very bad; bad roads, unpaved roads... Here, there are places if it rains, we cannot deliver" (BEER2E4).

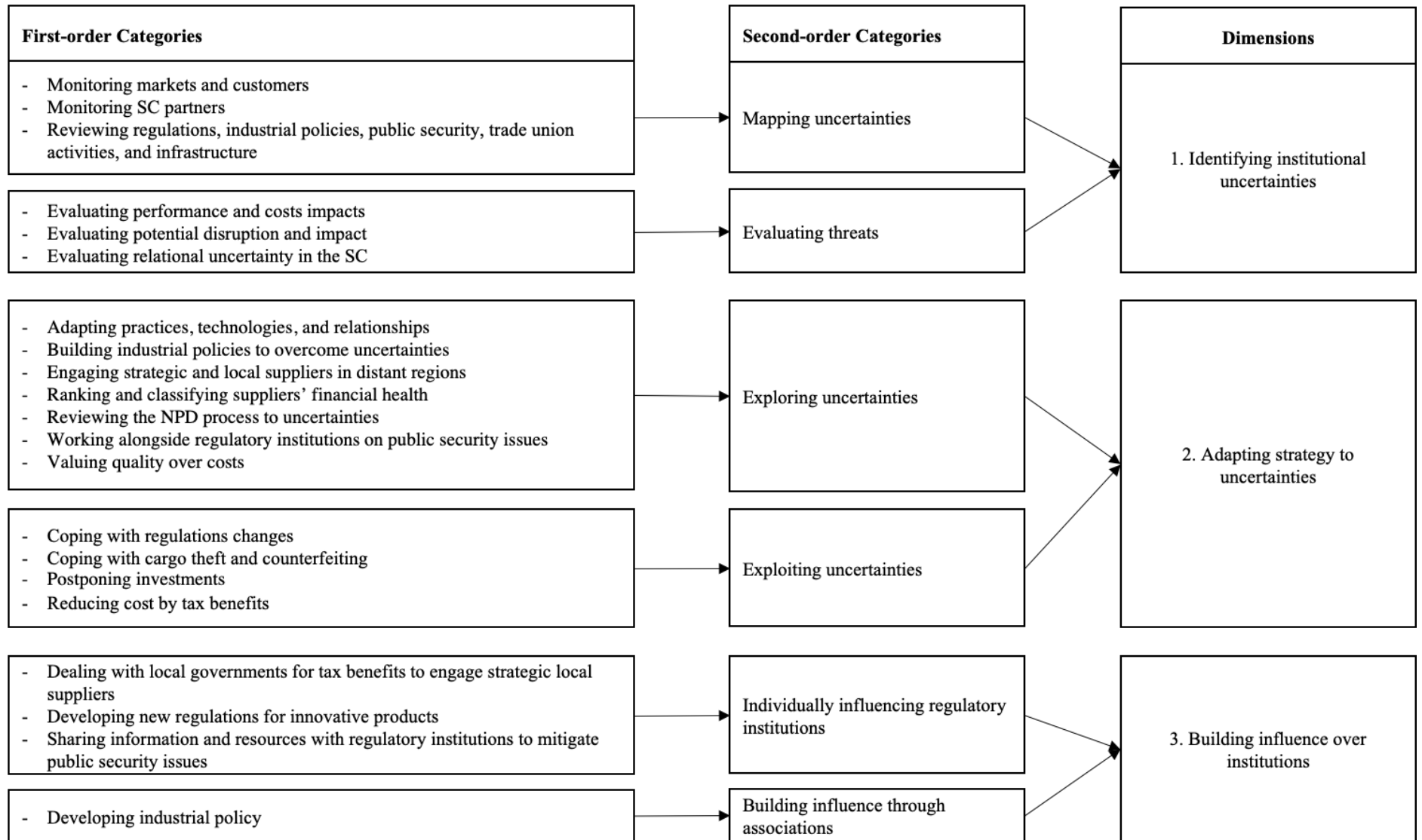


Figure 2.1. Data Structure

Adapting Strategy to Uncertainty

Different strategies to deal with a given type of uncertainty can lead to different results. We described some MNCs that had agreed to set up their factories in isolated regions of Brazil to receive tax benefits (AUTO1; BEER1; BEER2; COSM1; TOBC1). Although all these case companies were affected by distance and poor infrastructure quality, they accepted this uncertainty without taking explicit measures to reduce it; they do not demonstrate co-evolution. This response does not necessarily contribute to improving an MNC's strategic positioning or capability development, but only focuses on reducing its tax payment.

Table 2.6 - Strategy Adaptation

	Exploitation	Exploration
Uncertainty evaluation (Costs, performance, potential disruptions, and/or SC relationships)	Lower impact	Higher impact
Economic and fiscal crises	Ranking and classifying suppliers (AUTO1; AUTO2; AUTO3)	Better preparing through past crises knowledge (AUTO2)
Industrial policy and tax regulation	Cost reduction through tax benefits (AUTO1; BEER1; BEER2; COSM1; TOBC1)	Building industrial policy (AUTO1; AUTO2; AUTO3) Engaging strategic or local suppliers (AUTO1; COSM1) Improving competitiveness through tax benefits (COSM1)
Infrastructure	Coping with poor quality infrastructure (All cases)	Improve product quality (AUTO3)
Public security	Coping with the acceptable level of cargo thefts and counterfeiting (AUTO3)	Reconfiguring practices and technologies (AUTO1; AUTO2; BEER1; BEER2; COSM1; TOBC1) Reducing cargo theft alongside regulative institutions (BEER2; COSM1; TOBC1)
Regulations	Coping with changes in regulations (AUTO1)	Reviewing the NPD process to anticipating changes (AUTO2; AUTO3)
Trade unions	Postponing investments (AUTO2)	N/A

On the other hand, COSM1 strengthened local suppliers in the Amazon in its cosmetics production, capitalizing on this to strengthen its reputation as a sustainable firm and defender

of the rainforest. COSM1 actively used public policy to reinforce its original strategy (Carney, Dieleman & Taussig, 2016). Similarly, AUTO1 mitigated supplier uncertainty by creating facilities for strategic suppliers in its factory in a distant region, which afforded it more control over the entire process. These responses contribute to engaging suppliers and to improve performance, while reducing operations costs. Thus, COSM1 and AUTO1 demonstrated co-evolution with their environment.

Once we identified a type of uncertainty, it was possible to identify whether it had influence on strategic adaptation and the level of its impact on the MNC's operations. We group those responses into exploitation and exploration processes, as presented in Table 2.6. For lower-pressure impacts, the MNCs responded with a timely monitoring process, and any mechanism for monitoring could be implemented. For instance, some institutional uncertainties, such as union activity, had little influence or impact on operations in the beverage, cosmetics, and tobacco industries: "I don't see COSM1 close plants [because of] a problem with its union" (COSM1E2). Those MNCs cases tend to cope with those uncertainties by following an exploitation strategy, with little or no strategic change (Birkinshaw & Gupta, 2013; Kristal et al., 2010; Ossenbrink et al., 2019). Unlike uncertain institutions that impact the operations and production flow, monitoring is constant on low-impact uncertainties and, in general, accompanied by other mitigation mechanisms. For instance, AUTO3 identified that outdated infrastructure roads were a lifetime risk for its products, causing the engineering team to increase the accuracy of quality tests before putting its trucks upon sale. That resulted in better product positioning for AUTO3 by improving product quality (durability) for customers. Thus, MNCs evolve their practices due to pressures from different institutional environments, which suggests that these uncertainties lead to an exploitation strategy by creating quality capabilities through new product development practices (Birkinshaw & Gupta, 2013; Kristal et al., 2010; Ossenbrink et al., 2019).

Building Influence over Institutions

As predicted by co-evolutionary theory in some cases, firms do not act as passive agents to the environment but instead influence it (Cantwell et al., 2010; Duarte & Rodrigues, 2017; Vahlne & Jonsson, 2017). Our findings also suggest that companies seek government institutions more sharply in times of crisis. For instance, automotive companies co-developed a policy for energy efficiency with the government. However, the performance of weak institutions is uncertain even in these cases. Although it was a milestone, interviewees

considered that Inovar-Auto was short-term and insufficient for consistent and long-term improvement:

It [Brazilian government] developed an industrial policy [Inovar-auto] with bold goals and then forget it about that subject for 5-10 years [...] Similar industrial policies as this in the US, Europe, or China are 30-40 years old... Brazil created this policy that lasted two years [...] This type of thing greatly hinders the predictability of the business (AUTO1E4).

Moreover, the automotive industry built an emergency agreement to maintain labor during the drop in sales during the Brazilian domestic economic crisis. This industry also secured a line of credit at the Brazilian Development Bank [BNDES] to support their suppliers financially: “recently, AUTO3 promoted a meeting between suppliers and BNDES to encourage the BNDES to grant credit to these suppliers” (AUTO3E3).

These joint efforts go beyond establishing industrial policies with the central government by improving weak or absent public services. For instance, TOBC1 needed a significant increase in its distribution to account for expected cargo theft. One way to mitigate this was to work alongside public security agents, developing a network of information exchange between TOBC1’s supply chain risk management area and police stations. Thus, both company and police were able to better map incidents and reduce those threats, demonstrating co-evolution between TOBC1 and regulative institutions:

There is a work of intelligence to [...] map the robberies based on history and data from the federal highway police, military police. All to determine safer points. Then we align with the carriers to follow this script (TOBC1E2).

Although the corporate strategy of individual companies can influence the institutional environment, industry associations may have a strong influence on such relationships. In Brazil, the automotive industry jointly develops industrial policies with the government through its national association, the National Association of Motor Vehicle Manufacturers [ANFAVEA]. This forum has traditionally influenced the central government in developing policies for the entire industry. Specific demands, such as tax benefits for plants, are deal individually for each company. Also, in industries where a firm has a more significant market share, it acts independently, defending only its own corporative interests. TOBC1, for instance, used its own influence in building a national regulation for electronic cigarettes:

TOBC1 has several internal projects to try to justify to the government that this is a new trend and that it is time to market such a product [electronic cigarette] in Brazil. There

is a company strategy [...] to somehow migrate from one product to another (TOBC1E1).

DISCUSSION

Abrupt changes in legislation, economic crises, or changes in government public policies can influence a firm's long-term strategy (Meyer & Peng, 2016). Institutional theory recognized that weak institutions lead to higher levels of uncertainty (Kelling et al., 2020; White III et al., 2014; Zhou et al., 2016); however, what is little explored by this literature is how those uncertainties also affect supply chains (Kelling et al., 2020; Kreye, 2017). Our findings suggest that institutional uncertainty affects MNCs both directly and indirectly through their supply chains (Figure 2.2). In other words, it does not affect only these companies but impacts their relationship with other agents embedded in their environment (Kelling et al., 2020; Kreye, 2017). Even if an MNC internally mitigates this institutional uncertainty, it also can be a source of substantial uncertainty for the MNC through its suppliers or market due to supplier bankruptcy, demand drops, cargo thefts, and logistics challenges.

The OSCM literature has already established that supply chain relationships are crucial to MNCs' performance (Valk & Wynstra, 2012; Wynstra et al., 2015) and has an essential role in reducing uncertainties (Kreye, 2017). However, under weak regulative institutions (Kelling et al., 2020), supply chain partners can introduce relational uncertainty. Although the OSCM literature addressed relational uncertainty in supply chain relationships (Kreye, 2017; Kreye, 2019), these studies ignored institutions as its source. Institutional theory recognized that weak institutions promote uncertainty (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008). Our findings address it under a complex set of relationships in the OSCM perspective (Kelling et al., 2020). Higher levels of institutional uncertainty require MNCs to work together with their supply chain partners to avoid interruption in the production flow. Thus, it is possible to establish the following proposition:

Proposition 2.1. Higher institutional uncertainty is associated with higher relational uncertainty with an MNC's supply chain members

Sources of uncertainty are distinct by industry, generating different outcomes in impact on MNCs and their supply chains. MNCs respond with adaptative practices and strategies to respond to an uncertain environment and extend or develop their capabilities by improving their

supply chains' internal resources (Bravo et al., 2018; Ojha et al., 2018; Souza-Luz & Gavronski, 2020; Turner et al., 2018). Our findings suggest that pressures considered more critical are associated with a more significant effort to adapt, generating innovations in processes and new capabilities (Braguinsky & Hounshell, 2016; Carney et al., 2016; Duarte & Rodrigues, 2017; McKelvey, 1997). For example, cargo theft mitigation led TOBC1 to adapt its existing technologies and practices, and also led TOBC1 to develop a close relationship with police officers, which improved its capability to combat those threats. The same source of uncertainty led the automotive industry to cope with this crime, rather than adapt, because automotive companies considered it less important. Therefore, the strategic choice depends on the uncertainty impact in the MNCs.

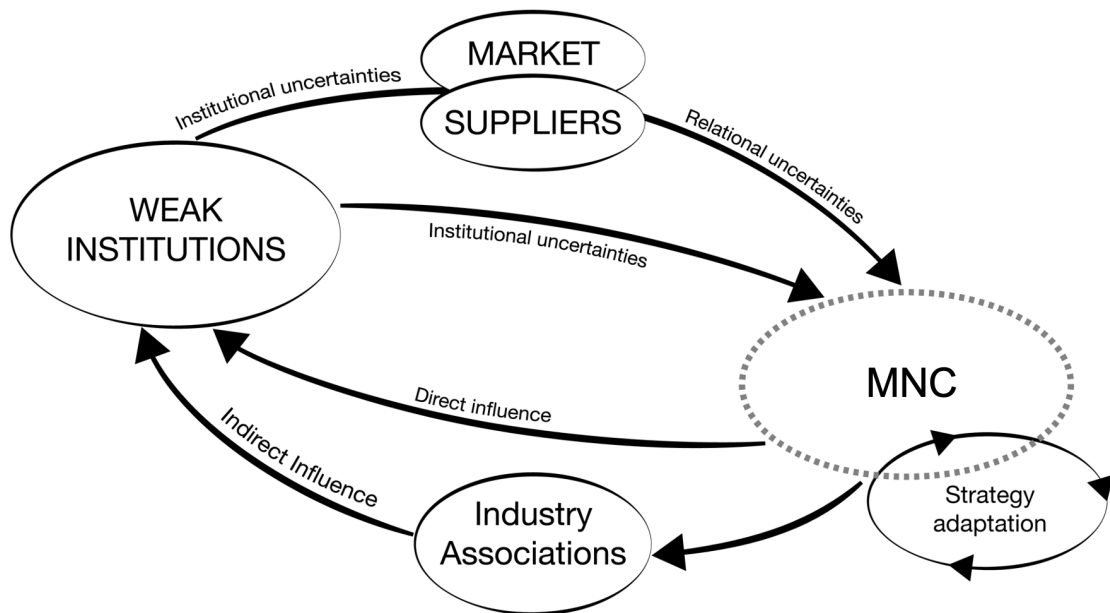


Figure 2.2. Influence Dynamics

Co-evolutionary theory describes firms' response to the external environment based on four mechanisms, composed by increasing stages from little connection with the external environment to collective learning and interacting between firms and their environment (Volberda & Lewin, 2003). However, prior studies suggest that MNCs perform both practices from their original countries and simultaneously adapting routines to the institutional environment in a host country (Jiang et al., 2016; Luo & Tung, 2017). We highlighted that the case MNCs strategically adapt through two distinct and simultaneous processes (Li, 2013; Kortmann, 2015; Parikh, 2016): exploitation and exploration. Higher levels of institutional

uncertainty pressure MNCs to develop new solutions through the resources exploration process, while lower levels of institutional uncertainties lead them to remain with the same set of practices and capabilities, focusing on exploitation. Thus, it is possible to establish our second proposition:

Proposition 2.2. Higher institutional uncertainty is associated with resource exploration by MNCs

Prior literature established that companies tend to rely on partners in times of need (Kreye, 2017). Our findings also suggest that MNCs tend to seek institutions as the MNCs' partners to reduce institutional pressure in times of higher levels of uncertainty, even when they are the source of these uncertainties. MNC's strategies simultaneously adapt themselves to institutions and try to influence them (Cantwell et al., 2010; Duarte & Rodrigues, 2017; Khavul et al., 2013) by building new industrial policies or by sharing information and resources (Arikan, Reinecke, Spence & Morrell, 2017; Espinosa, 2021; Zeng, 2021). Although institutional theory established that companies seek to adapt institutions for their own benefit (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008), our findings suggest that it also happens when institutions are the source of uncertainties for MNCs, leading those companies to change the "rules of the game". Thus, it is possible to establish our third proposition:

Proposition 2.3. Higher institutional uncertainty is associated with MNCs seeking greater influence over the institutional environment

Both institutional and co-evolutionary theories consider a mutual dynamic that involves firms and the institutions in their environments (Duarte & Rodrigues, 2017; Kolk & Tsang, 2015; Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Rodrigues & Child, 2003; Scott, 2008). However, how this dynamic occurs in the OSCM perspective is still uncharted. Our results examine in-depth the interaction between MNCs, supply chain members, industry associations, and regulative institutions, showing that this interaction occurs both directly and indirectly. First, if an MNC has a decisive individual influence over its industry, based on its market share, the MNC plays a decisive role in promoting public policies or influencing regulations, for example. Second, if there is a more prominent firm in the industry and some firms that compete for the same market, MNCs may use industry associations to influence

public policies (Duarte & Rodrigues, 2017). Our findings suggest that the market determines channels of influence. Therefore, MNCs with higher market share in their industry tend to seek direct channels. They can assume costs and risks associated with this influence and/or do not need to share the potential benefits from it (Garcia-Cabrera, Durán-Herrera & Suárez-Ortega, 2019). Thus, it is possible to establish our last proposition:

Proposition 2.4. The direct influence of an MNC in its institutional environment is directly associated with its market share

CONCLUSIONS

Our multiple case study answers recent calls for including new theories to discuss operations strategy (Anand & Gray, 2017). By synthesizing institutional and co-evolutionary theories, our analysis provides a broader understanding of the dynamic between MNCs and regulative institutions in an uncertain environment from the OSCM perspective. Moreover, our study expands the boundary of OSCM by addressing the role of regulative institutions in strategic choice. Prior studies have shown that the institutional environment offers a rich context for better understanding operations, such as supply chain localization and public policy (Wu & Jia, 2018; Spring et al., 2017).

We contribute to the literature by addressing four gaps. First, our findings expand knowledge about institutional uncertainty by explaining how it affects MNCs and their supply chains in environments with weak regulative institutions. Although institutional theory has recognized that weak institutions can increase uncertainty for firms (Kelling et al., 2020; Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008), we have shown how it can spread to other agents in the environment as relational uncertainty (Benedettini et al., 2015; Kelling et al., 2020; Kreye, 2017; Reim et al., 2016). Therefore, even if an MNC could raise protect shields in its operations from a specific institutional uncertainty, it can affect MNC's markets and suppliers, reducing supply chain performance.

Second, our study contributes to co-evolutionary theory by objecting to the four mechanisms approach that describe a possible path that might drive co-evolution (Volberda & Lewin, 2003). Unlike this approach, our findings suggest that the case MNCs strategically adapt their practices based on the impact of the institutional uncertainty on costs, performance, potential disruptions, and relational uncertainty. Higher levels of institutional uncertainty pressure MNCs to adopt the exploration process, seeking new solutions to reduce uncertainty.

While lower levels of institutional uncertainties lead them to adopt the exploitation process, remaining the same set of practices and capabilities.

Third, we highlight the role of weak regulative institutions in reducing institutional uncertainties. Our findings suggest that MNCs tend to seek support from those institutions in times of need by building industrial policies or reaching resources, such as information, financial resources, or police protection. Although institutional theory has addressed that MNCs tend to adapt institutions to their own benefits, they seek greater influence in the “rules of the game” under higher uncertainties. Therefore, we have the concept of ambidexterity to better understand both the strategic adaptation caused by institutional uncertainty and the building of an MNC’s influence over institutions in its environment.

Last, our study examines the role of other agents in the environment in the MNCs’ co-evolution (Duarte & Rodrigues, 2017; Kolk & Tsang, 2015; Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Rodrigues & Child, 2003; Scott, 2008). Our analysis has shown that the interaction between MNCs and regulative institutions occurs both directly and indirectly through other agents in the environment, such as supply chain members, markets, and industry associations. MNCs can influence those institutions directly when they assume costs, risks, and potential benefits associated with this influence. Therefore, we contribute to both institutional and co-evolutionary theories by highlighting the role of other agents in the environment in MNCs’ co-evolutions. Also, we suggest that the MNCs’ market determines channels of influence.

Managerial Implications

Our study has managerial implications as well. As MNCs expand their operations to emerging economies (Jung, 2020), they must adapt to different and new challenges embedded in the new environment (Crane, 2013; Huq & Stevenson, 2020). Managers from MNCs should continuously analyze the institutions in which they operate, identifying, in advance, new opportunities to improve their firms’ competitiveness in an environment characterized by weak regulative institutions. Institutional and co-evolutionary theories could guide practitioners to navigate complex environments.

Our findings suggest that weak regulative institutions play a significant role in MNCs and supply chain strategic choice, not only directly through the MNCs, but also across markets and suppliers. Managers in OSCM must identify these challenges but must also see

opportunities presented by uncertainty by developing new strategies. The identified prior strategic adaptations to institutional uncertainty can lead practitioners to possible paths to respond to this uncertainty in their environments.

Managers, policy makers, and government officials should consider the dual role played by weak regulative institutions, as both a source of uncertainties and solutions to MNCs. Those practitioners should also consider joint efforts to lead institutions to better economic, business, and social results. We suggest that managers need to stop ignoring the potential benefits of inter-organizational relationships with other companies, within and beyond their industry. Our results had shown that joint efforts could be very effective for building industrial policies, such as those organized by industry associations.

Limitations and Future Research Directions

Our study has limitations that point to unanswered questions for future research. First, the analysis does not allow for speculation about the difference in responses to uncertainty between home and host country MNCs. There could be differences between a company born in an uncertain institutional environment versus a host company from a country with more stable institutions. We question: would Brazilian MNCs be more effective to respond to institutional uncertainties in Brazil? It would be interesting to understand if this embeddedness in a home country environment led to better navigating through institutional uncertainties.

Second, future research could examine the monitoring companies during a longitudinal period, observing the creation and adaptation of its operations strategy under sources of specific uncertainty. For example, the industrial policy of the Inovar-auto was considered protectionist by WTO, which led to the discontinuity of this industrial policy. However, the Rota 2030 emerged as a new industrial policy from the automotive industry, improving the original means and goals. Understand how that change has affected practices and strategies of the automotive industry in Brazil could bring new insights to co-evolutionary theory.

Last, there is a great deal more to be revealed about the difference between two subsidiaries from the same MNC, where one operates in a strong regulative environment and one operates in a weak regulative environment. It would be interesting to examine to what extent the subsidiaries adapt their original practices and strategies to their national institutional environments. These gaps could be subjects to be explored in future related research. Therefore, the intersection of OSCM and institutional environment suggests a rich research agenda.

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Appendices Two

Appendix 2A - Qualitative Research Protocol

Research proposal

This research aims to understand the process of how MNCs develop strategies to adapt to uncertainty caused by weak institutions, and how they build influence over those institutions.

Research question

This study follows these research questions: *(RQ1) How do MNCs adapt their operations strategies to an uncertain institutional environment? (RQ2) How do MNCs build influence over weak institutions through their strategic choices?*

Theoretical bases of the research

- Co-evolutionary Theory
- Institutional Theory

Selection of cases

The main criteria for the selection of companies were:

- MNCs that have greater power of influencing their respective markets
- Leaders in the domestic and global market, of the automotive (3 companies), beverages (2 companies), cosmetics (1 firm), and tobacco (1 firm) industries

Data collection

- Interviews with managers recorded and transcribed
- At least three interviews with each firm

Data Analysis

- Definition of codes in an open way through the technique of content analysis
- Analysis based on within-case and cross-case analysis

Semi-structured Questionnaire

Introduction

Full name

Position

The interviewee's history in the firm

How do you see your firm in the market: Leader? In what categories? Who are the main competitors?

Internal factors

- 1) What are the main internal risks that your firm manages?
- 2) What does your firm do internally to manage them?
- 3) What competencies were created/adapted by your firm for risk management? Examples.

4) What motivates your firm to develop such skills? Describe internal and external factors (internal factors: managers, processes, supply chain, etc.).

External factors

5) What factors outside your firm motivate the creation/adaptation of firm skills? What is the role of each? (Competitors, suppliers, industry, institutions, regulatory, etc.).

6) How does your firm respond to external influences?

Performance

7) Regarding your operations performance such as cost, quality, flexibility, and delivery, which of them do you consider that your firm performs better than your competitors? Why?

8) How did risk capability development contribute to this performance? How did internal and external factors contribute to this?

9) Which practices do those factors support? How do you use such practices? Give examples.

10) How do risks describe the influence of the performance of your business or business unit.

Institutional aspects

11) How does labor legislation affect the competitiveness of your firm? Is there a risk from trade unions?

12) Is there any risk from tax regulation?

13) How are industry legislations defined? Does your firm have an active voice in this definition?

14) Has there been any change in your operations to deal with crime? (Theft of cargo; counterfeiting).

15) How does the issue of infrastructure affect your operations?

Appendix 2B - Representative informant quotes underlying second-order categories

Dimension 1: Identifying institutional uncertainty	
Mapping uncertainties	<p><i>AUTO is [...] off the map of most suppliers. It has a belt of suppliers here [distant region], [however,] it is a risk because the market falls a while [three years] ago; suppliers could bankrupt (AUTO1E1).</i></p> <p><i>[...] we buy more than 6, 7 thousand pieces to make a car. So, we have [different legislation in] several countries around the world, including here from Brazil. Also, Brazilian states have different legislation (AUTO2E4).</i></p> <p><i>We do not have tax benefits and every market works like this. One minute you have it, and the next it is gone (BEER2E6).</i></p> <p><i>Today, when TOBC1 build a facility, the first factor that we considered was taxes [...] As I told you, 90% of cigarette costs are from taxes (TOBC1E1).</i></p>
Evaluating threats	<p><i>I can tell you that one or two trucks [are steal] per year and the guy [criminal] sometimes sees the cargo load and gives up the theft (AUTO2E4).</i></p> <p><i>It's almost a knife in your throat. We spend money to buy the raw material for the guy [supplier]. Some suppliers are at that 'financial health] level (AUTO3E3).</i></p> <p><i>I think the cost of armed escorts and the risk it brings to people is too great (BEER1E2).</i></p> <p><i>Yes, but I think it is not in such a large proportion [counterfeiting of products]. We have already seen some cases here and it is not a volume that justifies any action on this (BEER2E3).</i></p> <p><i>The moment we know, or it becomes evident, that our supplier is supplying to a company in the black market, we automatically [cancel] the contract with it (TOBC1E1).</i></p>
Dimension 2: Adapting strategy to uncertainties	
Exploring uncertainties	<p><i>The guy [supplier] is here on your side, it stays inside our park. [...] So, it is very easy to solve a problem, if it gave a problem, you automatically, in 2 minutes, had it in the supplier's factory to solve. We have a great relationship (AUTO1E1).</i></p>

Dimension 2: Adapting strategy to uncertainties

We take advantage of the opportunity of having a crisis, having an idle capacity of the supplier, equipping suppliers, and manage to negotiate better prices for us because we have money (AUTO2E4).

Our products undergo the most rigorous tests here [in Brazil], and some of them simulating rough and/or poor paving. Also, the idea is always to have a product fit to work with the real conditions of Brazil (AUTO3E1).

Exploiting uncertainties

[...] the legislation changes, literally speaking, every day (AUTO1E4).

[...] eventually, in certain cases, we develop a final alternative source, and we leave that supplier [with financial problems] (AUTO2E2).

When we must expand, we don't choose that facility [with a problematic union], which has a much larger area, a much larger building. We produce almost nothing [in there]. It is a kind of "phantom plant" because of the union. [...] it was difficult to work with the union there (AUTO2E2).

It is not worth financially and not worth operationally. We have a too large operations to have an armed escort for every route (BEER1E2).

I know that this happens, that [criminals] exchange labels and caps. This harms the [BEER1] brand a lot, but it is difficult to track (BEER1E1).

They [local companies] make this distribution within the community because they know [the place] and many people there. [...] The problem is finding a trustworthy [company] [...], but after you find them, it is the best solution (BEER2E3).

Dimension 3: Building influence over institutions

Working individually with the government

So, we went to the [local] government and said, "Look, we have this strategic vision of a factory in [an Amazonian city], near the forest. So, minister, what [tax] benefits do we get?" (COSM1E2).

Recently, AUTO3 even promoted a meeting between suppliers and the BNDES to encourage it to grant credit to those suppliers [with financial problems] (AUTO3E3).

So, we fight the black market through a very strong engagement with the government, the Federal Police Office, and the Federal Revenue Office [...]. (TOBC1E1).

Dimension 3: Building influence over institutions

We visit the police stations [...] present what we have done for safety and what we need [from them] to support it (TABC1E4).

Building influence through associations *Unfortunately, the government linked the policy [Inovar-Auto] to steps in the production process. This gave an impression of a kind of protection to the local market, which caused this measure to be questioned by the WTO and we lost (AUTO1E4).*

The government has created a program that allows companies to negotiate a reduction in working hours and wages, and it subsidized 50% of this reduction [...] (AUTO3E2).

Recently, we had a funding line with the BNDES that is still active [...] [it] goes through discussions in ANFAVEA (AUTO3E1).

3. CHAPTER THREE – SECOND ESSAY

Can We Go on Together with Suspicious Minds?

Collaborative Risk Response to Cargo Theft under Weak Institutions

ABSTRACT

Purpose: This research aims to understand how companies employ relational governance mechanisms to enable collaborative risk response in environments with weak institutions, increasing their knowledge over time.

Design/methodology/approach: We applied an inductive multiple case study of nine Brazilian companies in the automotive, beverage, electronics, food, pharmaceuticals, and tobacco industries. Supply chain risk was operationalized as the risk of cargo theft. Case selection was based on the impact of cargo theft and product value.

Findings: The companies employed relational governance mechanisms to enhance trust with partners in an environment with weak institutions. This increased trust in their inter-organizational relationships, allowing social capital building with their supply chain partners, cross-sector organizations, and government institutions. Because companies cannot control their environment, they must learn from past risk occurrences to anticipate and better respond to the threat of cargo theft, reducing risk impact over time.

Originality: We contribute to the OSCM literature by highlighting institutions as sources of both risk and resources. Our findings also reveal that relational governance is a crucial ingredient to build social capital in inter-organizational relationships under distrustfulness. Last, we propose that institutional resources should be considered an essential element in supply chain risk management to external risks response.

Research limitations/implications: The companies in the case studies have operate in the Brazilian environment for decades. It would be enlightening to compare them to new entrants. Moreover, it would be interesting to analyze small and medium-sized companies, whose lack of resources and technologies could lead to different strategies.

Keywords

Supply chain risk management; Social capital; Relational governance; Weak institutions; Cargo theft.

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*We have not included those who work in the case companies.

INTRODUCTION

Today, we know for sure that it [fraud involving drivers and companies] comprises 90% of the [cargo theft] incidents.

(Police investigator from a station specialized in cargo theft - PSC2)

Almost 60% of driver dismissals involved cargo theft during the pandemic

(Manager from the tobacco industry - TOBC1E1*)

On a road in the South of Brazil, criminals blocked a van loaded with over 100 thousand dollars worth of cigarettes. While one criminal pointed a gun at the drivers' head, the other two unloaded the cargo. This was only one more victim of a hijacking in a country that registered over 25 thousand cargo thefts in 2017 (Transported Asset Protection Association [TAPA], 2021), except for one detail: the driver was part of the theft scheme. According to the police officer in charge, "the employee instructed [the criminals] on how the approach should be taken to deceive the police and the company itself in later investigations, to pose as a victim" (Arenza, 2021). Unlawful behavior such as this finds a nurturing environment under weak or absent institutions (DiMaggio & Powell, 1983; Su, Peng & Xie, 2016), raising supply chain risk and reducing social capital (Daghar, Alinaghian & Turner, 2021; Fan & Stevenson, 2018; Lima, Silva, Filho & Dias, 2018).

Supply chains in all the countries are under the constant threats of intentional attacks such as terrorism, piracy, sabotage, counterfeiting, cyber-attacks, and cargo theft (Ekwall & Lantz, 2018; Fiksel, Polyviou, Croxton & Pettit, 2015; Schneier, 2019); however, prior studies have focused more on non-intentional threats (Fiksel et al., 2015; Schneier, 2019), such as natural disasters (Gou & Lam, 2019; Ye, Jiao & Yan, 2020), political turbulence (Roscoe, Skipworth, Aktas & Habib, 2020), and outbreak diseases (Ivanov, 2020). Cargo theft, which is the focus of this study, is a growing concern to companies and supply chains worldwide (Boone, Skipper, Murfield & Murfield, 2016). There is no consensus about its costs; however, it is estimated that theft is responsible for annual global losses of over US\$30 billion (Federal Bureau of Investigation [FBI], 2018). Although cargo theft in South America is the most costly worldwide, reaching 100 thousand dollars per theft, on average, in 2020 (British Standards Institution [BSI], 2019), the United States alone represents US\$10 billion of the annual global losses (FBI, 2018). Its consequences, however, go far beyond material losses in supply chains; cargo theft affects all delivery systems, resulting in service level reduction, lost sales, increasing

operations costs, supply chain disruptions, and employee safety issues (Ekwall & Lantz, 2018). In sum, cargo theft can disturb every single part of a supply chain, from material flow to the last mile delivery (Ekwall & Lantz, 2016; Tong, Lo & Cheng, 2019). Because of its violent nature, the response to cargo theft should involve inter-organizational efforts beyond a supply chain's boundaries, including government institutions and cross-sector partners.

Companies access needed resources by mobilizing relationships with supply chain partners, cross-sector organizations, and government institutions to improve their performance (Gabler, Richey & Stewart, 2017; Medel, Kousar & Masood, 2020; Roscoe, Skipworth, Aktas & Habib, 2020). They tend to rely on partners under uncertainty and risk (Kreye, 2017). However, such relationships can also be a source of substantial uncertainties and risks (Collier & Sarkis, 2021; Kreye, 2017) in the absence or weakness of formal institutions (DiMaggio & Powell, 1983; Su et al., 2016).

Institutions regulate opportunistic, unfair, and unlawful behaviors, reducing the uncertainty embedded in relationships (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008). Conversely, weak institutional environments are dominated by fragile law enforcement, bribery, and superficial audits performed by overburdened inspectors (Crane, 2013; Huq & Stevenson, 2018). The absence of these formal institutions can lead individuals and organizations to rely more on informal institutions based on interpersonal relationships (Bachmann & Inkpen, 2011; Kreye, 2017; Zhou, Su, Yeung & Viswanathan, 2016), such as social ties, and cultural values and norms. However, drivers, facility workers, supply chain partners, and police officers become involved in making cargo theft attacks, making that "leap of faith" is even harder for companies.

Untrustworthy relationships increase risks by restraining social capital, such as information sharing, joint problem solving, and sustained inter-organizational collaboration over time (Collier & Sarkis, 2021; Fawcett, Jones & Fawcett, 2012). Therefore, companies sometimes need to create mechanisms to minimize their partners' unlawful behavior, enhance trust, and make room for social capital building (Bonatto, Resende & Pontes, 2020). Relational governance allows companies to operate in inter-organizational relationships under high-risk (Bonatto et al., 2020; Dyer & Singh, 1998), applying technologies and practices that ensure visibility and control of employees' and partners' behavior (Pilbeam, Alvarez & Wilson, 2012; Wacker, Yang & Sheu, 2016). From that greater visibility and control, companies can mobilize social capital, reduce risk, and increase performance (Bonatto et al., 2020; Dyer & Singh, 1998). Therefore, relational governance can be a critical element in enhancing social capital in weak

institutional environments, while reducing distrust, leading companies to increase their risk response knowledge and reduce the impact of unlawful behavior.

Despite recent call for a better understanding of institutions' influence over supply chains (Annala, Polsa & Kovács, 2019; Spring, Hughes, Mason & McCaffrey, 2017; Turkulainen, Kauppi & Nermes, 2017; Wang, Zhang, Wang & Sheng, 2016; Wu & Jia, 2018), most of these studies did not consider the risks that emerged from them (Fan & Stevenson, 2018; Friday, Ryan, Sridharan & Collins, 2018). We highlight how weak institutions affect inter-organizational relationships, reducing trust and restraining social capital building. There is a lack of understanding of how companies employ social capital in supply chain risk management in an environment characterized by mistrust. Relational governance can play an essential role in reducing uncertainty and risk; however, how companies engage partners in collaborative risk response when they do not trust those partners still needs more attention. Moreover, social capital has been largely studied in commercial relationships, such as buyer-supplier relationships (Daghar et al., 2021; Durach & Machuca, 2018; Fan & Stevenson, 2018; Friday et al., 2018); it seems particularly interesting to understand how this process happens in a non-commercial dynamic established between supply chains and government institutions. Finally, relational governance enables inter-organizational resource sharing and reconfiguration in the response of cargo theft over time. It would be interesting to understand how post-occurrence knowledge has led to reduce risk through those resources.

Therefore, following research questions guided this study: *(RQ1) How do companies respond to cargo theft in a weak institutional environment? (RQ2) How do companies adopt relational governance mechanisms to build social capital in an environment characterized by mistrust?* This research aims to understand how companies respond to the threat of cargo theft in environments with weak institutions, employing relational governance to build social capital in distrusting inter-organizational relationships.

We address those questions by following a multiple case study approach (Eisenhardt, 1989). The phenomenon of cargo theft involves several organizations in their environment, requiring a deep understanding of their relationships (Ketokivi & Choi, 2014). We selected the cases from industries known for cargo theft based on product value and risk impact (National Association of Cargo Transport and Logistics [NTC & Logistics], 2021). As a result, we selected nine Brazilian companies in the automotive, beverage, food, electronics, pharmaceuticals, and tobacco industries.

This study contributes to the operations and supply chain management [OSCM] literature by addressing the following gaps. First, our research extends prior OSCM studies that applied institutional theory by highlighting the dual role of institutions: as a source of external risk to supply chains and as a provider of resources employed in a collaborative risk response. Past studies have paid little attention to institutions as a source of supply chain risks (Kelling et al., 2020; Friday et al., 2018; Singh & Singh, 2019). Second, we propose that supply chain risk management [SCRM] should aggregate inter-organizational relationships beyond supply chain boundaries to effectively respond to external risks. Due to cargo theft's violent nature, the response to its threat may demand resources that supply chains alone do not possess, such as police protection and legal power to dismantle criminal groups. Therefore, our study contributes to apply social capital theory in relationships beyond supply chain boundaries to understand cargo theft response. Third, our findings reveal that relational governance is a crucial ingredient for building social capital in an environment characterized by mistrust. Relational governance provides greater visibility and control of employees' and partners' behavior, making room for collaborative risk response. It also promotes target alignment between supply chains and government institutions, seeking to reduce common threats. Fourth, our research highlights that companies used SCRM knowledge to move beyond collaborative risk response. They learned from past cargo theft occurrences, anticipating and better responding to the threat of cargo theft. This reduced both risk occurrence and severity, achieving better supply chain risk response.

This essay presents a literature review in the next section. We focus on SCRM in a weak institutional environment and social capital under distrustfulness. In the third section, we describe the steps following in our case study of nine cases in industries known for cargo theft in Brazil. The fourth section presents the within-case and cross-case analyses, describing how the case companies enhance inter-organizational relationships in an environment characterized by mistrust. The following section, we discuss the theoretical contributions of collaborative response to the threat of cargo theft, comparing our results with the OSCM literature and establishing prepositions. The last section presents the main conclusions, including theoretical and managerial implications of this research, its limitations, and suggestions for future studies.

THEORETICAL FRAMEWORK

Weak Institutions as a Source of Threats

OSCM researchers have addressed the role of institutions in supply chain performance (Kelling, Sauer, Gold & Seuring, 2020; Lee, Abbey, Heim & Abbey, 2016; Spring et al., 2017; Turkulainen et al., 2017; Wu & Jia, 2018), however, prior studies have paid little attention to institutions as sources of supply chain risks (Kelling et al., 2020; Kreye, 2017; Singh & Singh, 2019). Institutions are structural arrangements that establish “the rules of the game”, in which individual and collective behavior are oriented (Giddens, 1984).

Neo-institutional theory highlights that institutions enable and restrict the actions of individuals and companies through formal and informal patterns of behavior (Meyer & Rowan, 1977; Powell & DiMaggio, 1991; Scott, 2008), including the government, social and cultural norms, education, religion, and other shared forces that encourage convergent thinking. This theory groups those forces into regulative, normative, and social institutions (DiMaggio & Powell, 1983; Scott, 2008). Regulative institutions are based on a government’s ability to monitor the actions of firms in its environment, which are the focus of this research (Campbell, 2007). While the effect of strong institutions has been well documented, the absence or weakness of formal institutions can lead to the opposite effect, increasing the occurrence and severity of risks, with unpredictable consequences for firms, supply chains, markets, and society (Friday et al., 2018; Kelling et al., 2020; Zhou et al., 2016).

Weak institutional environments are characterized by unlawful behavior, superficial regulatory compliance, and political instability (Crane, 2013; Huq & Stevenson, 2018; Repolho, Marchesi, Silva Júnior & Bezerra, 2019; Viswanadham & Samvedi, 2013). The impact of long-term is affected by uncertain government actions, such as regulatory protection and government policies (Zhou et al., 2016). Because companies cannot control their environment, they turn to partners’ resources and information to respond to risks in the course of their business operations (Singh & Singh, 2019), demonstrating the increased importance of informal institutions based on interpersonal relationships (Zhou et al., 2016). While formal institutions provide safeguards for reducing opportunistic and unlawful behaviors (Spadaro, Gangl, Van Prooijen, Van Lange & Mosso, 2020), their absence inhibits inter-organizational risk response.

Supply Chain Risk Management in a Weak Institutional Environment

The OSCM literature has widely recognized collaboration, cooperation, and social capital as crucial elements in an efficient risk response (Durach & Machuca, 2018; Friday et al., 2018); however, most SCRM papers focus on relationships at supply chain boundaries,

specifically buyer-supplier relationships (Daghar et al., 2021; Durach & Machuca, 2018; Fan & Stevenson, 2018; Friday et al., 2018). SCRM is “an inter-organizational collaborative endeavor utilizing quantitative and qualitative risk management methodologies to identify, evaluate, mitigate and monitor unexpected macro and micro level events or conditions, which might adversely impact any part of a supply chain” (Ho, Zheng, Yildiz & Talluri, 2015, p. 5036). Prior studies have categorized this process into different stages (Fan, Li, Sun & Cheng, 2017; Fan & Stevenson, 2018), presented in Table 3.1.

Table 3.1 - Stages of SCRM

SCRM stage	Description
Risk identification or awareness	Recognize actual and potential vulnerabilities for a supply chain
Risk assessment	Identify and prioritize actions for risks by determining the likelihood, frequency, and impact of threats
Risk response	Address a strategy for each identified risk: acceptance, avoidance, transfer/sharing, and mitigation
Risk monitoring	Continuously manage risk sources and changes in the environment to adapt to the treatment

Note. Source: Adapted from Friday, D., Ryan, S., Sridharan, R., & Collins, D. (2018). Collaborative risk management: a systematic literature review. *International Journal of Physical Distribution & Logistics Management*, 48(3), 231-253. Durach, C. F., & Machuca, J. A. D. (2018). A matter of perspective – the role of interpersonal relationships in supply chain risk management. *International Journal of Operations and Production Management*, 38(10), 1866-1887.

Because of the violent nature of cargo theft, a response restricted to supply chain partners may not be enough to respond to cargo theft in environments characterized by weak institutions. Cargo theft can be categorized by different crimes (Table 3.2). For example, in a typical hijacking, criminals force a truck to stop *en route* to stealing the cargo. They may then threaten, kidnap, physically assault, or even murder workers during the hijacking (Ekwall & Lantz, 2018). Responding to a hijacking requires capabilities beyond companies’ scope as an organization, such as police protection and legal power to investigate and dismantle criminal groups. Therefore, external risks may demand inter-organization response, including formal institutions, cross-sector organizations, and supply chain partners. However, when solid formal institutions are absent, companies are less prone to engage their resources and information in inter-organizational relationships when they do not trust the other entities (Bonatto et al., 2020; Kelling et al., 2020; Singh & Singh, 2019).

Table 3.2 - Categories of Cargo Theft

Category	Description
Theft	A general category that implies that products were stolen
Burglary	Theft of products without the use of force, violence, or threats
Hijacking	Thefts that include the stoppage of a moving vehicle by force, violence, or threats against the driver
Robbery	Thefts that include force, violence, or threats against the driver performed while the vehicle is stationary
Fraud	Thefts performed through intentional deception promoted by companies' employees, workers from supply chain partners (without their knowledge or consent), and/or the supply chain partner (mainly retailers or third-party logistics providers)

Note. Source: Adapted from European Union Agency for Law Enforcement Cooperation - Europol. (2009). *Cargo Theft Report: Applying the Brakes to Road Cargo Crime in Europe*. The Hague: The Netherlands: Europol. Ekwall, D., & Lantz, B. (2016). Supply chain risk analysis and assessment: cargo theft. *Transportation Journal*, 55(4), 400-419.

Weak formal institutions nurture opportunistic and unlawful behaviors, allowing unknown risks to emerged from relationships (Bonatto et al., 2020; Kreye, 2017). This reduces trust (Sambasivan, Siew-Phaik, Mohamed & Leong, 2013) and, consequently, restrains social capital in inter-organizational relationships to respond to common risks (Bonatto et al., 2020). Because the social capital embedded in relationships plays a fundamental role in SCRM (Daghar et al., 2021; Durach & Machuca, 2018; Fan & Stevenson, 2018; Friday et al., 2018), companies should mobilize the social capital in their relationships with supply chain partners they do not trust and formal institutions.

Reducing Future Occurrences through Social Capital

Weak formal institutions nurture opportunistic and unlawful behavior, reducing trust (Sambasivan et al., 2013) and, consequently, restrain social capital from responding to common risks (Bonatto et al., 2020; Daghar et al., 2021). Social capital theory highlights the actual and potential resources embedded within network ties (Nahapiet & Ghoshal, 1998), including the norms and values shared by employees, supply chain partners, industry associations, and government institutions (Johnson, Elliott & Drake, 2013; Nahapiet & Ghoshal, 1998; Walker, Kogut & Shan, 1997). The social capital concept aggregates: structural, relational, and cognitive dimensions, each playing an essential role in SCRM (Daghar et al., 2021), as presented in Table 3.3. Structural capital refers to assets and routines configured to improve information and experience sharing (Gallear, Ghobadian & He, 2015; Stone & Rahimifard, 2018). Cognitive

capital includes the shared representations, narratives, values, goals, ambitions, and codes developed by joint and constant sense-making process (Chowdhury, Lau & Pittayachawan, 2019; Fan & Stevenson, 2018). Lastly, relational capital refers to personal relationships based on closeness, friendship, norms, reciprocity, identification, mutual respect, and trust (Day, 2014; Dubey et al., 2020; Duhadway, Talluri, Ho & Buckhoff, 2020; Gölgeci & Kuivalainen, 2020; Johnson et al., 2013; Nahapiet & Ghoshal, 1998;). Therefore, relational capital cannot be built in the absence of trust, and the lack of relational capital constrains collaborative risk response.

Trust improves buyer-supplier collaboration (Dubey et al., 2020), reduces opportunistic behavior (Wacker et al., 2016), and reduces risks emerging from a weak institutional environment (Lima et al., 2018). The concept of trust is the “willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party” (Mayer, Davis & Schoorman, 1995, p. 712). Trust only exists in lower-risk and uncertain environments (Laequuddin et al., 2009). Therefore, companies in a higher risk environment should focus on creating mechanisms for reduce risks in order to enhance trust.

Table 3.3 - Social Capital Applied to SCRM

Dimensions	Sub-dimension elements	Application in SCRM	References
Structural capital	Information and knowledge sharing Inter-organizational practices	Communication channels and guidelines Joint SCRM Best practice sharing Monitoring systems	(Brusset & Teller, 2017; Carey, Lawson, & Krause et al., 2010; Dubey et al., 2020; Jain et al., 2017; Duhadway et al., 2020)
Cognitive capital	Shared codes and language Share narrative	Target alignment Post knowledge management SCRM culture	(Chowdhury, Lau & Pittayachawan, 2019; Fan & Stevenson, 2018; Gupta & Gupta, 2019; Manhart, Summers & Blackhurst, 2020)
Relational capital	Relationship closeness Reciprocity Trust	Respect Friendship Interaction level Risk and revenue sharing	(Chowdhury, Lau & Pittayachawan, 2019; Day, 2014; Dubey et al., 2020; Duhadway et al., 2020; Gölgeci & Kuivalainen, 2020)

Relational governance is a set of mechanisms that allow companies to effectively operate in inter-organizational relationships under uncertainty and risk (Bonatto et al., 2020; Poppo, Zhou & Li, 2016; Wacker et al., 2016; Yeh, 2016). Relationally capable companies develop assets and routines that increase trust and, consequently, social capital, over time, such

as problem-solving routines, communication guidelines, information sharing, and monitoring systems, among other mechanisms (Bonatto et al., 2020). Individuals are more prone to cope with rules when they know they are being monitored (Schweitzer, Ho & Zhang, 2016). From those mechanisms, relational governance leads to superior control and collaboration (Pilbeam et al., 2012; Wacker et al., 2016), reducing risks and setting the stage for social capital building (Bonatto et al., 2020; Lima et al., 2018). Therefore, relational governance supports SCRM in managing inter-organizational resources and reconfiguring them to respond to external risks over time.

Companies can learn from past risk occurrences, identifying patterns that enable them to anticipate future occurrences (Mital, Del Guidice & Papa, 2018; Singh & Singh, 2018). This institutional memory increases SCRM efficiency, reducing risk and improving its response (Quang & Hara, 2018). For example, they can evaluate current technologies and the results of their practices, reinforcing their business continuity plan. In the case of cargo theft, SCRM knowledge can reduce future risk occurrences (Mital et al., 2018; Yang, Xie, Yu & Liu, 2021).

SCRM knowledge enables companies to develop capabilities to anticipate, better responds to, and quickly overcome threats (Mital et al., 2018; Singh & Singh, 2018; Yang et al., 2021), including cargo theft. For example, companies can apply risk location knowledge to prevent future theft in high-risk regions based on past occurrences, adopt tested assets and practices for responding to hijackings, and apply a recovery plan to absorb the negative impacts and reduce stockouts after a theft. Thus, companies can use knowledge gained from past theft occurrences to proactively anticipate cargo theft before its occurrence and improve their risk response to minimize cargo theft impacts (Mital et al., 2018; Yang et al., 2021).

RESEARCH METHODS AND PROCEDURES

The multiple case study approach is appropriate for theory elaboration in a contextually rich phenomenon such as cargo theft (Barratt, Choi & Li, 2011; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Ketokivi & Choi, 2014). Past studies have described the multiple case study approach as suitable for theory elaboration by analyzing both within-case and cross-case analysis (Ketokivi & Choi, 2014; Miles & Huberman, 1994). We employ an inductive multiple case study approach for nine companies. The OSCM literature on SCRM has paid little attention to risks emerging from the institutional environment (Daghar et al., 2021; Durach & Machuca, 2018; Fan & Stevenson, 2018; Friday et al., 2018). We know little about how companies

mitigate cargo theft in a weak institutional environment (Ekwall & Lantz, 2018; Tong et al., 2019) and how they can enhance supply chain partners' and institutional support in environments characterized by mistrust (Bonatto et al., 2020). The next subsections were structured following the five stages of case study analysis described by Eisenhardt (1989).

Case Selection

We selected our cases based on a theoretical sampling approach using three criteria to identify suitable companies (Eisenhardt, 1989; Miles & Huberman, 1994). First, we selected companies that operate in Brazil, based on the frequency of cargo theft and its financial impact in Brazil. Brazil ranks as seventh in the world in cargo theft occurrence, only behind countries that have been at war in recent years, such as Syria, Iraq, and Somalia (TAPA, 2021). There were 25 thousand cargo theft incidents in 2017, which means there was a theft every 20 minutes in Brazil, on average (TAPA, 2021). The financial loss associated with cargo theft in South America is 100 thousand dollars per incident, on average, the most expensive worldwide, with Brazil representing over 90% of South American occurrences (BSI, 2019). Also, cargo theft is a major concern for companies in some emerging markets and at the highest risk level in big economies such as Brazil, South Africa, and Mexico (Repolho, Marchesi, Júnior & Bezerra, 2019).

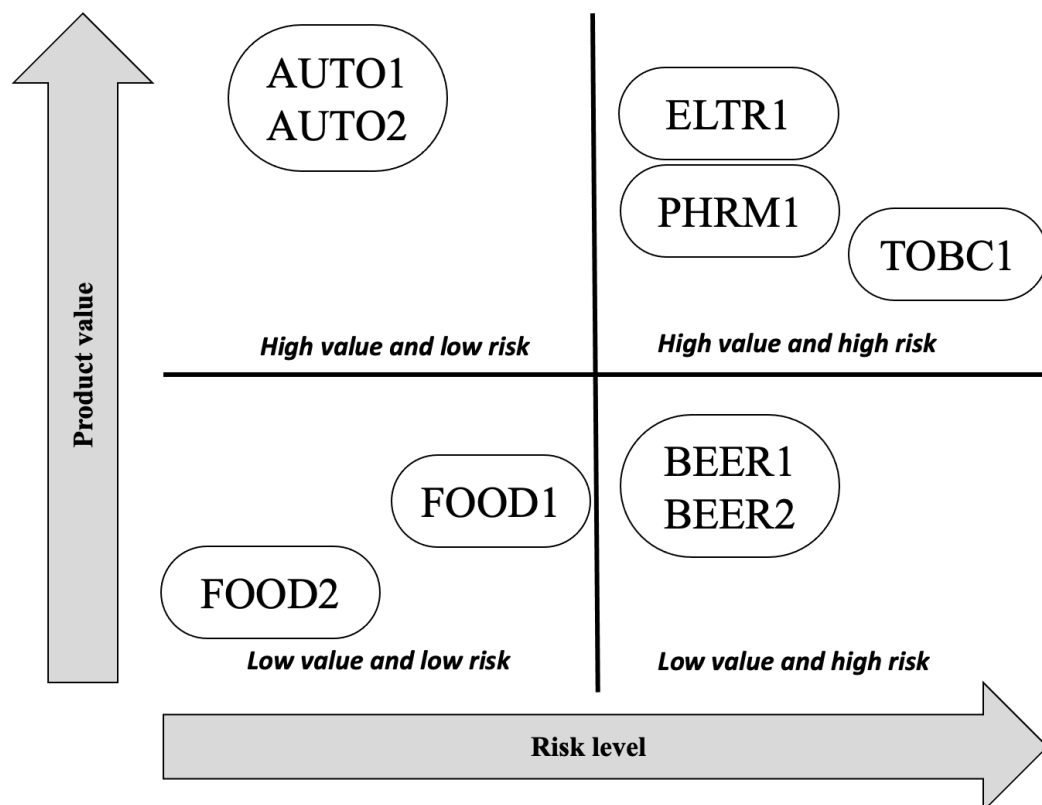


Figure 3.1. Selected Cases

Second, we selected six industries from those with the most target products by the black market in Brazil: food and drinks, electronics, cigarettes, pharmaceutical products, chemicals, clothing, auto parts, fuels, agricultural products, and personal care products (NTC & Logistics, 2021). Third, we selected nine companies based on two sub-criteria: product value and risk perception level (Figure 3.1). We expected that companies with higher cargo theft perception and high-value products would be more affected on service level and costs, leading them to more proactive mitigation strategies.

We identified a group of suitable companies based on those criteria, inviting their managers to participate in this research. We sent a confidentiality agreement, establishing that we would not disclose either the companies' or the participants' names. Finally, we selected nine companies in the automotive (2 companies), beverages (2 companies), food (2 companies), electronics, pharmaceuticals, and tobacco (1 firm each) industries. Eisenhardt (1989) considered a compelling multiple case study for theory-building purposes to have between four and ten cases.

Data Gathering

We interviewed 58 managers and two public agents as our primary data source (Barratt et al., 2011), with at least five and as many as nine interviews in each company (Table 4). The data gathering was performed in two stages. First, we interviewed managers in five companies from different functional areas, employing an exploratory semi-structured interview protocol between October 2017 and July 2018, presented in Appendix 3A (Barratt et al., 2011). At that stage, we focused on a variety of institutional uncertainties and risks, including cargo theft. From those interviews, we learned that the risk of cargo theft was perceived and deeply understood only by managers who work directly in material and product flow and those from risk and security management functions. Therefore, we collected relevant data from 14 of the 29 interviews.

In the second stage, we conducted the other 46 interviews from July to November 2020, employing a protocol more deeply focused on the cargo theft phenomenon (Appendix 3A). Communication technologies were used to ensure social distance during the pandemic, such as phone calls, videoconferencing apps, and online platforms (World Health Organization [WHO],

2020). Those technologies allowed us to interview managers from eight states in four of the five regions of Brazil, which increased our understanding of cargo theft, while avoiding regional biases. The interviews lasted 45 minutes on average, conducted in Portuguese, the interviewees' native language. We recorded 56 interviews with participants' consent, transcribed them, and then translated representative quotes into English (Appendix 3B). We relied only on our field notes for the other four interviews.

Table 3.4 - Overview of Interviews

Industry	Case	Global revenue ^a (2019)	Facilities	ID	Functional area of the interviewee	Time (minutes)
Automotive	AUTO1	US\$100-150 billion	Over 30 countries	AUTO1E5	International Trade	30
				AUTO1E6	Projects and Product Development	30
				AUTO1E7	International Trade	60
				AUTO1E8	Supply chain	30
				AUTO1E9	Supply chain	40
				AUTO1E10	Projects and Product Development	40
				AUTO1E11	Logistics and Transportation	50
				AUTO1E12	Projects and Product Development	30
	AUTO2	US\$100-150 billion	Over 30 countries	AUTO2E1*	Projects and Product Development	50
				AUTO2E6	Sales and Distribution	30
				AUTO2E7	Manufacturing	30
				AUTO2E8	Projects and Product Development	40
				AUTO2E9	Logistics and Transportation	30
				AUTO2E10	Sales and Distribution	30
Beverage	BEER1	US\$10-20 billion	Over 15 countries	BEER1E1*	Logistics and Transportation	50
				BEER1E4	General Management	30
				BEER1E5	Logistics and Transportation	30
				BEER1E6	Logistics and Transportation	40
				BEER1E7	Logistics and Transportation	60
				BEER1E8	Logistics and Transportation	30
				BEER1E9	Logistics and Transportation	50
	BEER2	US\$20-30 billion	Over 70 countries	BEER2E3*	Sales and Distribution	40

Industry	Case	Global revenue ^a (2019)	Facilities	ID	Functional area of the interviewee	Time (minutes)
				BEER2E4*	Sales and Distribution	60
				BEER2E8	Sales and Distribution	50
				BEER2E9	Security and Risk Management	40
				BEER2E10	Sales and Distribution	30
				BEER2E11	Operations Management	60
Electronics	ELTR1	US\$200-250 billion	Over 40 countries	ELTR1E1	Manufacturing	30
				ELTR1E2	Sales and Distribution	50
				ELTR1E3	Logistics and Transportation	30
				ELTR1E4	Logistics and Transportation	30
				ELTR1E5	Logistics and Transportation	30
Food	FOOD1	US\$50-100 billion	Over 150 countries	FOOD1E1	Sales and Distribution	60
				FOOD1E2	International Trade	40
				FOOD1E3	Supply chain	50
				FOOD1E4	Logistics and Transportation	30
				FOOD1E7	General Management	40
	FOOD2	US\$20-30 billion	Over 30 countries	FOOD2E1	Projects and Product Development	40
				FOOD2E2	Logistics and Transportation	40
				FOOD2E3	Procurement	40
				FOOD2E4	Sales and Distribution	30
				FOOD2E5	Sales and Distribution	30
Pharmaceuticals	PHRM1	US\$1-5 billion	2 countries	PHRM1E1	Sales and Distribution	60
				PHRM1E2	Supply chain	70
				PHRM1E3	Manufacturing	30
				PHRM1E4	Procurement	50

Industry	Case	Global revenue ^a (2019)	Facilities	ID	Functional area of the interviewee	Time (minutes)
				PHRM1E5	Supply chain	50
Tobacco	TOBC1	US\$30-50 billion	Over 40 countries	TOBC1E1*	Logistics and Transportation	70
				TOBC1E3*	Logistics and Transportation	50
				TOBC1E4*	Security and Risk Management	60
				TOBC1E5	Security and Risk Management	70
				TOBC1E6	Security and Risk Management	60

Note. ^a Financial information retrieved from companies' websites. ^b exploratory interview. * Second interview.

Data Analysis

We followed Gioia, Corley, and Hamilton's (2013) inductive approach process for theorizing evidence on constructs from the field. The within-case and cross-case analyses allowed us developed a set of propositions based on the field evidence (Barratt et al., 2011; Eisenhardt, 1989; Gioia et al., 2013; Ketokivi & Choi, 2014). During this process, we applied Corbin and Strauss's (2008) open coding strategy to coded and analyzed transcriptions and field notes.

We focused on identifying supply chain risk management under the threat of cargo theft threats (Ekwall & Lantz, 2018), following its four stages: risk identification, assessment, response, and monitoring (Fan & Stevenson, 2018). We also noted the lack of trust in workers, supply chain partners, and government officers' behavior. We built our model from the process codes, describing how companies combined technologies, practices, and social capital to improve supply chain risk management in a low trust environment. Firstly, we identified codes based on informant language (Corbin & Strauss, 2008; Gioia et al., 2013). Then, we grouped those codes into 35 first-order categories, grouped in eight second-order categories, and expressed in three aggregate dimensions. Lastly, we compared our findings with the OSCM literature and developed four propositions.

Replication

To ensure accuracy in data collection and analysis, we applied four criteria to ensure methodological rigor (Table 3.5): internal validity, external validity, reliability, and objectivity (Lincoln & Guba, 1985). We selected representative companies (Figure 3.1) and interviewed at least five managers for each company (Table 3.1) to address internal validity and provide an accurate view of the phenomenon. Second, external validity was addressed by applying a multiple case study approach, selecting companies based on clear criteria, delimitating the unit of analysis, and employing within-case analysis to describe the context of each case. This will help other researchers transfer and compare our findings to similar contexts.

Third, to ensure reliability, we present the documental procedures so that other researchers can use to them replicate our research, such as the semi-structured questionnaire in Appendix 3A, documented procedures, transcribed interviews, and data analysis. Fourth, we established an agreement with the participants that ensured anonymity of their names and

companies in any publications. We encourage the participants to freely share their opinions and experiences, ensuring objectivity in their information.

Table 3.5 - Criteria for Methodological Rigor

Criteria Definition	Methods of addressing
Internal Validity <i>(Credibility)</i> The extent to which the observed results correctly represent the phenomenon	We selected nine companies from six representative industries known for cargo theft We interviewed at least five managers per case from the material and product flow, risk, and security areas We developed a framework and propositions
External Validity <i>(Transferability)</i> The degree to how well the findings can be generalized to other settings	The unit of analysis was delimited Case selection criterion established The within-case analysis describing cases' context Employed a multiple case study approach
Reliability <i>(Dependability)</i> The extent to which another researcher can replicate the results	The semi-structured interview questionnaire (Appendix 3A) Data collection and analysis description Transcription of the interviews (in Portuguese)
Objectivity <i>(Conformability and Integrity)</i> The extent to which findings are free from researcher biases or misinformation from participants	Presentation of representative interviewee quotations (Appendix 3B) We established an agreement with interviewees that companies' and participants' names will remain anonymous in publications to encourage the participants to express their views

Note. Source: Adapted from Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications. Miles, M., & Huberman, A. (1994). *Qualitative data analysis: An expanded sourcebook*, Sage Publications, London, UK.

RESULTS

We employed within-case and cross-case analyses to analyze the interview data (Eisenhardt, 1989). We decoupled each of the nine cases in the within-case analysis, as presented in the following sub-section. From deeply understand their unique contexts, we summarized their key information separately by each case in Table 3.6 (Miles & Hubermann, 1994). Then, we categorized the information from the interviews in our cross-case analysis. From those categories, we proposed an analytical model that presents the constructs' interaction (Gioia et al., 2013), as presented in Figure 3.3. We developed four propositions based on these constructs. Representative quotations are listed in Appendix 3B.

Within-Case Analysis

AUTO1

This company is a prominent global producer in the automotive industry with a geographically dispersed supply chain in Brazil, due to regional tax incentives. Cargo theft has a minor impact on its operations, focusing on specific auto parts, rather than assemble vehicles. Although cars are expensive, the government regulates them, making the creation of a black market difficult. Auto parts, however, are both expensive and much less regulated. Cargo theft emerged as a viable risk since inbound logistics became AUTO1's responsibility ten years ago, as part of a strategy to reduce transportation costs: "[...] a tire supplier used to deliver this material [here in the factory], and there was no problem of cargo loss or theft. Nothing. AUTO1 took over this transport and in the first month, we had two or three thefts" (AUTO1E11).

AUTO1 established a partnership with external risk management consultants to mitigate cargo theft, as a requirement for its insurance contract. Because of this, AUTO1 must follow several requirements provided by its service provider to comply with the insurance policy: "the insurance company itself said that it only signs the insurance [contract] if AUTO1 sets up external risk manager consultants [to reinforce security]" (AUTO1E11). The external risk management consultants operate as a facilitator, providing consulting about technologies and practices. After a cargo theft, this service provider took over the investigation, applying its capabilities to lead AUTO1 to an early stable situation. This included, among other actions, information sharing between AUTO1 and government institutions, and limiting AUTO1's direct contact with the investigation or police officers involved. The service provider's support reduced cargo theft occurrence and their impact for AUTO1.

AUTO2

AUTO2 has several similarities with AUTO1 as one of the world's largest automotive manufacturers. Cargo theft has a minor impact on AUTO2's operations; it consists mostly of hijacking focused on auto parts. However, this risk becomes higher when embedded electronic equipment like radios became a primary target. The electronic equipment evolved over time, becoming more car-specific. Although this innovation was not targeted at mitigating crime, it had an unexpectedly positive effect on cargo theft, making those electronic parts less attractive to the black market:

In the past, when we had those radios that played tapes and fit in any car [...], it could be sold on the black market easily. Its transport employed armed escorts in some cases. But nowadays, the criminal can't do anything [with the stolen radio] (AUTO2E4).

AUTO2 maintains safety stock to compensate for cargo theft incidents. Unlike AUTO1, which has a more geographically dispersed supply chain, AUTO2's operations are in the main manufacturing region in Brazil. Thus, there is a lower distance between suppliers' facilities and AUTO2's, reducing travel time and the associated risk of cargo theft *en route*. Finally, AUTO2 adopted the security protocols required by the contract with its insurance company, such as armed escorts for the transportation of specific auto parts.

BEER1

BEER1 produces beer and non-alcoholic drinks, distributing its products all over Brazil. Cargo theft has a moderate impact on its operations, mainly targeting beer, but also caps and labels. However, BEER1 had a critical impact on cargo theft in the past, including hijacking, kidnapping, fraud, robbery, burglary, and death. Although BEER1's products are challenging to track after a theft, they have lower value in the black market than electronics or cigarettes. BEER1's cargo theft involves different criminal groups, including drug dealers, employees, its supply chain partners, and employees from the third-party logistics [3PL] provider. Unlike other companies that primarily identify cargo theft as hijacking, BEER1 also suffers from fraud conducted by its employees. For example, some of employees falsified stock numbers in BEER1's facilities to steal part of the cargo: "it must be a mini mafia inside the brewery. [...] From the moment you manage to put the brewery's concierge and a forklift operator into the scheme, you just load more [cargo] than you should on that truck" (BEER1E1*). Although cargo theft has a moderate impact on BEER1's cost and service level currently, criminals have sometimes kidnapped BEER1's employees, resulting in psychological trauma, dismissals, and leaves of absence.

BEER1 adopted several proactive strategies to mitigate cargo theft over the years, following its principal strategy of reducing transportation cost reduction and increasing service level. Those strategies included supply chain visibility increases through digital technologies and systems, building a security and risk management culture, applying standardized procedures and hiring former police officers with experience and personal ties to the police, collaborating with government institutions by sharing information and resources with police stations specializing in cargo theft, and improving the employee recruitment process by properly checking criminal and financial backgrounds. Such strategies led BEER1 to better prepare a cargo theft response and reduce its impact and occurrences.

BEER2

BEER2 produces beer and non-alcoholic drinks, which are difficult to track after a theft and have low value in the black market. Cargo theft has had a minor impact on BEER2's cost, and service level. Historically, however, the scenario for BEER2 was critical, including deaths in confrontations between armed escort agents and criminals. Most incidents occurred during last mile deliveries, done by specialized groups, opportunistic thieves, and drug dealers inside or outside their territories in the Brazilian slums (*favelas*). BEER2 was able to identify employees' involvement in these crimes, through leaking information about cargo handling and delivery:

The first thing is to control the hiring. [...] In Rio, the first thing I did was to identify everyone who had problems with cargo theft: drivers and helpers [...] We started to map the risk per employee, how many times he was involved with cargo theft occurrences (BEER2E11).

To mitigate this risk, BEER2 applied several proactive strategies. Those strategies include increasing visibility through digital and embedded technologies, highlighting employee misconduct, information sharing with police officers about thefts and criminal groups, increasing SCRM knowledge management through digital and embedded technologies, building social capital with communities in high-crime *favelas* through investing in local improvements, and improving the employees recruitment process by properly checking criminal and financial backgrounds. Combining these strategies over time, BEER2 is better prepared for mitigating cargo theft, reducing uncertainty and distrust.

ELTR1

ELTR1 is a large producer of cell phones, televisions, and computers in Brazil. ELTR1 has a moderate and decreasing impact of cargo theft on its operations. The main targeted product is cell phones, which have a high-added value and are difficult to track after a theft. ELTR1 developed strategies with external risk management consultants, which as required by its insurance contract. ELTR1's cargo theft mitigation strategy includes armed escorts, tracking systems, and monitoring employees directly involved in cargo handling and delivery. All logistics follow procedures that guarantee cargo safety during transportation, a requirement from ELTR1's cross-sector partners:

When the insurance company considers the risk to be high, it limits the maximum to \$100,000 per vehicle. If you are going to transport toilet paper, you can transport up to 1 million dollars because the risk of the load is low. It will depend on the type of product and where it goes (ELTR1E3).

ELTR1's most effective strategy, however, was employing a digital locking system installed in each cell phone. This system blocks many functions of the equipment, ruining the stolen cargo and inhibiting commercialization of stolen cell phones in the black market.

We reduce the "loss". The only thing a criminal will be able to do with this cell phone is to sell its components. Because selling for use, they can't do it anymore. After this system, we identified a significant reduction in thefts because [the cell phone] can't be used [for callings and internet] (ELTR1E2).

Although ELTR1 has higher governance of commercial activities in its supply chain, each member implements its risk management individually. Thus, the responsibility for the cargo stops when the ELTR1 delivers the cargo in the retailers' facility or after the retailers accepted it in its distribution centers. Although this locking system is not provided free of charge for distributors or retailers, ELTR1 considered it a good investment. In this way, ELTR1 profits through this added service, while reducing its cargo theft occurrence and severity.

FOOD1

FOOD1 is a global producer of child and baby nutrition, pet care, milk, chocolate, confectionery, bottled water, coffee, creamer, and food seasoning. FOOD1 has decreased its cargo theft in Brazil over the last two decades, dropping from 400 thefts in 2000 to approximately 15 occurrences in 2020. This drop is associated with FOOD1's significant efforts to improve practices, including its risk and security culture, combining technologies, practices, and inter-organizational resources in a joint strategy. The result is that FOOD1 became a benchmark of security and risk management practices for the Brazilian market:

Almost the entire [national] market copies our practices [to respond to the threat of cargo theft]. With so many people who worked here and are in other companies, our [cargo theft response] plans are in several companies in the country. Basically, FOOD1 formed the security area [of Brazilian companies] (FOOD1E5).

FOOD1 realized that many thefts were conducted by its own employees, working directly as part of the criminal group or leaking information related to cargo handling and delivery to criminals. FOOD1's managers also identified retail partners that sold stolen products. Government institutions did not effectively investigate the incidents since they are composed of overburdened inspectors with low access to resources provided by the technological infrastructure, which reduced FOOD1's trust and increased uncertainty.

However, FOOD1 improved both its embedded and digital technologies to better control delivery, such as tracking systems, highlighting its workers' unlawful behavior. FOOD1 also improved its employee recruitment process, reducing its risk of hiring someone with a criminal background. FOOD1 improved information sharing with police officers from those monitoring systems, increasing its ability to provide information about location, thieves and vehicle characteristics, employee involvement suspicions, and the cargo route after the theft. This proactive information sharing provided valuable insights for the work of the police, increasing their chances of arresting the criminals.

FOOD2

FOOD2 is one of the largest dairy food producers in the world. Cargo theft has a negligible impact on FOOD2's operations in Brazil. Although its stolen products are challenging to track, dairy products are both low value and quickly deteriorate without proper refrigeration, making them less attractive to criminals. Most of FOOD2's cargo theft occurrences fall in two groups: by mistake or as punishment. In the first case, opportunistic thieves stole a refrigerated truck, kidnaped the driver, and drove the truck to a *favela*. Later, they realized it was a truck loaded with yogurt, so they distributed the cargo as a "gift" to the community from the criminal group. In the second case, criminals demanded bribes for FOOD2's facility operations, that are within or on the border of the criminals' territory. Therefore, cargo theft is a way to pressure FOOD2 to "cooperate" with this extortion:

It's not to steal the cargo itself, it's just to send a message: "you owe me, you forgot to pay me this month." It's a kind of arrangement that they [criminals] do [for pressure companies] (FOOD2E1).

For FOOD2, cargo theft has a low impact on its cost, service level, and workers' safety, making it less likely to adopt strategies to reduce cargo theft. Because FOOD2's product is not attractive to the black market, employees are more cautious about cooperating in thefts. Therefore, FOOD2 accepts the risk of cargo theft because it is low, absorbing its impact when cargo theft occurs.

PHRM1

PHRM1 produces an extensive portfolio of medicines, selling all over Brazil. PHRM1 has a moderate and decreasing impact of cargo theft, which mainly affects its final products. Some trucks full of raw materials were stolen by mistake and afterwards were promptly abandoned by the criminals. PHRM1's cargo theft involves different criminal groups with

different *modus operandi*, including its partners' employees, international criminal groups, counterfeiting groups, and small retailers that fence stolen products. However, since a government policy was established, PHRM1 has improved safety in its supply chain.

After some scandals involving the counterfeiting of medicines, the Brazilian government established a centralized system to control and track medicines in the outbound supply chain based on internet of things [IoT] technology. The government expects to be able to monitor all medicines sold in Brazil from the producer to the retailer, from this system. The system will be fully operational in 2022, however, pharmaceutical companies already control many of those products, giving them the visibility to easily identify and track not only counterfeited medicines but also stolen products. The government and companies expect that will be easier to identify which retailers fence illegal products. Therefore, PHRM1's stolen products have become less attractive to the black market, reducing its risk:

So, when a consumer buys a medicine at the drugstore, he will be able to verify that it is a counterfeit, stolen product. [...] So, this will inhibit cargo theft. It will be harder for criminals to market [the stolen product] because of this technology (PHRM1E2).

TOBC1

TOBC1 manufactures, markets, and sells tobacco products all over Brazil. Cargo theft decidedly affects its operations because its product is high valued and difficult to track. That makes it very attractive to the black market, affecting TOBC1's cost, service level, and consequently workers' safety. TOBC1 identified that cargo theft as mainly happening during transit in outbound logistics, between facilities and last mile delivery. Cargo theft of TOBC1's product involves several criminal groups such as specialized gangs, opportunistic cargo theft criminals, and drug dealers. TOBC1 identified employee involvement in many cargo theft occurrences, resulting in 60% of driver dismissals being caused by their direct involvement in crimes or leaking information about cargo handling and delivery: "we know that drivers are not well paid. [...] We know that when the driver transports a product that is very volatile [turning into money easily] and has high added value, he often ends up being enticed [by criminals]" (TOBC1E1*). TOBC1 had identified the involvement of retailers and even police officers in some thefts, making it harder for TOBC1 to trust them in collaborative efforts.

TOBC1 combined several proactive strategies in its cargo theft response. TOBC1 increased its last-mile visibility using digital and embedded technologies, allowing it to recognize employees' and partners' unlawful behavior, enhanced its SCRM culture by new

practices established alongside 3PL providers and its external risk management consultants, permitting the redesign of the employee recruitment process by properly checking their criminal and financial background, and engaged government institutions, sharing information and resources with police officers from stations specializing in cargo theft.

Many companies go to the police and say they were robbed by a blue car, a criminal wearing a red cap. Unlike us who invest in technology, to have more information to bring to the police what they need (TOBC1E4*).

Those measures improved TOBC1's cargo theft response, reducing its costs, improving workers' safety, and decreasing its theft losses.

Table 3.6 - Within-case Summary

	AUTO1	AUTO2	BEER1	BEER2	ELTR1	FOOD1	FOOD2	PHRM1	TOBC1
Cargo Theft Characteristics									
Target products	Auto parts	Auto parts	Products and material	Products	Products and parts	Products	Products	Products	Products
Product value	High	High	Low	Low	High	Low	Low	High	High
Historical impact	Minor	Minor	Major	Moderate	Major	Major	Negligible	Major	Critical
Cargo theft awareness									
<i>Thefts in the SC</i>									
Inbound logistics	X	X	X						
Inside facilities			X		X		X		
Between facilities			X						X
Last mile delivery			X	X	X	X	X	X	X
<i>Crime categories</i>									
Robbery			X	X	X	X	X	X	X
Hijacking	X	X	X	X	X	X	X	X	X
Fraud			X	X	X	X		X	X
Burglary			X	X		X	X		X
<i>Unlawful behavior</i>									
Employees			X	X	X	X		X	X
Retailers			X			X			X
3PL providers			X					X	X
Police officers			X	X		X			X
<i>Cargo theft impacts</i>									
Service level	No effect	No effect	Minor	Minor	Minor	Minor	Negligible	Minor	Minor

	AUTO1	AUTO2	BEER1	BEER2	ELTR1	FOOD1	FOOD2	PHRM1	TOBC1
Costs	Negligible	Negligible	Minor	Minor	Major	Major	Negligible	Major	Critical
Worker safety	Negligible	Negligible	Catastrophic	Catastrophic	Minor	Minor	Minor	Minor	Catastrophic
Responding to cargo theft threats									
<i>SCRM procedures definition</i>									
SCRM functional area			X	X	X	X			X
ERMC	X	X			X				X
Insurance company	X	X			X		X		
3PL provider							X	X	X
<i>Resources and information sharing</i>									
Cross-sector partners	Insurance	Insurance	Insurance ERMC	ERMC	Insurance ERMC	Insurance ERMC	Insurance ERMC	Insurance ERMC	ERMC
SC partners				X		X			X
Companies from other SC			X	X		X			
Government institutions			X	X		X		X	X
<i>Unlawful behavior mitigation</i>									
Digital technologies			X	X	X	X	X	X	X
Embedded technologies					X	X		X	X
Formal SCRM practices			X	X	X	X			X
Rigorous recruitment			X	X	X	X			X
Partners' knowledge			X	X	X	X			X
<i>Strategy definition</i>									
Reactive response	X	X			X		X	X	
Proactive response			X	X		X			X
Building future risk reduction									

	AUTO1	AUTO2	BEER1	BEER2	ELTR1	FOOD1	FOOD2	PHRM1	TOBC1
<i>Building social capital</i>									
Communication channels			X	X		X		X	X
Common target alignment			X	X		X			X
Trust from past experiences			X	X		X			X
<i>Post knowledge SCRM</i>									
Decisions' reevaluation	X	X	X	X	X	X	X	X	X
Previous procedures definition	X	X	X	X	X	X	X	X	X
SCRM culture			X	X		X			X
Monitoring unlawful behavior			X	X		X			X

Note. ERMC – External risk management consultants. SC – Supply chain.

Cross-Case Analysis

We employed the open coding technique to analyze the interview data (Corbin & Strauss, 2008). As presented in Figure 3.3, we grouped the information about the nine cases into a final model with three dimensions, 35 second-order categories, and eight first-order categories, following the approach described by Gioia et al. (2013). The dimensions referred to the four stages of the SCRM process (Fan et al., 2017; Fan & Stevenson, 2018). The first dimension, “Awareness and Assessment”, refers to the two first stages of SCRM process, risk identification and risk assessment. The second dimension, “Response”, represents the risk response stage. Last, the “Reducing Future Occurrences” dimension embodies the risk monitoring stage in a larger phase that preparing for future incidents.

Awareness and Assessment

Cargo thefts increase actual and future uncertainties that could generate risks for their operations and supply chain management activities (Ekwall & Lantz, 2018; Tong et al., 2019), implying an early determination of its impact for further assessment and treatment (Fan et al., 2017; Fan & Stevenson, 2018). The data suggest that cargo theft is an unpredictable threat to supply chains in environments with weak institutions, changing its occurrence and severity over time. The interviewees associated cargo theft with different aspects of the environment, including the absence of efficient institutions, transitory public security policies, abrupt changes in the legal system, and generalized corruption. Additionally, economic factors such as Brazil’s national economic crisis, increase in poverty, and, more recently, the effects of the Coronavirus [COVID-19] pandemic, also have affected the environment in Brazil. Therefore, characteristics of the environment can be an additional source of risk. As cargo theft is an intentional attack to supply chains, understanding how this crime works is crucial for its response:

We know that Rio de Janeiro, and the surrounding region, have a very high crime rate. The product is stolen to finance the traffic. So, [its profits] buy arms, buy drugs. Our product is very volatile [easy to sell in the black market] and it finances the crime (TOBC1E1*).

Risk occurrence, in general, is not an isolated event, often associated with other risks and consequences (Fan & Stevenson, 2018). In the case of cargo theft, this risk is also directly related to other crimes such as counterfeiting (BEER1; PHRM1), smuggling (TOBC1), drug dealing (BEER1; BEER2; FOOD1; FOOD2; TOBC1), and extortion (BEER1; BEER2; FOOD2). For example, TOBC1 related the increase in legal cigarette thefts along with an

outbreak in smuggling cigarettes from Paraguay during the pandemic. The case companies employed resources to map risk locations in their supply chains and geographical territories, such as big data, routing systems, artificial intelligence, and pre-occurrence expertise. Although the entire supply chain was potentially vulnerable (Figure 3.2), most cargo thefts were in the last mile delivery as hijacking or robbery events. Some companies also experience cargo theft through burglary and fraud (Table 3.6). This last category emerged as an additional threat to supply chains since trust in employees, partners, and police officers is fundamental to establishing joint efforts to effectively respond to risks (Bonatto et al., 2020; Daghar et al., 2021; Lima et al., 2018):

I had almost 60% driver dismissal for alleged involvement in crime and cigarette theft during the pandemic (TOBC1E1*).

The case companies applied risk location technology to identify, assess, and design risk response plans to reduce the occurrence and severity of cargo theft. Hence, the risk and security areas of those companies put extra effort into understanding the *modus operandi* and unlawful behavior of criminal groups (BEER1; BEER2; FOOD1; TOBC1). Based on the interviews, we categorized three groups that engage in cargo theft: criminal groups specialized in cargo theft, clandestine paramilitary groups, and opportunistic thieves who were engaging in other unlawful activities at the same time.

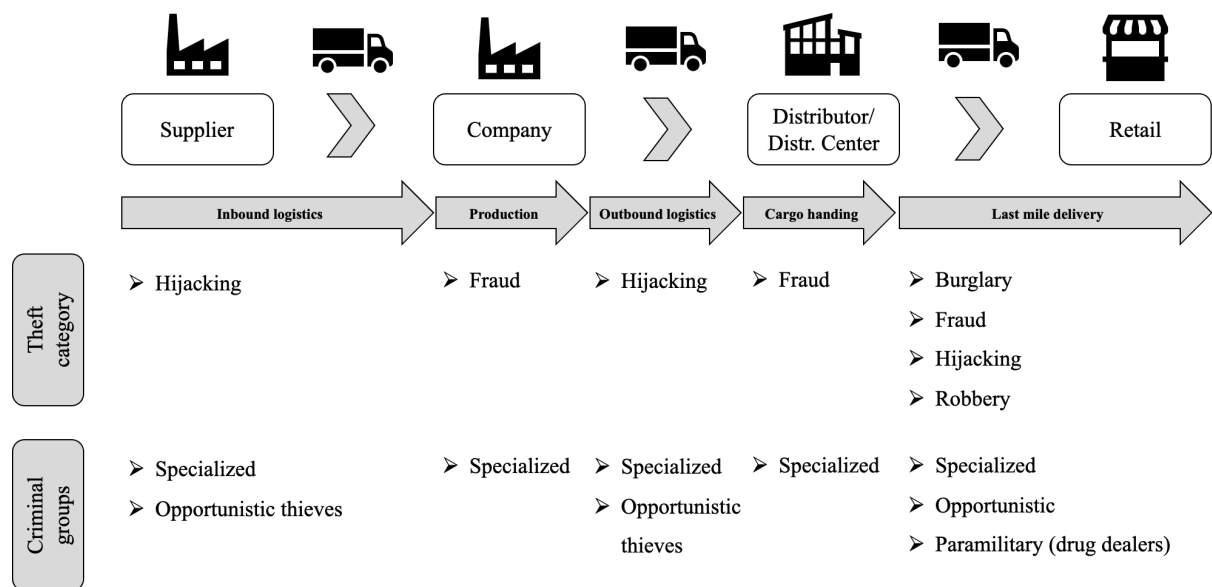


Figure 3.2. Categories of Cargo Theft Attacks in Supply Chains

Criminal groups specialized in cargo theft have skills that allow them to identify cargo handling and delivery of particular loads, with the support of workers or partners in the supply chain. Because they are more organized than other groups, specialized criminals stole products that are demanded by retailers in the black market in some cases: “we know internally that many retailers are colluding with theft” (TOBC1E1*).

The clandestine paramilitary groups mostly composed of drug dealers or former police officers, dominate part of the geographical territory in Rio de Janeiro, in general, a *favela* and its surroundings. Those groups act as the real authorities in a region since the government is entirely absent in those regions, openly engaging in cargo theft and extorting companies that operate and deliver in those regions: “our biggest brewery is next to a *favela*. Drug dealers invaded our water treatment plant and shut down the brewery’s water. They [criminals] wanted [free] beer” (BEER1E9).

The last group is composed of opportunistic thieves engaged in other illegal activities such as mugging, pickpocketing, and smuggling, they are ready whenever the occasion or the need arises. Each of those groups has a different *modus operandi*, which results in different outcomes for the same risk response. For example, using armed escorts is a very effective dissuasive practice against hijacking and robberies by opportunistic thieves but can lead to escalating violence during a hijacking by specialized or paramilitary groups (TOBC1; BEER2). Therefore, cargo theft is contextually dependent of the group who perpetrate the attack as well as its response should be too.

Our results suggest that consequences of cargo theft are highly associated with the black-market’s capacity to absorb the stolen products. The black market is most interested in higher value products (AUTO1; AUTO2; ELTR1; PHRM1; TOBC1) that are difficult for the producer or police to track (BEER1; BEER2; FOOD1; FOOD2; TOBC1). For example, cigarettes are both high-value and difficult to track after a theft, making them treasured by thieves. On the other hand, the government highly regulates automobile production and sales. A stolen car is easily identified by its identification number, which makes car rarely stolen despite their high value. Hence, an effective risk response should be based on products and criminal group characteristics, and cargo theft effects on a supply chain.

We identified three primary consequences of cargo theft. First is the increase of costs. Most of the case companies assessed costs based on the increase in their insurance contracts and their deductible co-payments. Insurance companies in Brazil make mandate protection of the cargo *en route*, such as armed escorts, embedded technologies, and external risk

management consulting, increasing costs. On the other hand, TOBC1, FOOD1, and BEER2 did not purchase insurance, thus their costs were solely based on product and asset losses.

The second primary consequence of cargo theft is reduced service levels. Managers perceive cargo theft as a direct threat to service level performance, viewing it as a mitigable risk that can result in stockouts or disrupts in the materials flow. For example, FOOD1's managers described how their consumers would buy a different brand if FOOD1's products are no longer available for sale because of a cargo theft occurrence:

Those who experienced 400 cargo thefts [per year] know what we lost in sell out, in market share... because until you put that product back on the shelf, our consumer who wants chocolate buy from the competitor [since] mine [product] didn't arrive [in the store because of the theft] (FOOD1E5).

The OSCM literature recognized the increased costs and reduced service levels as important consequences of risks (Fan et al., 2017; Fan & Stevenson, 2018). However, a third important consequence emerged from our interviews. Managers also consider workers safety as a critical indicator. For example, BEER1, BEER2, and TOBC1 reported employee deaths during hijackings, primarily through gunfights involving armed escort agents and drug dealers. Those causalities reduced company morale and reputation in the market: "the kidnapping of drivers in front of my brewery impacts the business in several ways" (BEER1E9).

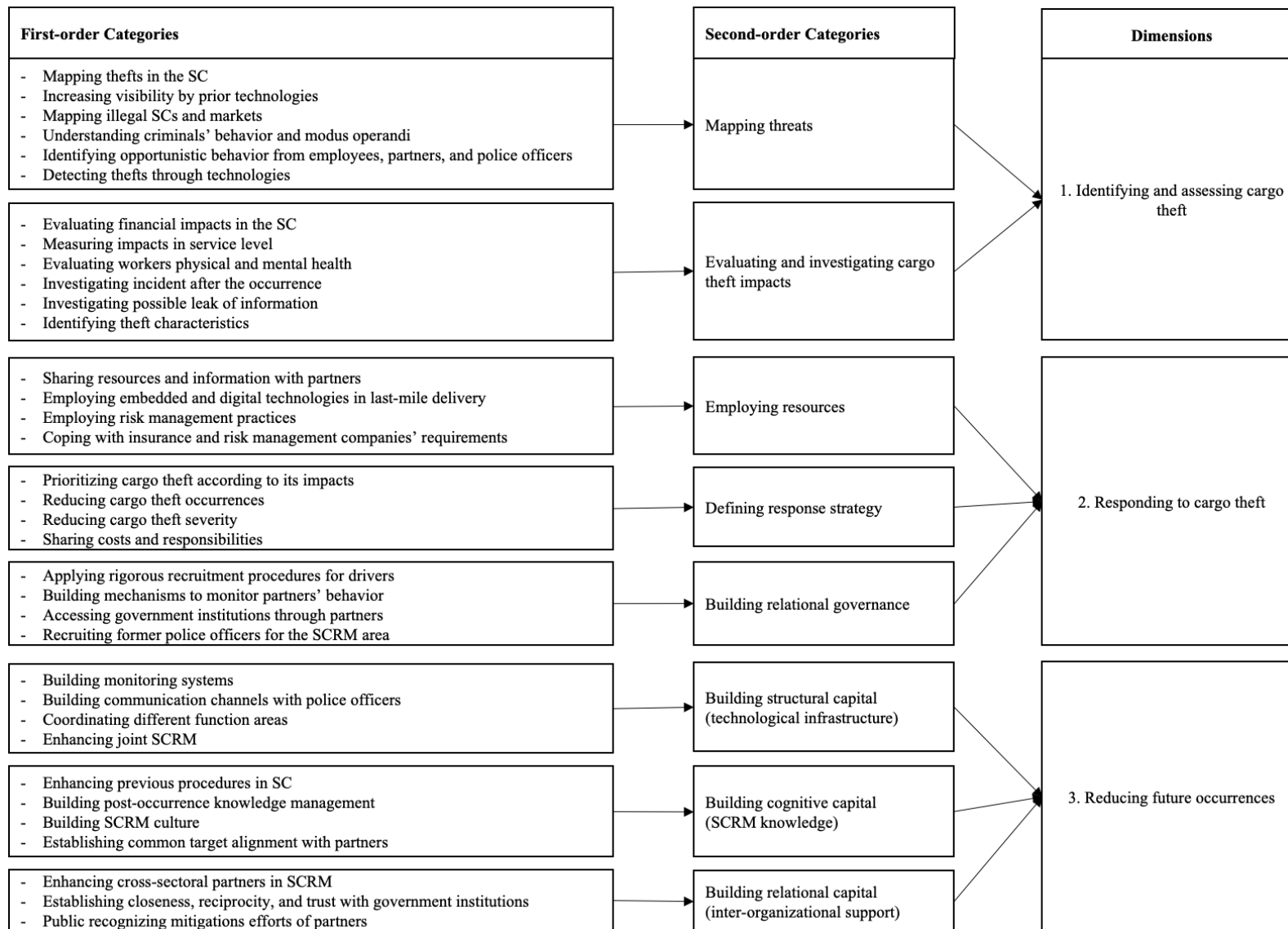


Figure 3.3. Data Structure

Response

The OSCM literature recognized different types of risk response, including acceptance, avoidance, transfer, sharing, and mitigation (Fan & Stevenson, 2018), presented in Table 3.7. We grouped the cases into reactive and proactive focus responses to cargo theft. The first group (AUTO1; AUTO2; ELTR1; FOOD2; PHRM1) comprises those companies where cargo theft had a lower impact based on occurrence and severity. Those companies focus on acceptance of theft outcomes, avoidance of high crime regions, transference, and sharing of their costs with their insurance companies, supply chain partners, or/and consumers. For example, although FOOD2 have few occurrences of cargo theft in its operations, it transfers cargo and assets losses through insurance: “in our case [threat of cargo theft] is not so critical. The financial loss ends up being the most critical [consequence of cargo theft]. The security [response] is through insurance” (FOOD2E3). On the other hand, ELTR1 develop a system that can block its cellphones, sharing costs to supply chain partners.

The second group (BEER1; BEER2; FOOD1; TOBC1) includes companies focusing on reducing the impact of cargo theft to an acceptable and controlled level, proactively improving resources and knowledge in their response plans. Our results suggest that companies that experience higher impact of cargo theft develop proactive risk responses, involving inter-organizational resources from partners and government institutions into a collaborative risk response. For example, TOBC1 experiences higher impact of cargo theft on service level, costs, and workers safety in a unique bad case scenario: “when you say that the tobacco industry has about 20% of cargo thefts [in Brazil], that’s 4,000 thefts per year [...] in [basically] two companies” (TOBC1E5). TOBC1 combined several proactive strategies in reducing the impact of cargo theft, which included properly checking criminal and financial backgrounds through external risk management consults, and information sharing with police stations specializing in cargo theft to dismantled criminal groups:

I collect information [about the theft] and send it on to someone from the intelligence are [of the police]. I send it and say that “We have an occurrence of cargo theft that day, [...] we identified that it was a silver Corolla with that plate number”. This policeman broadcasts this [information] on his network. Any police station receiving this information and go after it. [When] the police have this information, they go there and arrest [the criminals] (TOBC1E4*).

Table 3.7 - Reactive and Proactive Responses to Cargo Theft

	Reactive	Proactive
The case companies	AUTO1; AUTO2; ELTR1; FOOD2; PHRM1	BEER1; BEER2; FOOD1; TOBC1
Cargo theft impact <i>(Occurrence, severity, and safety)</i>	Lower impact	Higher impact
Risk responses ^a <i>(Primary adopted)</i>	Acceptance <i>Accepts the risk consequences</i> Avoidance <i>Seeks to eliminate risk triggers</i> Transfer <i>Assigns the consequences to another party</i> Sharing <i>Sharing some or all risks to another party</i>	Mitigation <i>Actively reduces risk to an acceptable level</i>
Inter-organizational relationship extent <i>(Direct relationships)</i>	SC partners Insurance companies ERMC	SC partners Insurance companies ERMC Regulative institutions
Social capital <i>(Directly or indirectly)</i>	Indirectly <i>Cross-sector partners relationships</i>	Directly <i>Communications channels</i> <i>Common target alignment</i> <i>Trust from past experiences</i>
Post-occurrence knowledge	Decisions' reevaluation Previous procedures definition	Decisions' reevaluation Previous procedures definition SCRM culture Monitoring unlawful behavior
Collaboration	Limited to commercial relationships	Those who possess resources in needed

Note. SC – Supply chain. ERMC – External risk management consultants.

^a Source: Adapted from Fan, Y., & Stevenson, M. (2018). A review of supply chain risk management: definition, theory, and research agenda. *International Journal of Physical Distribution & Logistics Management*, 48(3), 205-230.

Social capital plays an essential role in SCRM (Daghar et al., 2021) by mobilizing resources embedded in inter-organizational relationships (Nahapiet & Ghoshal, 1998). Because of its violent and criminal nature, cargo theft demands resources beyond companies' scope as an organization. For example, many of the case companies proactively investigate their cargo theft occurrences (BEER1; BEER2; FOOD1; TOBC1), gathering and analyzing data that can be used as evidence and lead to the arrest of criminal groups. Some companies relied on external risk companies and 3PL providers to do this (AUTO1; AUTO2; ELTR1; PHRM1, FOOD2):

“they [external risk management consultants] have statistical data on places where [more] robberies occur [...] Then they advise [where it is safer to transport our cargo]” (AUTO1E11). However, only government institutions have police power to legally fight back against these groups, which means that all companies will eventually need to follow this approach.

The case companies described that they understand that overburdened police officers have little time and technological resources to investigate cargo theft incidents properly:

We need to show that we are there [working with the police] to develop support work, investigation, gathering data and facts [...], and give help to the police, who often have 500, 1000 processes to analyze and they won't have time (BEER2E9).

However, police are very effective in arresting criminals. Thus, the case companies willing shared information collected by their digital and embedded devices that could be very useful in the police investigation. BEER1, BEER2, FOOD1, and TOBC1 go further by developing an intelligence function that investigates thefts in parallel with police investigations. They develop reports that precisely present individuals, vehicles, and group characteristics, recorded by cameras in a hijacked truck, GPS information showing cargo location during and after a theft, regions of higher risk, and other information. Thus, some of the companies established collaborative ties with police officers as part of their risk response, based on resource sharing.

Risk response should not relieve one threat and simultaneously makes room for additional supply chain vulnerabilities (Fan & Stevenson, 2018). Based on their higher cargo theft impact, some case companies (BEER1; BEER2; ELTR1; FOOD1; PHRM1; TOBC1) identified risk embedded in their relationships, such as the involvement of their employees, supply chain partners, and police officers in the attacks: “this situation is very delicate because, unfortunately, we know that there are good and bad people in all professions [talking about police officers]” (BEER2E9). In another perspective, police officers noted that a large portion of the investigated thefts were in fact fraud, some performed by drivers, as well other insurance fraud committed by small and medium-sized companies (PBSC2). As a result, inter-organizational relationships can be highly uncertain and low trust in environments with weak institutions.

The case companies developed mechanisms for identifying unlawful behaviors in their own employees, partners, and police officers, so they could select trustworthy partners for collaborative risk response. In this way, relational governance emerged as a set of mechanisms that allowed the companies to reduce opportunistic and illegal behaviors and lay the foundations

for the social capital building. The data suggests that those mechanisms are based on technologies, knowledge from cross-sector partners, and redesign SCRM procedures. Technology played an important role in their cargo theft response, increasing visibility in detecting and anticipating attacks. Tracking technologies allowed the companies to control their cargo and delivery systems in real time. Embedded assets generate data that can be used to identify the occurrence of a theft, unlawful behavior by employees and partners, map *modus operandi* of criminal groups, among other benefits. However, technology alone is not enough to respond to cargo theft; it must be part of a broader strategy that combines resources in a unique risk response: “The truck is tracked, but it is f* useless. [...] The criminal steals the truck and leaves it to the *favela*. How are we supposed to get the truck?” (BEER2E11).

Second, the case companies established relationships with cross-sector partners that had expertise in cargo theft, such as external risk management consultants, insurance companies, and 3PL providers. Those partners employ former police officers and have a large database of past occurrences. All nine cases rely on relationships with those partners seeking different objectives. For companies that employed a proactive response (BEER1; BEER2; FOOD1; TOBC1), those partners provided information and training to enhance their SCRM culture. Also, the partners take over fraud investigations that involve the companies’ employees, guarantying its compliance. For the others (AUTO1; AUTO2; ELTR1; FOOD2; PHRM1), those making a reactive response, the companies’ partners actively develop strategies based on their database, established SCRM practices, and intermediates the relationship with police stations. Therefore, the companies that made a reactive response usually promptly adopted the risk response suggest by their partners. On the other hand, those for whom cargo theft tended to work together with their partners, accommodating partners’ suggestions and expertise for their own strategy.

Last, companies reinforced their practice and strategy through post-occurrence knowledge management. For example, because their own drivers’ unlawful behavior is a threat to the proactive response companies, they have redesigned their employee recruitment process by properly checking criminal and financial backgrounds. This reduces the source of frauds and their impact (BEER1; BEER2; ELTR1; FOOD1; TOBC1). In sum, all these mechanisms, combined, reduced the environmental uncertainty and risk for the case companies, making room for the development of trust and social capital building. For example, TOBC1 mapped the police stations country wide. Because cargo theft is geographically concentrated in some regions of the country, TOBC1 engaged the specialized cargo theft stations from those high

crime regions. Those police officers are prone to establish partnerships with private companies because they have their own objectives in reducing cargo theft in their surroundings, receiving crucial data from them, and offering police power to dismantled criminal groups. The better results of that target alignment bring those partners closer over time, enhancing trust and social capital:

Generally, with police officers from stations specializing in cargo theft, opening [an investigation process] is much easier because they have their own goals and objectives. [They] want to compute for them [the positive result of the investigation]. So, there is no such problem [lack of interest from the public agent] (TOBC1E6).

I'll give you an example from Minas Gerais [a Brazilian state]. The official officer [from the station specializing in cargo theft] of Minas Gerais cargo is Dr. John [name hidden]. Moreover, for the whole state of Minas Gerais, then, it is natural that we relate [the fight against cargo theft] to Dr. John (TOBC1E6).

Reducing Future Occurrences

Cargo theft is a dynamic risk and therefore needs to be continuously monitored to continually improve the environment, including evaluating a company's existing technologies, SCRM practices, and inter-organizational support in their existing risk response. Post occurrence, the case companies developed their SCRM knowledge to better prepare for future occurrences. For example, TOBC1 realized that using armed escorts actually led to an escalation of violence, killing TOBC1's workers during confrontations with thieves: "in 2018, four [workers] died and 2 of them were [armed] escort agents" (TOBC1E6). To enhance its workers' safety, TOBC1 removed using armed escorts as strategy and, simultaneously, enhanced its use of embedded technologies, redesigned its last mile delivery system to reduce the amount of cargo per vehicle making it last-mile deliveries of tobacco products by motorbike, applied rigorous recruitment procedures for drivers, and reinforced its SCRM culture:

We did not simply remove the [armed] escort, there was a lot of work for the removal. We increased the requirements [for hiring a driver], engaged with our external stakeholders [police officers and cross-sector partners], and reduced the volume [of cargo in transit] (TOBC1E6).

Therefore, TOBC1 reconfigured its resources to develop a single strategy that spared lives, sustained its service level, and eliminated the cost of using armed escorts.

SCRM knowledge allowed the case companies to develop additional mechanisms to access information and resources from partners and government institutions, building social

capital over time. For example, BEER1, BEER2, FOOD1, and TOBC1 added communication channels such as mobile apps, expanded the access to police officers in specialized stations and access used third-party security teams. This decision built structural capital, allowing those companies to agile shared information about theft occurrences. These companies also aligned their targets in cargo theft reduction with officers from the stations focused on it in their surroundings. Targeted alignment built cognitive capital, as well as enhancing trust between companies and police stations at the organizational level, including the public recognizing and awarding those police stations that performed an excellent job (TOBC1). Thus, both TOBC1 and the police stations benefitted.

Although companies' employees and police officers worked together over time, there was still much suspicion about this to friendship emerging from these relationships: "It is not a relationship of having barbecue together, playing soccer..." (TOBC1E4*). However, they established closeness and reciprocity, raising relational capital and trust between them over time. Moreover, the case companies began monitoring unlawful behavior as an ongoing process following a cargo theft, continuously updating and reviewing whom they can trust. The case companies' managers were not concerned only with police officers, but they also investigated supply chain partners and employees if something suspicious happens. All these mechanisms combined, reduced environmental uncertainty and risk for the case companies, making room for building trust and social capital.

After years of updating and reviewing their collaborative risk responses, the case companies have become better positioned to anticipate cargo theft and reduce its occurrence and severity interns of cost, service level, and workers' safety. For example, the occurrence of cargo theft has increased in Brazil in the last years, reaching over 25 thousand occurrences in 2017 (TAPA, 2021). However, FOOD1 dropped its incidents from 400 thefts in 2000 to around 15 in 2020: "I wonder today if we hadn't done anything. Today, we would have more than a thousand cases [a day] because you imagine 8 thousand tons [transported per day]. We have absolute control over everything that happens [in our operations] (FOOD1E5)".

Moreover, the companies learned how to operate under the threat of cargo theft. Although TOBC1 was the most impacted company, it was able to maintain a high level of service level. ELTR1 developed a locking system to protect its cellphones against unlawful use, reducing the theft occurrences drastically. PHRM1 controlled the entire supply chain through a national system based on IoT technology. On the other hand, companies with a lower impact (AUTO1; AUTO2; FOOD2) relied on external risk management consultants and transferred

their cargo theft costs to insurance companies, supply chain partners, or/and consumers. Therefore, companies experiencing a significant impact of cargo theft followed different mitigation strategies than those experiencing a lower impact of cargo theft.

DISCUSSION

Past OSCM studies have considered cargo theft to be a contextually dependent threat to supply chains, highlighting the role played by the national environment (Ekwall & Lantz, 2018; Tong et al., 2019). Most prior research was conducted in developed countries in environments characterized by a low level of risk and solid institutional support (Ekwall & Lantz, 2016; Ekwall & Lantz, 2018). Our study examines cargo theft as a risk that emerges from weak institutions, analyzing it in a high-risk environment (TAPA, 2021).

Cargo theft in global supply chains (Ekwall & Lantz, 2018; Tong et al., 2019) results in cost increases, service level declines, and worker safety issues. Our results suggest that its occurrence and severity changes with the target product, how the theft is perpetrated, the criminal group that made the attack, and the location of the theft. Those aspects affect cargo theft which impacts supply chains and requires the development of risk response plans.

Prior SCRM studies have focused more on non-intentional threats (Fiksel et al., 2015; Schneier, 2019), such as natural disasters (Gou & Lam, 2019; Ye, Jiao & Yan, 2020), political instability (Roscoe, Skipworth, Aktas & Habib, 2020), economic crises, and the COVID-19 pandemic (Ivanov, 2020) that are exogenous to a supply chain (Fiksel et al., 2015; Schneier, 2019). Given cargo theft's intentional nature, we need to understand how this type of crime works, to design an adequate response. Our results point to the direct connection between cargo theft and other types of crimes, such as counterfeiting, smuggling, drug dealing, extortion, and fraud. Fraud is particularly challenging for companies, affecting trust and collaborative risk responses.

When the cargo theft happens through frauds, employees, supply chain partners, and government officers promoted or participated in the theft, seeking easy gain. Police officers identified a high rate of fraud promoted by employees or small medium-sized companies in their investigation. Although prior studies recommend joint efforts in SCRM (Durach & Machuca, 2018; Friday et al., 2018), mutual trust is fundamental to establishing a collaborative risk response (Bonatto et al., 2020; Daghar, et al., 2021). As most prior researchers conducted their cargo theft studies in developed country contexts (Ekwall & Lantz, 2016; Ekwall & Lantz,

2018), they did not consider how weak institutional support affects inter-organizational relationships (Daghar et al., 2021; Fan & Stevenson, 2018). Our findings suggest that institutions played a dual role in cargo theft. They are both a source of risk that emerged from their ineffectiveness in applying police protection and legal power, and a source of support for relational capable companies that learn to work with them.

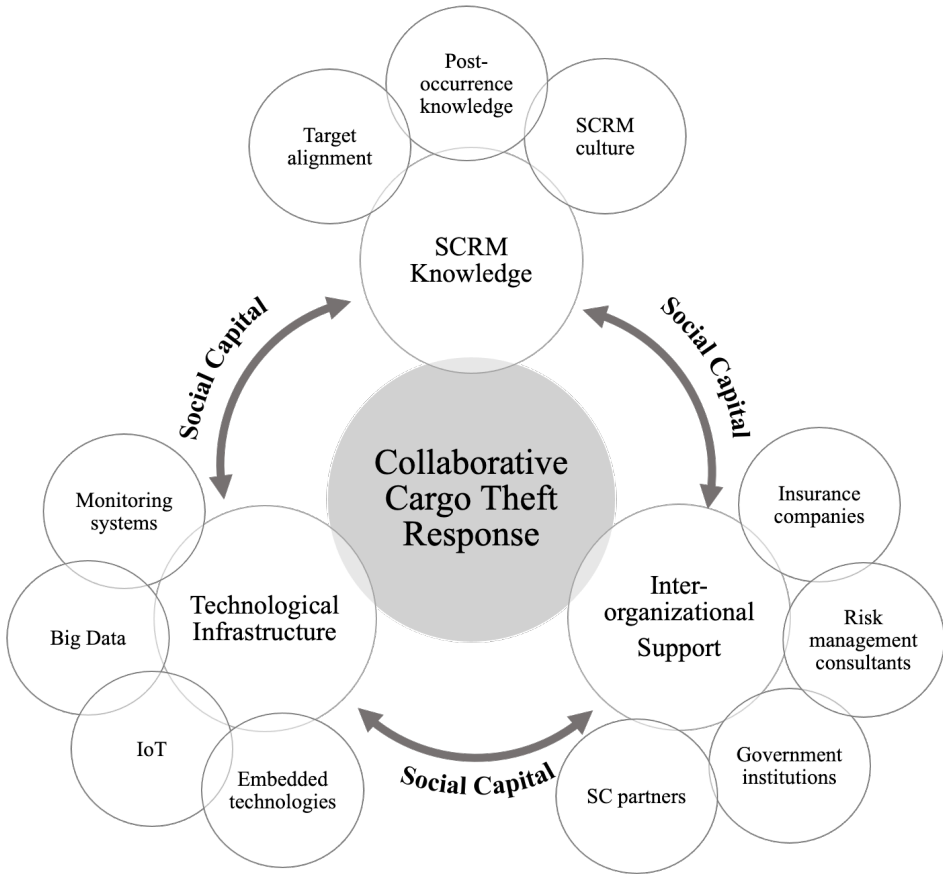


Figure 3.4. Collaborative Cargo Theft Response

That case companies experiencing a greater impact of cargo theft broadly identified unlawful behavior of employees, partners, and police officers. Because contributing the black market quickly absorbed their products, they felt a sense of impunity. Thus, such behavior is supported by weak institutions. On the other hand, unlawful employees, partners, and police behavior is less likely for companies where cargo theft has a lower impact (Laequddin et al., 2009). A high-risk environment presents a dual challenge for companies. It affects them by its actual impact and it reduces the trust in their partners for future collaborative responses (Bonatto et al., 2020; Daghar et al., 2021; Lima et al., 2018). Thus, we establish the following proposition:

Proposition 3.1. The lower the trust, a lower collaborative risk response

Although the absence of formal institutions supports unlawful behavior and reduces companies' trust in their collaborators, the response to cargo theft demands resources beyond companies' scope, due to its violent nature. While companies need to access resources from partners and government institutions to reduce their cargo theft risks, they do not trust them enough to openly share their information with them, establish joint efforts, or sustain collaboration over time (Collier & Sarkis, 2021; Fawcett et al., 2012).

Our results suggest that those companies focusing on proactive responses developed relational governance mechanisms to identify unlawful behaviors by their employees, supply chain partners, and police officers. Those mechanisms combine technologies, SCRM knowledge, and inter-organizational support to allow the companies to select individuals whom they can trust in the long term (Figure 3.4). This combination was associated with a reduced risk of cargo theft, making room for building social capital from collaborative risk responses (Bonatto et al., 2020; Dyer & Singh, 1998; Kreye, 2017). Thus, we established the following propositions:

Proposition 3.2. Higher relational governance is associated with an increase in social capital building, in an environment characterized by distrustfulness

Proposition 3.3. Higher social capital is associated with a more proactive response to cargo theft

Companies learn from past cargo theft occurrences (Mital et al., 2018; Singh & Singh, 2018), increasing their institutional memory (Quang & Hara, 2018). Cargo theft demands continuous monitoring to anticipate possible changes in the environment, evaluate risk response results, and develop additional mechanisms for preventing future occurrences, such as new technologies, reconfigured practices, and closer support from inter-organizational relationships. Fan and Stevenson's (2018) systematic literature review found out that only ten of 354 SCRM papers paid attention to risk monitoring. Some of those papers considered it as a risk assessment task, in other words, a re-assessment in an endless circle of risk (Blackhurst, Scheibe & Johnson, 2008). Our findings suggest cargo theft occurrence led to post-occurrence knowledge occurrence, improving SCRM knowledge over time.

After years of updating and reviewing their collaborative cargo theft response, the case companies were able to better anticipate, respond, and overcome this threat (Mital et al., 2018; Singh & Singh, 2018; Yang et al., 2021), to reduce their cargo theft impact on cost, service levels, and worker safety. In other words, companies learned how to operate under the threat of cargo theft, reducing its impacts on their business. Unlike understanding SCRM as an endless circle of risk assessment and response, we found that knowledge led the case companies to a superior position to fight back against cargo theft over time. Therefore, we should consider the SCRM process as a positive spiral where the company reduce future occurrences. Thus, we establish our last proposition:

Proposition 3.4. A higher collaborative risk response is associated with a reduction of future occurrences

CONCLUSION

The OSCM literature is still in the early stages of understand its institutional influences, compared to the organizational studies and international business fields. Past OSCM studies have shown that weak institutions affect companies in several ways, resulting in different consequences for supply chains than strong institutions do (Annala et al., 2019; Spring et al., 2017; Turkulainen et al., 2017; Wang et al., 2016; Wu & Jia, 2018). However, researchers should not characterize weak institutions only for their harmful effects, but should also considering their potential support of weak institutions for companies that know work with their inherent lack of trust. Our multiple case study contributes to the OSCM field by addressing four gaps.

First, our research highlights the dual role of institutions as both a source of external risk and inter-organizational support to supply chains. By analyzing companies in embedded high-risk environments, we expand the understanding of cargo theft as a threat that emerges from weak regulative institutions, especially those with police protection and legal power. Companies need to learn how to work with regulative institutions in cargo theft response, since the violent nature of this risk demands capabilities that companies do not possess.

This leads to our second contribution: we proposed that companies rely on inter-organizational relationships to respond to external and intentional threats. They employ their existing ties in their supply chains, aggregating regulative institutions and cross-sector partners such as risk management and insurance companies developing in a collaborative risk response.

However, the absence and weakness of institutions nurture opportunistic and unlawful behaviors, reducing trust and, consequently, reducing social capital.

Third, our findings reveal that cargo theft is perpetrated by different criminal groups, including employees, supply chain partners, and police officers. We contribute to the OSCM literature by expanding the understanding of relational governance in a context of non-commercial relationships, highlighting target alignment between supply chains and government institutions as an essential factor in the reduction of common threats.

Last, we found that companies learn from past occurrences of cargo theft and collaborative risk response, anticipating and better responding to future incidents. This SCRM knowledge led them to reduce cargo theft occurrence and severity and improve worker safety over time.

Managerial Implications

Our study has clear managerial implications. We highlighted the threat of cargo theft as an intentional attack to supply chains, presenting a more accurate picture of this phenomenon. Managers have to consider the importance of relational governance to risk response in environments characterized by weak institutions and distrustfulness. We encourage managers to develop relational governance mechanisms, improving trust in their relationships with other agents in the environment.

Although the current understanding of inter-organizational relationships exists within supply chain boundaries, managers should enhance social capital with non-commercial organizations, such as regulative institutions. From those inter-organizational relationships, they can access resources needed for responding to cargo theft effectively. Since distrustfulness is embedded in an environment characterized by weak institutions, managers should focus on developing mechanisms that provide unlawful behavior monitoring and target alignment with partners.

Limitations and Future Research Directions

Our study has limitations that suggest the direction for future research. Our research highlighted collaborative responses to common threats, including supply chain partners, cross-sector organizations, and regulative institutions. However, our results described little effort to

enhance competitors in this collaborative inter-organizational response. It would be interesting to understand in what contexts they are more prone to collaborate, analyzing different external threats.

We selected cases of domestic Brazilian companies or multinational companies that have operated in the Brazilian environment for decades. Those companies have had experience reconfiguring their resources for a high-risk environment over many years. However, it still is unclear how new entrants reconfigure their original resources to respond to cargo theft in a high-risk environment. Also, it would be interesting to analyze small and medium-sized companies, whose lack of resources and technologies could lead to different strategies in an environment characterized by high risk for cargo theft. These non-answered gaps could be explored in future related research.

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Appendices Three

Appendix 3A - Research protocol

Research proposal

This research aims to understand how companies respond to cargo theft under weak institutions, employing relational governance to build social capital in distrusting inter-organizational relationships.

Research questions

- (RQ1) How do companies respond to cargo theft in a weak institutional environment?
- (RQ2) How do companies adopt relational governance mechanisms to build social capital under distrustfulness?

Theoretical bases of the research

- Institutional theory
- SCRM concept
- Social capital theory
- Relational governance concept

Selection of cases

The main criteria for the selection of companies were:

- Companies that operate in a high uncertainty institutional environment (Brazil)
- Companies from industries affected by cargo theft
- Leaders in the national market, and the top five of the largest producers in each industry
- Cases based on different levels of product value and cargo theft impact

Data collection

- Interviews with managers recorded and transcribed
- At least five interviews in each case

Data Analysis

- Definition of codes in an open way through the technique of content analysis
- Analysis based on within-case and cross-case analysis

Semi-structured Questionnaires

Introduction (applied in both stages)

Full name

Position

Respondent (code)

Company (code)

The interviewee's history in the firm

Exploratory Stage (applied between 2017 and 2018)

Institutional aspects

- How does labor legislation affect the competitiveness of the firm? Is there a risk to trade unions?
- Is there any risk of tax regulation?
- How are industry legislations defined? Does the firm have an active voice in this definition?
- Has there been any change in your operations to deal with crime?
- How does the issue of infrastructure affect your operations?

Cargo Theft Stage (applied between July and November 2020)

Risk identification

1. Where does cargo theft risk occurs in our supply chain? In which step in the supply chain is more frequent?

(Type of product/material most vulnerable, impacted function, production steps where it occurs most - distribution within facilities or supply to distribution centers)

2. How is this risk assessed and analyzed?

(Identify the frequency of occurrence, the severity of the impact, and the ability to detect and prevent)

3. Your company owns the truck? Does it affect safety precautions?

(Identify if the ownership is a factor that helps to prevent the risk. Identify if the 3PL have resources to mitigate cargo theft – big truck companies vs. small/individual drivers)

Risk response

4. How your company responds to cargo theft? How your company prevents this risk?

(Identify what are actions to mitigate cargo theft, its advantages, and limitations)

5. When it does occur, what your company does to minimize the impact of cargo theft?

(Identify if the supply chain is resilient after occurrences. Checking for learning after the occurrence – monitoring process)

Adaptation of technologies

6. Do you adopt any technology to detect or prevent this risk? Did you adapt any current technology (trucks routing) to detect or prevent cargo theft?

(Identify the technologies used to avoid cargo theft, if these new technologies or old technologies adapted, its advantages and limitations)

Adaptation of practices

7. Did you adapt any practices in distribution to detect or prevent cargo thefts? And how do you adapt your security practices?

(Identify if there was a change in trucks routing, cargo consolidation process, instructions for drivers, safety mechanisms)

Supply chain relationship

8. Did your company involves supply chain partners in managing this risk? Before or after the incident? Do you use partners who have expertise in experience in the highest theft rate regions? How do they select them? Do they have connections with the local community?

(Understand how partners in the chain help to avoid this risk. Is there insurance or other ways of sharing this risk with partners (suppliers or customers)? Was there a search for local partners?)

Relationship with institutions

9. How do industry associations help your company to mitigate this risk? How do public institutions help your company mitigating this risk?

(Technical support? Exchange of information? Public policies?)

Closing the interview

10. To continue this research, could you suggest a colleague to be interview?

(Seek to snowball the sample)

Appendix 3B - Representative informant quotes underlying second-order categories

Dimension 1: Cargo theft awareness and assessment	
Mapping vulnerabilities	<p><i>We have cargo theft for some specific auto parts. The truck that transports for us is required [by the insurance company] to have security [armed escort] (AUTO2E3).</i></p> <p><i>[Cargo theft happens] during transportation and in facilities. Most frequent during transport (ELTR1E4).</i></p> <p><i>All trucks are tracked. [...] All trucks have a panic button and two types of track systems. Things like that to prevent it [cargo theft] (BEER1E2).</i></p> <p><i>We know that Rio de Janeiro, and the surrounding region, have a very high crime rate. The product is stolen to finance the traffic. So, [its profits] buy arms, buy drugs. Our product is very volatile [easy to sell in the black market] and it finances the crime (TOBC1E1*).</i></p> <p><i>The funny thing is that much of what is stolen, which is brought into the communities [favelas], it is not sold to [people of] the community most of the time. It is outsiders [people who live in wealthy regions] who come to buy. Therefore, it is a product that is sold in certain retailer. Some owners become corrupted and come to buy [the stolen products] to have a higher profit margin (FOOD2E4).</i></p> <p><i>So, it is a sensitive product of ours, caps and labels, because there is an attempt to steal [for counterfeiting]. If they steal, for example, a whole container of labels, you have enough to run an illegal brewery for one year (BEER1E9).</i></p> <p><i>Organized crime in Rio de Janeiro is more drug-oriented [business]. So, cargo theft is usually not a primary activity. It is an activity to get a bigger volume of [free] beer, [to have] party, or move the neighborhood economy. However, it is not a primary business. In Sao Paulo, I see a most institutionalized crime. Cargo theft as the primary objective [of the gangs]. [...] They have more robust distribution structures; they have their own trucks to distribute the [stolen] product. So, I see it differently. Despite [cargo theft] are being a less violent crime in São Paulo (BEER1E9).</i></p> <p><i>So, when we take over the cargo police station, we imagine that 50% of the cargo stolen [was fraud]. [...] And today, we are sure that this reaches 90% (PBSC2).</i></p> <p><i>Almost 60% of driver dismissals are involved with cargo theft during the pandemic (TOBC1E1*).</i></p>

Dimension 1: Cargo theft awareness and assessment

Evaluating and investigating cargo theft impacts

Pharmaceutical companies prefer to have their own distribution insurance instead of using that provided by the third-party logistics, which ends up being more expensive because of taxes. In the end, it is the laboratory that ends up bearing the impact of thefts (PHRM1E2).

To incur a cost because of that [cargo theft] because I must put another truck there at the supplier so that he can come expressly to the factory so that I don't have a line stop. Usually, we work with 1 or 2 days of stock (AUTO1E3).

Companies turn their backs on problems [cargo theft] because, in the end, they manage to pass on [costs to consumers] (FOOD1E5).

In Rio de Janeiro, the time [of cargo handling] is longer than the rest of Brazil. Because my truck, even after loaded and ready to go, stays in my yard waiting for the escort. In Rio de Janeiro, I always go escorted, and this is an expensive tool, but in Rio de Janeiro, it is necessary (BEER1E1).*

Thank God, since 2018, we have had no deaths in the operation (TOBC1E6).

The kidnapping of drivers in front of my brewery impacts the business in several ways (BEER1E9).

Today, most of the problems we have are with shooting. Two years ago, we had eight deaths. Last year, we only had 1, unfortunately... (TOBC1E4).

I never liked [the use of armed escorts]. Even when I worked at BEER1 I was always against it. Until the day the guy from the armed escort with the exchange of fire died (BEER2E11).

Now, in the pandemic, our turnover of drivers for enticement as accident situations [cargo theft] has reached almost 60%. I had almost 60% driver dismissal for alleged involvement in crime and cigarette theft during the pandemic (TOBC1E1).*

The criminal organizations end up [stealing] the drugs, including using the packaging to give other directions [counterfeiting] (PHRM1E5).

Dimension 2: Responding to cargo theft

Employing resources

Usually, not. It is usually a one-way street. Usually, the company provides this data [information about theft] that we were able to collect and develop, and we provide it concerning a specific case (BEER2E9).

Typically, the Brazilian police [...] do not usually reach the gang. However, with us helping, giving a license plate that was stopped near [the crime scene], the moment, the places of higher occurrence... Providing these more specific data, directing their investigation. They have been more effective (BEER1E9).

When we remove the armed escort, we had to include other assets such as better locks on the vehicles, reinforced steel doors that people do not break into the truck, audible alarm, fuel lock... (TOBC1E5).

We installed cameras, change routes, [controlled by] GPS... (AUTO1E8).

However, I usually say that the best way is preventive. It is precisely that you work hard on the routing [of deliveries]. You work with security instructions for the teams. Usually, we approach this every morning, passing the training to the teams as they should proceed. How should they walk, what actions will they take in some occurrence [theft]. That's usually how I prefer to work; that's how I reaped most of the results during my professional life (BEER2E9).

BEERI stipulated several rules for us to work together with our partners, security management. They say that they must be like our employees, enter the company, attend training, have a checklist, that they have to do everything. Only today is not followed (BEER1E5).

Companies that provide risk management services [...] end up determining which routes are most at risk, which alternative routes, and which need to be avoided (PHRM1E2).

We have companies that advise us on risk management, always bringing news [...] and technology suppliers stimulating with something new for us. We have all this engagement, and it is necessary; it is worth mentioning that (TOBC1E4).*

Defining response strategy

Also, a logistical loss occurs when cargo is stolen. We must do the planning again, load the truck to go out again for distribution. There is a waste of time, effort, money, fuel for you to attend to this. There is the financial part [of the impact] the stolen cargo is lost. We do not have insurance for the cargo and even if there were any, there would be a financial loss to pay for the insurance (TOBC1E5).

Some regions are more critical. Rio de Janeiro is the most critical today. Cargo theft has reduced in the last year but had an index of 2 trucks a day stolen in Rio de Janeiro 6 years ago. When we had a distribution center [in Rio de Janeiro], the truck practically left and was stolen (FOOD2E5).

Dimension 2: Responding to cargo theft

These are specific regions that we are now taking action to reduce theft rate so high in these locations (TOBC1E1).*

You reduce “loss”. The only thing that the person will do with this cell phone is to sell components [after the company blocks the stolen cargo], because selling for use is no longer possible. After this system, we noticed a significant reduction in the number of thefts because they are no longer used as much as they would have been before (ELTR1E2).

Furthermore, risk management consultants suggested that we were paying a high price for the [armed] escort and was not having the effect it needed. Then, the partner himself offered the service of making an electronic bait [to track the stolen cargo] (AUTO1E11).

In the robberies of 2017 and 2018, all the deaths we had [...] were due to armed escorts. From the moment we removed the armed escort, the mortality of our operation began to zero (AUTO1E6).

Who “shares” the risk [with us] is the government [...] The payment of the cigarette taxes is in the production and not in the sale (TOBC1E5).

We shared data [on theft] with the insurance company. Naturally, we end up having contact, but the information comes from the security companies (PHRM1E5).

Building relational governance

The first thing is to control the hiring. [...] In Rio, the first thing I did was to raise everyone who had problems with cargo theft, drivers and helpers [...] We started to map the risk per employee, how many times he was involved with cargo theft (BEER2E11).

The only thing that can help us is that we have a camera system, facial and behavioral recognition of the driver. For example, if cargo theft occurs, we can enter the system [and analyze the information collected] (BEER1E1).*

AUTO1 is bureaucratic [compliance] to regulate this operations part [after the theft], working with the police to catch the bad guys, trying to rescue the cargo, the [external risk management consultant] does. I met some people from this company a while ago, right when we closed the contract with them. They are ex-police, mostly military (AUTO1E11).

We only have contact with this [risk management] company that provides consultancy in terms of security. If they have any official contact [with the police], I don't know. I know that obviously, they are in contact, but officially what we have is their consultancy. We, like FOOD2, have no contact [with the police] (FOOD2E2).

Dimension 2: Responding to cargo theft

There are some regional managers; many of them have already worked in armies, police, and everything. They make a historical mapping either by TOBC1 itself or even national public sources of cargo theft to determine which areas are at risk (TOBC1E2).

So, today we suffer a lot from cargo theft. We have a risk team with people who have already participated in the intelligence of the Military Police of the state of São Paulo (BEER1E9).

The sale of cigarettes is beneficial for retailers because, together with cigarettes, they can resell other products, they can call customers and they can boost their trade itself. We know that cigarettes are not profitable for retailers as in a bakery, convenience store, bar, or pub. So, we know that his profit margin is not high [...] Only, that we end up having a problem with driver enticement and these guys [retailers that sell stolen cigarettes] illicitly earn from it and you end up having a level of very high claim (TOBC1E1).*

Suppliers are involved when there are repetitions. However, the precaution of maintaining confidentiality is due to cases where the cargo information comes from the dispatch operator (AUTO1E3).*

Dimension 3: Reducing Future Occurrences

Building structural capital (Technological infrastructure)

We distribute, share, we hand over to the police and there they do the reading. Some companies [...] have contact with intelligence [of the police], take information, deliver information, send by WhatsApp, take a photo [...] In the best possible way, we deliver the report [containing the theft information] we take the receipt stamp, dated, we store this document ensuring distribution. We do everything over the top (TOBC1E5).

Intelligence time does the investigation at TOBC1. Moreover, there is the prevention time who do the procedures of the process. Besides, a psychologist and a criminal lawyer monitor the entire process (TOBC1E6).

At FOOD1, we have autonomy, although my boss is in the supply chain. I have full autonomy to interrupt an operation in his area because my main objective is safety [...] We select carriers together with [the purchasing team]. The [shopping] guy says: "but this transporter has the best price", [and I say:] "but this one won't, it won't because he undergoes a security analysis". So, we must evaluate all of this. This is well-established governance (FOOD1E5).

Rio de Janeiro was not a problem for FOOD1 and the market in general. In 2017, there was a migration of traffic to cargo theft. Cargo theft was one of the easiest crimes for those who practice it because the driver is totally helpless, does not have many resources, takes

Dimension 3: Reducing Future Occurrences

him to the community, unloads the cargo, and releases the driver. [...] It is a disease that has no cure. What we do here is to medicate. We have no solution for the problem [...] (FOOD1E5).

There was an increase in demand for cigarettes because of the reduction in Paraguayan [smuggled] cigarettes because of the border closure. The numbers are approximate; there may be some tithes there. Until last year, 60% of the market was illegal, of the Paraguayan cigarette [smuggled]. With the Frontier issue, that number dropped overnight to 50% of the legal cigarette consumption [...] The demand for the legal cigarette increased, and, on the other hand, the criminal needs to supply his market anyway, so they migrated from smuggling to cargo theft (TOBC1E6).

We have several fleet monitoring systems, including internal transport, between the distribution center and factory, and between factories. [Approximately] 90% of our shipments are made with the fleet itself. Our fleet is tracked and has a security system that you keep watching if the driver stops in places that he cannot. [...] The fleet trucks have a camera in the cabin. So, we can understand everything that will happen inside, so this type of theft is more difficult (BEER1E1).*

[...] We know internally that many retailers are colluding with theft. So, there are also internal investigations to verify which retailers are colluding with this type of claim. [...] So, this reception by the retailers is also investigated in the security area of TOBC1 and local authorities (TOBC1E1).*

So, he [large distributor] ends up taking advantage of stolen goods, buying stolen goods at a better price. As a result, he has no way to prove the purchase [of the stolen goods] (BEER2E8).

You must walk on thin ice. You have a whole limbo between the institutional and the informal. It has all these precautions of a multinational company based on compliance rules. So, we must narrow this down very well. We know that there are gangs that work with the support of the police (TOBC1E4).*

We had a problem [of policemen involved in cargo theft] in another state with their own delegate ... [...] The cargo theft officer himself stole cargo. Then, we did an investigation there, and he was like, "but FOOD1E6, how did you find this load so fast?", And he said, "it's none of your business, sorry, go and get it [back]". Because? Because we couldn't, we couldn't, and we can't trust the police (FOOD1E5).

Building cognitive capital
(SCRM knowledge)

Generally, with the staff of specialized police stations, opening [an investigation process] is much easier because they have their own goals and objectives. [They] want to compute for them [the positive result of the investigation]. So, there is not much of this problem [lack of interest from the public agent] (TOBC1E6).

Dimension 3: Reducing Future Occurrences

We always try to be close to the specialized police stations, especially the theft and cargo theft stations, which are the main ones involved in this process. Moreover, in a way, when we arrive with the work done ethically, we are usually well received wherever we go (BEER2E9).

We removed all armed escorts; our operation has nothing left. [...] What happens is that the biggest reason was primarily people's lives. People ended up dying. It does not matter whether they are outsourced or self-employed. It doesn't matter; they are people (TOBC1E5).

Veiled escort is when a motorcycle or car follows the truck as if it were an ordinary car. [...] This is used because it is cheaper and does not characterize that you are being escorted (ELTR1E3).

*So, there is a procedure that every transport supplier that works for TOBC1 must follow, risk every item (TOBC1E1 *).*

The pharmaceutical sector controls everything because it is a sector that has a very strategic sales force. [...] Is there a control to minimize theft? It exists, but their control is to be efficient in what they do (PHRM1E6).

So, today we suffer a lot from cargo theft. We have a risk team with people who have already participated in the intelligence of the military police of the state of São Paulo. There is a group that works towards this. They look at the heritage part, so they look at [both] cargo theft and plant invasions at distribution centers (BEER1E9).

Safety. It's over [the discussion]. [...] is the change in value. We demonstrate through facts and consequences and a lot of work that resolves [the balance between service level and security]. Then, everyone joins. When FOOD1E6 or I am going to discuss anything with any company area, they understand this difference because otherwise, I say, "when I'm in chaos, don't call me" (FOOD1E5).

Building relational capital
(Inter-organizational support)

I'll give you an example from Minas Gerais [the Brazilian state], the official [from the theft police station] of Minas Gerais cargo is Dr. João [name hidden]. Moreover, for the whole state of Minas Gerais, then, it is natural that we relate to the name of Dr. João [the fight against cargo theft in Minas Gerais] (TOBC1E6).

So, these [security] areas started at the first moment to establish a relationship with a public agency, with the police commander himself, trying to strengthen the relationship. So, this narrowing of the relationship was to guarantee security in certain regions [of the high occurrence of cargo theft] at the first moment. Then, you develop this relationship without an exchange of [personal] favors. It was much more to strengthen the relationship even [between the company and the public body] (BEER2E11).

Dimension 3: Reducing Future Occurrences

I was just informed yesterday that TOBC1 is making a letter of thanks to the [hidden] state through the police station [specializing in theft] cargoes because of a historic [reduction in theft in the state] (PBSC2).

The most stolen cargo in the whole of Brazil is cigarettes. The biggest victim in South America, if not in the world, is TOBC1. [...] We agreed with him in which every robbery they have given us all the information [about the incident] (PBSC2).

So, if we have an accident or theft, it [external risk management consultant] is immediately triggered. In these high-risk flows, it also managed the [armed] sheet. When would be escorted, it organized what time the security guard wanted to get there with the truck. It architected this with us (AUTO1E11).

*Does BEER1 share information with BEER2 regarding risks? It shares, but it is not something profound ... It is very similar to a football team. I support a team; will I exchange information with the opponent? [I do], but I go to that limit. To some extent, I will teach how I manage; after that, I want him to f *. This is how it works (BEER2E11).*

[...] this relationship with the [police] authorities, especially those specialized in cargo theft, created WhatsApp groups. So, technology also helps us to streamline the internal process, for example, and a good relationship with the [police station] delegate who specializes in cargo theft. [...] This group is composed of authorities, private initiative, risk managers. So, there is a relationship. Technology also helps us in that sense; some actions are done with specialized [police stations] through WhatsApp groups shorten the path. Anyway, it brings a good result (FOOD1E6).

4. CHAPTER FOUR – THIRD ESSAY

Help Yourself by Helping Others:

Building Collective Resilience through Social Capital

ABSTRACT

Purpose: Our study aims to understand how supply chains employed social capital to build resilience during the Coronavirus pandemic.

Design/methodology/approach: We conducted a multiple case study with nine companies from different industries in Brazil: automotive, beverage, electronics, food, pharmaceuticals, and tobacco. The case selection was based on their dependence on global suppliers and how essential their products were during the pandemic.

Findings: Our findings suggest that companies relied on their social capital to compensate for their lack of prior disruption knowledge or strategy during the pandemic, establishing relationships within and beyond their supply chain boundaries to access resources for resilience. These relationships allowed them to anticipate threats, developed early protection, and collectively respond and recover quickly. Because of the pandemic was long-term and widespread, with a growing socio-economic impact, we specifically highlight the engagement of the case companies in disaster relief efforts as part of their supply chain resilience processes, reducing the virus spread and leading to a more stable environment for their operations.

Originality: We contribute to the OSCM field by fleshing out the concept of “collective supply chain resilience” to help understand resilience in this type of disruption.

Research limitations/implications: The sample cases were almost all companies embedded in global manufacturing networks, except for one focused only on the domestic market. It would be interesting to compare a broader set of cases. Future studies can also explore if social capital built during the pandemic will be continue be used in other future disruptions or to take advantage of business opportunities.

Keywords

Supply Chain Resilience; Collective Resilience; Social Capital; Disaster relief.

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*We do not include those who work in the selected companies.

INTRODUCTION

*We repaired 1000 ventilators in 1, 2 months [to equip hospitals] [...].
The faster we can equip hospitals, the faster we can relieve [the pandemic effects and operate again]
That's why most automakers joined quickly [in the network]
(Automaker manager – AUTO2E1*).*

In “The Masque of the Red Death”, Edgar Allan Poe (1842) tells of Prince Prospero’s efforts to avoid a deadly plague by hiding in his abbey along with the wealthy and privileged members of his society. However, during one of many festivities, an enigmatic guest masked as the plague itself walked silently in each room during the ball. The host and his guests realized too late that the death they attempted to avoid by leaving their subjects behind was already there. Poe's tale suggests that isolating yourself from someone else’s problems is not a good policy during a pandemic. On March 11, 2020, the World Health Organization [WHO] declared the Coronavirus [COVID-19] diseases to be a global pandemic, with significant damaging effects on society and global supply chains (Dolgui, Ivanov & Sokolov, 2020; Glynn, 2021; Handfield, Graham & Burns, 2020; Hoek, 2020; Ivanov & Dolgui, 2020).

The COVID-19 pandemic affected the global economy and society and tested our understanding of supply chain resilience (Choi, Rogers & Vakil, 2020; Queiroz, Ivanov, Dolgui & Wamba, 2020; Singh, Kumar, Panchal & Tiwari, 2020). While the operations and supply chain management [OSCM] literature has investigated resilience in external catastrophic events, including natural disasters (Gou & Lam, 2019; Ye, Jiao & Yan, 2020), fuel crises (Scholten, Scott & Fynes, 2014), political turbulence (Roscoe, Skipworth, Aktas & Habib, 2020), diseases outbreaks (Büyüktaktın, des-Bordes & Kılış, 2018; Parvin, Beygi, Helm, Larson & Van Oyen, 2018), and terrorism (Scholten, Scott & Fynes, 2014), the unprecedented disruptive impact of COVID-19 still remain uncharted (Craighead, Ketchen & Darby, 2020; Gunessee & Subramanian, 2020; Hoek, 2020; Ivanov, 2020; Ivanov & Dolgui, 2020). Unlike more typical supply chain disruptions, COVID-19 shook global supply chains for the long term, increasing its impact over time, and spreading to every continent (Handfield et al., 2020; Hoek, 2020; Ivanov & Dolgui, 2020; Moritz, 2020). Therefore, the COVID-19 pandemic provides an opportunity for OSCM researchers to advance supply chain resilience research and practice in the context of a unique disaster (Handfield et al., 2020; Hoek, 2020; Ivanov, 2020).

Supply chain resilience is an adaptive process involving preparation for unforeseen events, integrated responses by supply chain partners, and recovery of operations to a stable situation (Ali & Golgeci, 2019; Piprani, Jaafar & Ali, 2020; Ponomarov & Holcomb, 2009). However, the unique characteristics of COVID-19 led companies to collaborate with different organizations beyond their supply chains, including cross-sector organizations, competitors, government institutions, and non-governmental organizations [NGOs] (Lawton, Dorobantu, Rajwani & Sun, 2020). This collaboration led Glynn (2021) to coin the term “collective resilience” to explain the joint social effort to contain the spread of the disease spread and return the entire environment to a more stable situation for all.

The OSCM literature has long recognized that supply chains could use their pre-existing networks to boost response and recovery through collaboration (Johnson, Elliott & Drake, 2013; Piprani et al., 2020). Embedded in relationships, social capital can reshape companies’ access to needed resources, mobilize their efforts to pursue shared goals, influence institutions, and build future business opportunities (Johnson et al., 2013; Nahapiet & Ghoshal, 1998). However, little attention has been given to how social capital networks can build knowledge from prior disruptions, access needed resources from organizations outside the supply chain, and engage buying companies in working jointly in disaster relief efforts. Also, the efforts focused on aid to society need to be understood from a supply chain resilience perspective, recognizing them as part of a company’s resilience efforts. Therefore, understanding how supply chains incorporate disaster relief into their recovery process is important for future disruptions.

The following questions guided this study: *(RQ1) How do companies employ their social capital to build supply chain resilience in a pandemic context? (RQ2) How do companies employ disaster relief as part of their supply chain resilience process?* Thus, this research aims to understand how supply chains employ social capital to build resilience, addressing how they enhanced relationships within and beyond their supply chains during the COVID-19 pandemic. Also, we aim to understand how companies enhanced disaster relief as part of their own supply chain resilience processes.

We followed a multiple case study approach to address those questions (Eisenhardt, 1989). Using case studies is appropriate because the pandemic phenomenon still requires a deep understanding of its impact on supply chains. Also, supply chain resilience has emerged as a set of complex relationships involving supply chain partners, competitors, cross-sector organizations, NGOs, and government institutions (Ketokivi & Choi, 2014). Thus, we selected

nine companies in the automotive, beverage, food, electronics, pharmaceuticals, and tobacco industries in Brazil, based on how essential their products were and their dependence on global suppliers.

Brazil reported the second higher number of deaths globally (Johns Hopkins Coronavirus Resource Center, 2021). However, the pandemic took longer to spread in Brazil compared to Asian, European, and North American countries, making Brazil an intriguing setting for this research. Brazilian government launched its first measures to contain the pandemic in the middle of March 2020, weeks after the United States [US], and months after Asian and European countries. Although the Brazilian subsidiaries had more time to adapt to the pandemic than subsidiaries and learn from subsidiaries in early affected countries, their supply chains experienced severe disruption long before the diseases had spread in Brazil.

We contribute to the OSCM literature by addressing the following gaps. First, our findings advance supply chain resilience literature by highlighting the importance of social capital in the different phases of resilience during pandemic (Johnson et al., 2013; Piprani et al., 2020). Second, we contribute to developing a better understanding of disaster relief efforts as a fundamental part of supply chain resilience, due to the pandemic's unique attributes (Ivanov, 2020; Ivanov & Dolgui, 2020; Piprani et al., 2020). We analyzed how the companies' decisions were made to adapt their operations capabilities to produce and supply essential products such as alcohol, hand sanitizer, personal protective equipment [PPE], and ventilators. Therefore, companies need to apply their capabilities to stabilize the entire environment in order to recovery from disruptions.

The following section presents a literature review on supply chain resilience and social capital theory, focusing on how supply chains can develop collective resilience through relationships and networks. The third section describes the methodological steps used in our case studies, based on Eisenhardt (1989). In the fourth section, we present our within-case and cross-case analyses results, followed by a discussion of our findings and synthesis with the literature. Finally, the main conclusions and suggestions for future studies are presented in the last section.

THEORETICAL FRAMEWORK

Collective Supply Chain Resilience

Global supply chains have grown in complexity during recent decades, as they pursue cost reduction. However, this also increased the exposure to spread of several disruptive events (Dolgui et al., 2018; Dubey et al. 2019; Hendry et al., 2019; Pavlov, Ivanov, Werner, Dolgui & Sokolov, 2019). Although OSCM researchers have contributed to enlarging our current understanding of disruptions and supply chain resilience (Chen, Das & Ivanov, 2019; DuHadway, Carnovale & Hazen, 2019; Govindan, Fattahi & Keyvanshokoo, 2017; Ivanov et al., 2018; Tang, 2006), it may not fully explain the unique characteristics of the COVID-19 pandemic and its subsequent impacts on supply chain resilience (Handfield et al., 2020; Hoek, 2020; Moritz, 2020). OSCM practitioners and scholars have focused their attention on understanding supply chain resilience during the pandemic, calling for new studies and approaches (Glynn, 2021; Hoek, 2020; Ivanov & Dolgui, 2020).

Resilient supply chains developed capabilities to prepare, respond, and recovery from a disruption (Piprani et al., 2020; Ponomarov & Holcomb, 2009). Ponomarov and Holcomb (2009, p. 131) define supply chain resilience as “the adaptive capability of an SC to prepare for unexecuted events, respond to disruptions, and recover from them by maintaining continuity of operations at the desired level of connectedness and control over structure and function.” The resilient literature defines three stages of the supply chain resilience process: readiness, response, and recovery (Han, Chong & Li, 2020; Piprani et al., 2020; Ponomarov & Holcomb, 2009). The readiness stage recognized potential threats and applies prior protections (Chowdhury & Quaddus, 2016). In the response phase, the supply chain quickly responds while the disruption is still occurring (Pettit, Croxton & Fiksel, 2013). Last, the recovery stage focuses on the ability of a supply chain to return to its original position (Craighead, Blackhurst, Rungtusanatham & Handfield, 2007; Piprani et al., 2020). However, the long duration of the pandemic challenged our knowledge related to supply chain resilience.

Most OSCM studies of supply chain resilience are focus on how companies recovered from a specific industry disruption, limited to a region or country, are guided by prior planning and experience, and only focus on short-term supply or demand that has on immediate and consequential human impact (Moritz, 2020; Piprani et al., 2020). In contrast, the COVID-19 pandemic has several unique aspects. Companies cannot rely on prior disruption knowledge; the last global pandemic was the Spanish Flu of 1918, over one hundred years ago. The long-term human impact of COVID-19 is widespread and growing, affecting workers, consumers, and society. These attributes affect several supply chain resilience capabilities, including

situational awareness, previous protections, contingency planning, security building, and collaboration (Handfield et al., 2020; Hoek, 2020; Ivanov & Dolgui, 2020; Moritz, 2020).

Although previous studies have established collaboration as a critical capability in supply chain resilience (Gunasekaran, Subramanian & Rahman, 2015; Kim, Chen & Linderman, 2015; Yan & Dooley, 2013) and subsequent performance (Villena, Revilla & Choi, 2011), most it has not consider relationships beyond supply chain partners (Johnson, Dooley, Hyatt & Hutson, 2018). Cross-sector collaborations increased in number, scope, and involved organizations during the pandemic, putting companies, governments, and NGOs to work together (Lawton et al., 2020). Prior studies have established the importance of cross-sector partnerships in accessing needed resources in the context of humanitarian supply chains (Johnson et al., 2018); however, there is still a lack of understanding of how these relationships and ties could be applied to supply chain resilience in the pandemic context.

Glynn (2021) suggests that resilience must be understood in a broader view, including institutions, communities, and society. The so-called “collective resilience” can be achieved by cultivating trust, which is essential to unlocking needed resources, by working together as a community, enabling flows, and sharing resources through ties and relationships, and by calling out individuals that embody values that inspire others. Disaster relief efforts, for example, employ multiple actors such as the government, military, aid agencies, NGOs, and private companies to manage catastrophic events (Gabler, Richey & Stewart, 2017; Medel, Kousar & Masood, 2020). Private companies provide essential goods, donors, and their operations capabilities, sharing information and resources, and creating and maintaining critical infrastructure during disruptions (Gabler et al., 2017; Nurmala, Vries & Leeuw, 2018; Swanson & Smith, 2013). Therefore, supply chains play an important role in serving their direct customers and functioning as part of a community and society in times of great uncertainty (Glynn, 2021; Swanson & Smith, 2013).

Extending this view to an OSCM perspective, supply chain resilience can incorporate mechanisms to relieve the impacts of a pandemic on society, improving health systems, and slowing down contagion. Our research focuses on understanding how companies improved their own resilience by mobilizing their networks to access resources and simultaneously shared their own resources and capabilities within disaster relief efforts to help society during the COVID-19 pandemic. Therefore, it is crucial to understand the resources embedded in interpersonal supply chain relationships and how companies can mobilize them in uncertain times.

Social Capital Theory

Companies are embedded in a variety of inter-organizational and network ties that enable them to share resources such as financial, information, knowledge, and other forms of capital (Johnson et al., 2013; Villena et al., 2011; Zhou et al., 2014). During uncertainty, they rely on those ties to access resources to improve resilience, mobilizing supply chain partners, cross-sector ties, institutions, and society (Gabler et al., 2017; Gao, 2019; Medel et al., 2020; Roscoe et al., 2020).

Social capital theory highlights the resources embedded in interpersonal relationships, including the norms and values within employees, subsidiaries, supply chain partners, industry associations, communities, government institutions, and societies (Johnson et al., 2013; Nahapiet & Ghoshal, 1998; Walker, Kogut & Shan, 1997). Nahapiet and Ghoshal (1998, p. 243) defined social capital as “the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit [...] [It] comprises both the network and the assets that may be mobilized through that network”.

Social capital is a complex construct that we examine in three dimensions: structural capital, relational capital, and cognitive capital (Johnson et al., 2013; Nahapiet & Ghoshal, 1998). Structural social capital refers to network ties and configurations that help exchange information and experience through interactions; it is embedded in roles, rules, precedents, and procedures. Cognitive social capital shared understanding based on values, purposes, ambitions, languages, and codes between actors. Last, relational social capital refers to the nature and quality of relationships based on trust, friendship, norms, reciprocity, identification, and mutual respect (Granovetter, 1992; Johnson et al., 2013; Nahapiet & Ghoshal, 1998; Villena et al., 2011; Zhou et al., 2014). These dimensions “constitute some aspect of the social structure” and “facilitate the actions of individuals within the structure” (Nahapiet & Ghoshal, 1998, p. 244). Therefore, social capital can bond collective efforts, modeling readiness, response, and recovery from outbreaks (Piprani et al., 2020).

Social capital theory had been previously applied in the supply chain resilience literature (Gölgeci & Kuivalainen, 2019; Johnson et al., 2013); however, there has been little attention to how companies employ social capital during the three phases of resilience (Piprani et al., 2020). Most papers focus on collaboration during the response phase, through information sharing and

collaborative planning (Gunasekaran et al., 2015; Yan & Dooley, 2013); and the social capital building in the recovery phase by enhancing trust and inter-organizational relationships (Gölgeci & Kuivalainen, 2019, Johnson et al., 2013; Polyviou, Croxton, & Knemeyer, 2019). There is still a lack of understanding of how companies interact within networks to overcome serious disruptions for which they have no prior information or predisruption planning. It is crucial to understand how companies in partnerships access resources beyond their supply chains from governments, competitors, and cross-sector organizations (Daghar, Alinaghian & Turner, 2020; Kilubi & Rogers, 2017; Polyviou et al., 2020). Also, it remains unclear how those networks can improve disaster relief by mobilizing the operations capabilities of different partners.

RESEARCH METHODS AND PROCEDURES

This study aims to understand how the supply chain employed and developed social capital to build resilience during the COVID-19 pandemic. We use multiple case studies, following an inductive approach, to investigate this contextually rich phenomenon (Barratt, Choi, & Li, 2011; Eisenhardt, 1989; Eisenhardt & Graebner, 2007; Ketokivi & Choi, 2014). Multiple case studies are suitable for developing a rich, reliable, and analytically generalizable theoretical framework by exploring both within-case and cross-case analysis (Ketokivi & Choi, 2014; Miles & Huberman, 1994).

We built our research questions on the concepts of supply chain resilience and social theory. Although OSCM studies have broadly employed supply chain resilience and social capital (Gölgeci & Kuivalainen, 2019; Johnson et al., 2013; Piprani et al., 2020), they have not been applied together in the pandemic context. Because we know very little about the effects of the COVID-19 pandemic on supply chain resilience, this approach can lead to more accurate theoretical insights. This research can be classified as a theory elaboration approach, due to “the context is not known well enough to obtain sufficiently detailed premises that could be used in conjunction with the general theory to deduce testable hypotheses” (Ketokivi & Choi, 2014, p. 236). We structured this section following Eisenhardt’s steps (1989), including case selection, data gathering, data analysis, and replication.

Case Selection

We used a theoretical sampling approach to select the case companies (Eisenhardt, 1989; Miles & Huberman, 1994), using three criteria to identify suitable companies, presented in Table 2. First, we selected nine companies located in Brazil, a country highly affected by the COVID-19 pandemic. According to the Johns Hopkins Coronavirus Resource Center (2021), Brazil was second globally in the number of deaths at the beginning of 2021, only exceeded by the United States [US]. The Brazilian government launched its first actions to contain the pandemic in the middle of March 2020, weeks after the US, and months after Asia and Europe. Therefore, the Brazilian subsidiaries had more time to adapt and learn from other subsidiaries within their manufacturing networks.

Second, we analyzed six industries based on two sub-criteria: how essential their products were during the pandemic and their dependence on global suppliers. We expected that essential products' sales would increase during the pandemic, based on consumer habits changes and panic buying, putting pressure on entire supply chains. However, sales of non-essential products dropped because of consumers' uncertainty, especially regarding the subsequent economic crisis. We also expected that globally embedded supply chains were at greater disruption risk than domestic supply chains. We targeted companies from the automotive, beverage, electronics, food, pharmaceutical, and tobacco industries based on these two characteristics (Figure 4.1). Finally, we identified representative companies, leaders in the domestic market, and the top five largest producers in each industry.

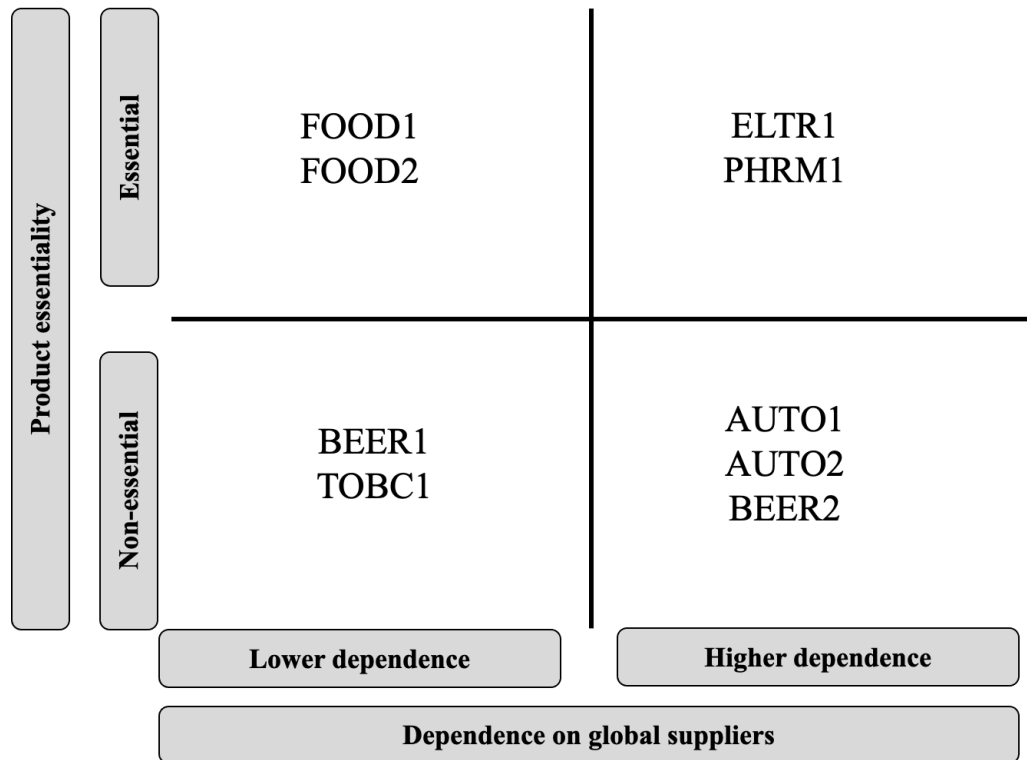


Figure 4.1. Selected Cases

Eisenhardt (1989) recommended between four and ten cases as effective for theory-building purposes. We selected nine companies in the automotive (2 companies), beverages (2 companies), food (2 companies), electronics, pharmaceuticals, and tobacco (1 firm each) industries. After identifying a group of suitable companies, we invited the managers of these companies to take part and sent a confidentiality agreement, indicating that we would not disclose the companies' or the participants' names. We have contacted managers from ten companies, resulting in one decline and nine acceptances.

Data Gathering

We interviewed managers as our primary data source, using the semi-structured questionnaire presented in Appendix 4A (Barratt et al., 2011). We conducted at least five and as many as eight interviews in each company (Table 4.1). We spoke with managers from several functional areas to obtain a broader view of the companies, to reduce the risk of interviewees' subjectivity or lack of information availability.

We conducted 52 interviews between July and November 2020 by phone, videoconferencing apps, and online platforms, to ensure social distance during the pandemic

(WHO, 2020), and allowing to interview managers from different regions of Brazil. We interviewed managers from seven states in four of the five regions of Brazil. On average, the interviews lasted 40 minutes. All the interviews were conducted in the interviewee's native language, Portuguese. We were allowed to record 48 of the interviews. The recordings were transcribed and then translated representative quotes into English, presented in Appendix 4A. For the other four interviews, we relied only on our field notes.

Table 4.1 - Overview of Interviews

Industry	Case	Global revenue ^a (2019)	Facilities	ID	Functional area of the interviewee	Time (minutes)
Automotive	AUTO1	US\$100-150 billion	Over 30 countries	AUTO1E5	International Trade	30
				AUTO1E6	Projects and Product Development	30
				AUTO1E7	International Trade	60
				AUTO1E8	Supply chain	30
				AUTO1E9	Supply chain	40
				AUTO1E10	Projects and Product Development	40
				AUTO1E11	Logistics and Transportation	50
				AUTO1E12	Projects and Product Development	30
	AUTO2	US\$100-150 billion	Over 30 countries	AUTO2E1*	Projects and Product Development	50
				AUTO2E6	Sales and Distribution	30
				AUTO2E7	Manufacturing	30
				AUTO2E8	Projects and Product Development	40
				AUTO2E9	Logistics and Transportation	30
				AUTO2E10	Sales and Distribution	30
Beverage	BEER1	US\$10-20 billion	Over 15 countries	BEER1E1*	Logistics and Transportation	50
				BEER1E4	General Management	30
				BEER1E5	Logistics and Transportation	30
				BEER1E6	Logistics and Transportation	40
				BEER1E7	Logistics and Transportation	60
				BEER1E8	Logistics and Transportation	30
				BEER1E9	Logistics and Transportation	50
	BEER2	US\$20-30 billion	Over 70 countries	BEER2E3*	Sales and Distribution	40

Industry	Case	Global revenue ^a (2019)	Facilities	ID	Functional area of the interviewee	Time (minutes)
				BEER2E4*	Sales and Distribution	60
				BEER2E8	Sales and Distribution	50
				BEER2E9	Security and Risk Management	40
				BEER2E10	Sales and Distribution	30
				BEER2E11	Operations Management	60
Electronics	ELTR1	US\$200-250 billion	Over 40 countries	ELTR1E1	Manufacturing	30
				ELTR1E2	Sales and Distribution	50
				ELTR1E3	Logistics and Transportation	30
				ELTR1E4	Logistics and Transportation	30
				ELTR1E5	Logistics and Transportation	30
Food	FOOD1	US\$50-100 billion	Over 150 countries	FOOD1E1	Sales and Distribution	60
				FOOD1E2	International Trade	40
				FOOD1E3	Supply chain	50
				FOOD1E4	Logistics and Transportation	30
				FOOD1E7	General Management	40
	FOOD2	US\$20-30 billion	Over 30 countries	FOOD2E1	Projects and Product Development	40
				FOOD2E2	Logistics and Transportation	40
				FOOD2E3	Procurement	40
				FOOD2E4	Sales and Distribution	30
				FOOD2E5	Sales and Distribution	30
Pharmaceuticals	PHRM1	US\$1-5 billion	2 countries	PHRM1E1	Sales and Distribution	60
				PHRM1E2	Supply chain	70
				PHRM1E3	Manufacturing	30
				PHRM1E4	Procurement	50

Industry	Case	Global revenue ^a (2019)	Facilities	ID	Functional area of the interviewee	Time (minutes)
				PHRM1E5	Supply chain	50
Tobacco	TOBC1	US\$30-50 billion	Over 40 countries	TOBC1E1*	Logistics and Transportation	70
				TOBC1E3*	Logistics and Transportation	50
				TOBC1E4*	Security and Risk Management	60
				TOBC1E5	Security and Risk Management	70
				TOBC1E6	Security and Risk Management	60

Note. ^a Financial information retrieved from companies' websites.

Data Analysis

We analyzed our data in using inductive approach, focusing on the emergence of constructs (Gioia, Corley & Hamilton, 2013; Randall & Mello, 2012). After the within-case and cross-case analyses, we developed a set of propositions based on case evidence (Barratt et al., 2011; Eisenhardt, 1989; Gioia et al., 2013; Ketokivi & Choi, 2014). For both the within- and cross-case analysis (Eisenhardt, 1989), we applied open coding strategy proposed (Corbin & Strauss, 2008) to code and analyze all transcriptions and field notes using the Atlas TI software.

We focus on identifying companies' resilience during the COVID-19 pandemic during the readiness, response, and recovery stages (Johnson et al., 2013). Also, we paid attention to their interactions both within and beyond their supply chains to help overcome this pandemic. We identified initial codes based on the natural language of the informant (Corbin & Strauss, 2008; Gioia et al., 2013). We grouped those codes into 40 first-order categories, then grouped those categories into 11 second-order categories that were expressed in 3 aggregate dimensions. That process resulted in our model, which describes how inter-organizational interactions led to collective resilience during the pandemic (Figure 4.2). Finally, we compared our findings with the OSCM literature, leading to the development of our six propositions.

Replication

We applied four quality criteria to ensure methodological rigor following Lincoln and Guba (1985): internal validity, external validity, reliability, and objectivity. These criteria allow the research replication, described in Table 4.2. Internal validity was addressed by selecting representative companies (Figure 4.1), conducting at least five interviews per company, representing the data in a framework (Figure 4.2), and addressing our findings as propositions related to the phenomena (see Discussion section). We addressed external validity by delimitating the unit of analysis, selecting cases based on clear criteria, describing the context of the cases in the within-case analysis, and applying a multiple case study approach.

Table 4.2 - Quality Criteria Application

Criteria Definition	Methods of addressing
Internal Validity The extent to which findings correctly map the phenomena	Nine leading companies from six representative industries At least five interviews per company with managers from different operations areas Framework and propositions

Criteria Definition	Methods of addressing
External Validity The degree to which results can be generalized to other contexts	Delimitation of the unit of analysis Case selection criteria Context description in the within-case analysis Applying a multiple case study approach
Reliability The extent to which another researcher can replicate the results	Semi structural questionnaire in Appendix 4A Description of all procedures performed during data collection and analysis Transcription of the interviews (in Portuguese) Use of multiple researchers
Objectivity The extent to which findings are free from researcher biases or misinformation from participants	Presentation of interviewees quotations in Appendix 4B Agreement with interviewees that companies' and participants' names will not be revealed in publications, to encourage the participants to express their views

Note. Source: Adapted from Lincoln, Y., & Guba, E. (1985). *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications. Miles, M., & Huberman, A. (1994). *Qualitative data analysis: An expanded sourcebook*, Sage Publications, London, UK.

Reliability was addressed through the semi-structured questionnaire in Appendix 4A, documenting procedures and transcribing interviews. This assured consistency in data analysis across informants and allows other investigators to replicate our findings. Fourth, objectivity was addressed by interviewees' quotation presentation and by establishing an agreement with the interviewees that names of companies and participants will not be revealed in any publications. This encouraged the interviewees to share their views and increased the trustworthiness of the information.

RESULTS

We analyzed the interviews in two steps (Eisenhardt, 1989). In the within-case analysis, we analyzed each of the nine cases independently, in order to understand their unique contexts and summarize their primary information (Miles & Hubermann, 1994), see Table 4.3. Our cross-case analysis evaluated the main categories that emerged from interviews, proposing an analytical model that presents the relationships between the constructs (Gioia et al., 2013), presented in Figure 4.2. Representative quotations from the cases are listed in Appendix 4B.

Within-Case Analysis

AUTO1

AUTO1 is a subsidiary from a global automotive company that has operated in Brazil for more than four decades. It is highly dependent on global suppliers from Europe, North America, and especially Asia. As a result, AUTO1 was able to anticipate pandemic's impact on its supply chain months before the first measures for social distancing were applied by the government in Brazil in March 2020. AUTO1's suppliers in Asia stopped production in January, and the European and American suppliers did the same direction weeks later:

[The direct impact of the pandemic was in] March in Brazil, but we already started to sense the pandemic in December and January because a large part of the inputs is imported mainly from China (AUTO1E7).

Therefore, as AUTO1's production was running out of parts, its global headquarters had closed most of its factories worldwide.

Although there was no prior disruption plan for dealing with this sort of disruption, AUTO1 increased its understanding through information sharing with other subsidiaries of the same automotive company in other regions. The subsidiaries from other countries shared information about the main attributes of the outbreak, such as their supply chain vulnerabilities, and implemented protections such as tested health protocols and procedures to adapt their factories for social distancing. AUTO1 coordinated previous response and recovery efforts through existing committees and communication channels established in different functions with the manufacturing network, supply chain partners, and government institutions. For example, AUTO1 bought anticipation inventory from the US before suppliers stopped production, building redundancy by its strategic stocks. This strategy was one of many suggestions made by the crisis committee within AUTO1's manufacturing network. As a result, the Brazilian stayed closed for less time during the pandemic than subsidiaries in other parts of the world.

Recovery planning involved AUTO1's supply chain partners, as well cross-sector organizations and government institutions. Within its recovery planning, AUTO1 mitigated the effect of the virus on society, resulting in a more stable environment for its operations and consumers. For that reason, AUTO1 donated money, resources, and PPE to local communities close to its factories, shared its buildings with a field hospital, and built and equipped a permanent emergency medical unit. Working alongside cross-sector organizations, competitors, and government institutions, AUTO1 developed a successful national network for refurbishing ventilators, along with 42 other companies. AUTO1's success was associated with its involvements in committees to discuss public policies for innovation in the automotive

industry, both in the industry association [National Association of Motor Vehicle Manufacturers – ANFAVEA] and within the Brazilian Ministry of Economy, which allowed managers from various automotive companies to get to know each other, bond, establishing trust, and developed friendships.

An airline called me saying it had an idle aircraft maintenance team because it has no flying [during the pandemic] and they wanted to set up a refurbish center [for ventilator]. Then, I said that I needed to move some equipment between the Brazilian capitals: “I know you have such a network, why not help?” So, [this company] also joined and was part of the volunteering [network]. We start with what we have and what we don’t have, running after partners who can make it possible (AUTO1E6).

AUTO2

AUTO2 is a subsidiary of one of the world’s largest manufacturers in the automotive industry, operating in over 30 countries and 100 locations worldwide. AUTO2 learn about the first impact of the pandemic from its Asian suppliers in January 2020. Like AUTO1, AUTO2 was able to prepare for the pandemic from information shared by other subsidiaries in the countries that were affected by COVID-19 sooner, as well as its supply chain partners.

The outbreak of COVID-19 in global supply chains led the entire automotive industry to shut down production, reflecting a drop of around 95% for two months in Brazil. The global company applied its prior disruption knowledge acquired from Japan’s Fukushima nuclear disaster in 2011, after which it better integrated its suppliers, applied multiple sourcing, and reinforced its regional supply chains. These strategies were also effective in its recovery from the COVID-19 pandemic. AUTO2 also adapted its factories and practices for social distancing following its manufacturing network’s procedures.

Unlike other disasters, AUTO2 understands that mitigating the virus in society would result in a more stable environment for recovery. Therefore, AUTO2 shared its resources in humanitarian initiatives, such as donating resources, sharing vehicles such as ambulances, creating a mask factory to supply its employees and local community needs, and developing a national network to refurbish ventilators along with cross-sector organizations and competitors, including AUTO1. The success of the ventilator initiative was built on AUTO2’s engineering team’s prior, personal, and trusting ties with those who work on public policy for the innovations committee. Those employees set up this network in just a few days, using WhatsApp to reach their personal ties.

Sunday morning, [an employee from the Ministry of Economy] called me and [asked] if I could coordinate this [network for recovery of respirators]. On Monday, there were already six [companies] that join into it. During the week, I talked to many others... (AUTO2E1*).

According to the interviewees, by helping society during the pandemic, AUTO2 built on its organizational values related to social responsibility and organizational culture, enhancing its trust and friendship with local communities, governments, and other companies. This will generate future business and partnerships opportunities, and also reinforce employees' commitment and pride, which could help attract and keep talented collaborators.

BEER1

BEER1 is a Brazilian beverage company that produces beer and non-alcoholic drinks, distributing them to bars, restaurants, and supermarkets all over the country. Its supply chain has a low dependence on global suppliers and a high level of control over its partners, primarily related to costs. During the pandemic, BEER1 was initially affected by the closing of bars and restaurants in the middle of March, affecting both its production and finance.

BEER1 integrated its supply chain partners and disaster relief efforts into its response to the pandemic. It adopted health protocols that had already been tested in its global manufacturing network and in one of the most legitimate health companies in Brazil, sharing them with its supply chain partners. Also, BEER1 developed a cell phone app that could track workers during their shifts in factories, recording where they went and with whom they have been in contact, which allows a more precise response in case of contagion. They shared this app with their cross-sector and supply chain partners. Last, alongside their cross-sector partners, BEER1 helped bars and restaurants by launching marketing campaigns that carried the name of their products, engaging customers to purchase vouchers at these establishments for future visits: "we have a marketing campaign alongside large [cross-sector] companies in Brazil to help the re-opening of bars [through] distribution of hand sanitizer to the bars [...] and increased payment deadlines..." (BEER1E8).

For the aid of society, BEER1 produced masks, hand sanitizer from the alcohol removed from its non-alcoholic beers, face shields from recycle soda bottles, soaps, and chips from cassava to go into a regional drink, donated to employees and local communities. BEER1 applied its management capabilities to build and equip permanent and field hospitals, and a vaccine factory, alongside its cross-sector partners, including health institutions. By its

involvement in those efforts, BEER1 influenced the health indicators applied in the governments' decision to reopen bars and restaurants. According to the interviewees, the company has historically been perceived by the market as aggressive towards its employees and partners. The pandemic provided BEER1 an opportunity to be recognized for its social impact and build a new organizational culture.

It was a natural movement that we live now at BEER1. [BEER1] wanted to have a good environmental, social, economic perceptions [by market and consumers], etc. Moreover, the company has a much more aggressive perception of [how it treats] workers and competition, of oppressing suppliers, of the company that counts every cent. This is cool but this is not politically correct for you to grow the way we did. So, they're trying to change that perception a little bit. I think that's basically it (BEER1E1*).

BEER2

BEER2 is a beverage company that produces premium beer and non-alcoholic drinks. To keep the quality and maintain its signature taste, BEER2 imports more ingredients than its competitors, which increases its vulnerability to international trade and transportation disruptions. Like BEER1, BEER2 faced extreme market volatility caused by the closing of bars and restaurants during the pandemic. It consequently focused on the distribution of canned beers in supermarkets, affecting its operations and financial results.

To respond to the pandemic, BEER2 adapted its factories and practices based on the health protocol tested by its manufacturing network in other countries. To avoid a loss of inventory due to product expiration, BEER2 reduces its production and applied flexible pricing even for its premium line. However, BEER2's market improved with the lockdown relaxation in June and July 2020, putting pressure on BEER2's production and limiting its recovery. As part of its recovery strategy, BEER2 shared its health protocol with bars and restaurants, postponed payments, developed campaigns for customers, and engaged bars and restaurants in using delivery apps: "another initiative was a partnership with [a large hospital from Sao Paulo] to comply with some security protocols [...] It is a partnership to help bars to comply with security protocols in the reopening" (BEER2E8).

Like other companies, BEER2 also engaged in humanitarian missions during the pandemic. Although most of its measures focused on donating money and its products (water), BEER2 also produced hand sanitizer in its factories using the alcohol from non-alcoholic drinks. According to the interviewees, being part of those missions is vital for the brand, positioning BEER2 as socially responsible.

ELTR1

ELTR1 produces semiconductors, telecommunications equipment, personal computers, peripherals, monitors, televisions, and home appliances. ELTR1 is a large domestic cell phone, television, and computer producer, highly dependent on global suppliers, especially from Asia. ELTR1 first sensed the impact of the pandemic before it spread within Brazil's borders based on its Asian suppliers' disruption that resulted in them running out of parts and needing to postpone product delivery. After the first lockdown measures in the middle of March 2020, ELTR1 went from a drop in sales in March and April to a boost in the following months, supported by the spread of home offices and home schooling all over Brazil, which resulted in the need for new or better personal computers and cell phones.

ELTR1 employed its vertically integrated supply chain to respond to the pandemic, capitalizing on the re-opening of its factories in Asia: "we don't have any impact because we don't buy from suppliers. We only buy from ourselves [companies from the same group]" (ELTR1E3). However, global logistics has not completely recovered from the pandemic, affecting its flow of parts. ELTR1 took advantage of its embeddedness in its global manufacturing network to apply approaches previously tested in its global factories to social distancing in its operations, increasing its control of material flows and increasing the use of digital technologies in its factories. The distribution channel had shifted to physical stores for e-commerce, including its own, given it more control of the production flow.

ELTR1 increased its sales during the pandemic, due to the increasing need for personal computers and cell phones. According to the interviewees, its increased demand was why ELTR1 was more involved in disaster relief efforts; it was not able to apply its operations capabilities in provide goods for social needs. However, ELTR1 did donate resources, such as food and masks, to communities in need, computers to children from public schools for homeschooling, and televisions and computer monitors to public hospitals.

FOOD1

FOOD1 produces a wide range of products, such as nutrition products for children and babies, pet care, milk, chocolate, confectionery, bottled water, coffee, creamer, and food seasoning. As Brazil is a large food producer, FOOD1 has a robust local supply chain, with low dependence on global suppliers. FOOD1 was able sensed the pandemic in other countries early; however, the first impact in Brazil was in the middle of March 2020, in panic buying of essential

products during the first weeks of the lockdown. As FOOD1 mostly produces items for home consumption, this became an advantage during the pandemic.

In response to the pandemic, FOOD1 learn from its manufacturing network to quickly develop health protocols for its factories to reduce the risk of contagion, sharing these protocols with its supply chain members. FOOD1 intensified its multiple sourcing strategy, maintaining secondary national or regional sources even though they were more expensive than foreign suppliers.

Because you can't just develop a second source of supply [only in times of crisis], you must keep it active [over time]. It means that if I have an input in Brazil, which is 25% more expensive than the imported one, I still have to buy something to keep my [domestic] supplier active, because otherwise, if I need it, I don't have it (FOOD1E7).

As FOOD1 operates in an essential industry, the interviewees agreed that the best thing it could do was focus on providing its food products to society rather than changing to address disaster relief efforts. However, FOOD1 was also involved in an extensive campaign to open bars and restaurants, share health protocols, and build security for retail workers and their customers. Also, FOOD1 donated food products and money to needy communities (*favelas*).

FOOD2

FOOD2 is a subsidiary of a larger global company, one of the largest dairy food producers in the world. Its operations focus on dairy products, specialized nutrition, and bottled water, taking advantage of Brazil's strong domestic food supply chain. Like FOOD1, FOOD2 had to deal with the phenomenon of panic buying during the lockdown in March and April 2020. Although it had no prior disruption plan to deal with this outbreak, FOOD2 mapped the market changes caused by COVID-19 through its manufacturing network, applying health protocols and adapting its factories for social distancing.

The pandemic was already at its peak there [Europe], which was arriving here in Brazil. The Brazilian subsidiary already took protocols that were being employed in Europe. [...] We were ahead of many companies in Brazil; we had minimal impact on the operation. [...] No people get COVID-19 here (FOOD2E5).

FOOD2 reinforced its redundancy strategy in its supply base, keeping regional/national suppliers as a secondary source. The government's restrict regulations for food production were flexible, allowing FOOD2 to shift supplies that were running out of the market. Also, FOOD2 reduced its portfolio of dairy products and postponed or suspended product launches.

Like FOOD1 and ELTR1, FOOD2 did not involve its factories in disaster relief. According to the interviewees, this was due to its Brazilian factories lack of capabilities and few capacity. However, FOOD2 donated money and food products to *favelas* in the states in which it has factories.

PHRM1

PHRM1 is a Brazilian company that produces an extensive portfolio of medicines, exporting to over 40 countries in Asia, Europe, Latin America, and the Middle-East. PHRM1 depends highly on its global suppliers, especially from China and India. PHRM1 sensed the first impact of the pandemic from those suppliers, which had delayed shipping to retain scarce raw material in their own countries. The Brazilian government helped PHRM1 by negotiating with India to release the raw materials and assisted in shipping it using a military cargo aircraft: “India would no longer export chloroquine for some time. The value of this raw material came to triple. We worked alongside the Brazilian embassy to release the cargo that had been purchased for some time” (PHMR1E4).

PHRM1 had never applied a lean production strategy, thus, it had at least six months of strategic inventories at the start of the pandemic. According to an interviewee, that was because of the high risk of running out of material in the past. Unlike the other cases, PHRM1 is not embedded in a global manufacturing network. When COVID-19 spread among the workers in PHRM1’s factory in the North of Brazil. According to an interviewee, its competitors from multinationals who applied security measures previously took advantage of tested health protocols in their manufacturing network.

Like other companies pressured by higher demand, PHRM1 was not involved in pandemic relief, other than donating medicines and food to needy communities. According to an interviewee, helping society in times of need by donating products is effective merchandising.

TOBC1

TOBC1 manufactures, markets, and sells tobacco products worldwide. Its supply chain is primarily domestic with multiple suppliers of raw material from the South of Brazil and lower dependence on global suppliers. It first sensed the impact of the pandemic in the Brazilian market after the measures for social distancing for TOBC1 applied by the government, such as the closing of bars, an important distribution channel.

TOBC1 adapted its factories for social distancing much early than most companies in the Brazilian market did. According to the interviewee, its CEO in Brazil interpreted the early signals that the global manufacturing sent, anticipating and preparing TOBC1 for changes. TOBC1 hired a legitimate health company for this adaptation, sharing health protocols with supply chain partners. These strategies allow TOBC1 to increase its production to supply a larger national demand and markets of countries that imposed more restrictions on their subsidiaries than Brazil.

There [another Latin American country], the government closed the factory for 60 days. Totally closed, nobody worked, and only the surveillance personnel were controlling the factory. All production [that local subsidiary did] in [that country] came to Brazil during this period (TOBC1E6).

Although TOBC1 donated essential resources, such as masks and food, it also applied its operations capabilities to support society's needs during the pandemic. Because TOBC1 had an established national logistical distribution structure, it was able to help in distributing essential products such as PPE, flu vaccines, and food to society using its partnerships with its suppliers, NGOs, and government institutions. TOBC1 also produced alcohol for donation using the capabilities of cigarette essence processing that has never been used because of a regulative restriction. Most of this assistance was aids were directed to local communities and governments, close to TOBC1 factories or logistical structure, enhancing their relationship and trust in it.

Table 4.3 - Within-case Summary

	AUTO1	AUTO2	BEER1	BEER2	ELTR1	FOOD1	FOOD2	PHRM1	TOBC1
Supply Chain Characteristics									
Dependence on global suppliers	Higher	Higher	Lower	Higher	Higher	Lower	Lower	Higher	Lower
Were its products essential?	Not essential	Not essential	Not essential	Not essential	Essential	Essential	Essential	Essential	Not essential
Embeddedness manufacturing network	High	High	High	High	High	High	High	Low	High
First impact of COVID-19	December-January	December-January	March	January-February	December-January	March	March	March	March
Readiness Capabilities									
<i>Robustness</i>									
Integrated supply chain	X	X	X		X				
Multiple supply sources						X	X		X
Strategic supplies vertical integrated			X		X			X	
Prior disruption knowledge management		X	X				X	X	
<i>Health security</i>									
Shared information within its global manufacturing network	X	X	X	X	X	X	X	X	X
Engaging legitimate health companies			X	X		X			X
Adapting factories and practices to social distancing	X	X	X	X	X	X	X	X	X
Sharing health protocols with supply chain partners	X	X	X	X		X	X		X
Building employees' health security through digital technologies	X		X						
<i>Supply chain vulnerabilities</i>									

	AUTO1	AUTO2	BEER1	BEER2	ELTR1	FOOD1	FOOD2	PHRM1	TOBC1
Identifying market and consumer behavior changes	Critical drop	Critical drop	Volatile	Volatile	Volatile	Panic buying	Volatile	Panic buying	Volatile
Anticipating political/national restrictions	X							X	X
Monitoring global suppliers' disruption risk	X	X	X	X		X		X	
Monitoring global transportation and distribution disruption risk				X	X			X	
<i>Sensing and interpreting the pandemic</i>									
Mapping COVID-19 propagation in other countries	Asia and Europe	Asia, Europe, and North America	Europe and Asia	Europe	Asia	Europe	Europe	North America	Europe
Sharing information within supply chain partners	X	X							
Sharing information within the global manufacturing network	X	X	X	X	X	X	X		X
Responsiveness Capabilities									
<i>Flexibility</i>									
Flexible transportation and distribution	X				X		X	X	
Supply base flexibility			X	X		X	X		X
Digital technologies in distribution channels			X	X	X			X	X
<i>Redundancy</i>									
Strategic stocking	X		X			X	X	X	
Vertical integrating suppliers			X		X			X	
Multiple suppliers				X		X	X		X
<i>Collective response</i>									
Collaborative planning within the supply chain	X	X	X	X		X			X

	AUTO1	AUTO2	BEER1	BEER2	ELTR1	FOOD1	FOOD2	PHRM1	TOBC1
Redirection of preexisting communications channels and committees to pandemic response	X						X		
Inter-organizational cooperation and information sharing	X	X	X	X		X		X	
Recovery capabilities									
<i>Cognitive capital</i>									
Sharing values within the supply chain	X	X	X						
Reinforcing employees' commitment	X	X	X						X
Building corporate social responsibility recognition	X	X	X	X		X			
Selecting partners in humanitarian activities by common requirements	X	X	X						
<i>Relational capital</i>									
Organizational ties with local governments and communities	X	X	X			X	X		X
Organizational and personal trust and friendship with governments, partners, and society	X	X	X						X
Building future business opportunities	X	X	X						
<i>Disaster relief efforts</i>									
Sharing and donating recourses	X	X	X	X	X	X	X	X	X
Applying and/or developing operations capabilities	X	X	X	X					X
<i>Recovering within the supply chain</i>									
Reconfiguring supply chain design and resources	X			X		X	X	X	X
Monitoring the ripple effect and forecasting uncertainty	X			X					
Monitoring long-term market changes	X	X	X	X		X	X	X	
Improving digital technologies		X		X	X				

Cross-Case Analysis

We analyzed the 52 interviews using open coding technique (Corbin & Strauss, 2008). We grouped the initial codes in aggregated categories, evolving to a final model with three dimensions, 11 second-order categories, and 40 first-order categories, following Gioia et al. (2013) (Figure 4.2). This section describes the four dimensions of our model with propositions developed in the following section (Discussion). We classified the four dimensions into three phases of supply chain resilience (Johnson et al., 2013). The dimensions “Employing structural capital to better prepare”, “Responding to threats”, and “Collective recovery” refer to the readiness, response, and recovery phases, respectively.

Employing Structural Capital to Better Prepare

A resilient supply chain incorporates mechanisms that allow companies to identify their vulnerabilities, anticipate potential threats, and apply proactive protection before any disruption happens (Chowdhury & Quaddus, 2016). Our data suggest that companies with higher dependence on global suppliers were impacted early during the pandemic, months before COVID-19 spread to Brazil and any changes were necessary. For instance, the automotive and electronics industries had to deal with shortages of parts and materials in January 2020, when their Asian suppliers had to stop production to contain the virus in their countries. Weeks later, European, Indian, and North American suppliers had to adopt the same measures, which also affected BEER2 and PHRM1.

In January, we held the first emergency meetings to understand why China closed. [...] When it happened a few weeks later, COVID-19 was already in Brazil. We got into the pandemic for good, and we ended up stopping [the production line] (AUTO1E11).

Although all the cases had limited established strategies or plans for responding to a pandemic, the Brazilian subsidiaries (AUTO1; AUTO2; BEER1; BEER2; ELTR1; FOOD1; FOOD2; TOBC1) built visibility and applied early protection through information sharing with their other subsidiaries in countries affected early by the disease. Structural capital embedded in prior committees and other communication channels allowed the Brazilian managers to recognize the potential threats associated with COVID-19 by anticipating changes in their markets and consumer behavior, vulnerabilities of their suppliers, potential transportation disruptions, political and national restrictions, and other harmful effects. Because of this, the Brazilian subsidiaries had developed protective shields weeks earlier than their competitors, the impacts on their supply chains were less. They employed structural capital by mobilizing

resources from their prior ties to develop health security protocols and adapt their processes and practices to social distancing, building on approaches that had been previously developed and tested by other subsidiaries. The cases enhance their relational capital by involving their supply chain partners in these processes.

When China and Europe had returned the operation with social distancing, the consumption of masks busted. Here in Brazil, [...] we bought machineries and set up a factory of surgical masks inside our plant. To you have an idea, we could supply masks for our entire operations in South America. All because of the consumption we saw of it [in China and Europe] (AUTO1E10).

PHRM1 was the only case not embedded in a global manufacturing network, and it was the only one to stop its production because of the spread of COVID-19 within its factories: “the factory in [North of Brazil] was extremely impacted at the peak of [contagion]. We have a factory in the center and the South of the country; these had not stopped. [However,] we were unable to manufacture an additional amount to compensate” (PHRM1E5).

Responding to Threats

The analysis of the cases suggests that the companies relied on their relationships within supply chains, cross-sector companies, and other organizations from their institutional environment to respond to the effects of the pandemic. In the response phase, the companies adapted and familiarized themselves with the context of the pandemic, promptly responding to this unexpected situation (Pettit et al., 2013). However, the companies could not individually respond to the pandemic effectively (Kamalahmadi & Parast, 2016; Piprani et al., 2020). They needed to adopt several strategies, so they could respond to these threats at the firm, supply chain, and external environment levels (Table 3).

Although the case companies had to adapt to the context of the pandemic, our results suggest that they were more prone to collaborate during the pandemic, accessing the needed resources through their networks. At the firm level, the case companies redirected their existing communication channels within their manufacturing networks to respond to the pandemic at the firm level (all companies, except PHRM1). At the supply chain level, the cases that were subsidiaries of multinational companies all increased flexibility by adapting their production flow to the new context and building redundancy through relevant information, such as potential disruption risks and prior disruption knowledge. They enhanced their agility by collaborative planning, and sharing information with their supply chain and financing those. AUTO1, AUTO2, BEER1, BEER2, FOOD1, and TOBC1 made anticipatory payments to their partners,

especially for those supply chains that were highly dependent on local partners (suppliers, bars, restaurants, and car dealers). At the external environment level, PRHM1 worked closely with government agencies to solve common problems, such as diplomatic support to release raw material in India or shipping strategic supplies from other countries in military aircraft.

So, just as we had the crisis committee here [in Brazil], we had a global committee too. The lessons we learn in China and Europe that suffered first, we brought here and shared [with the company and supply chain partners] (AUTO1E10).

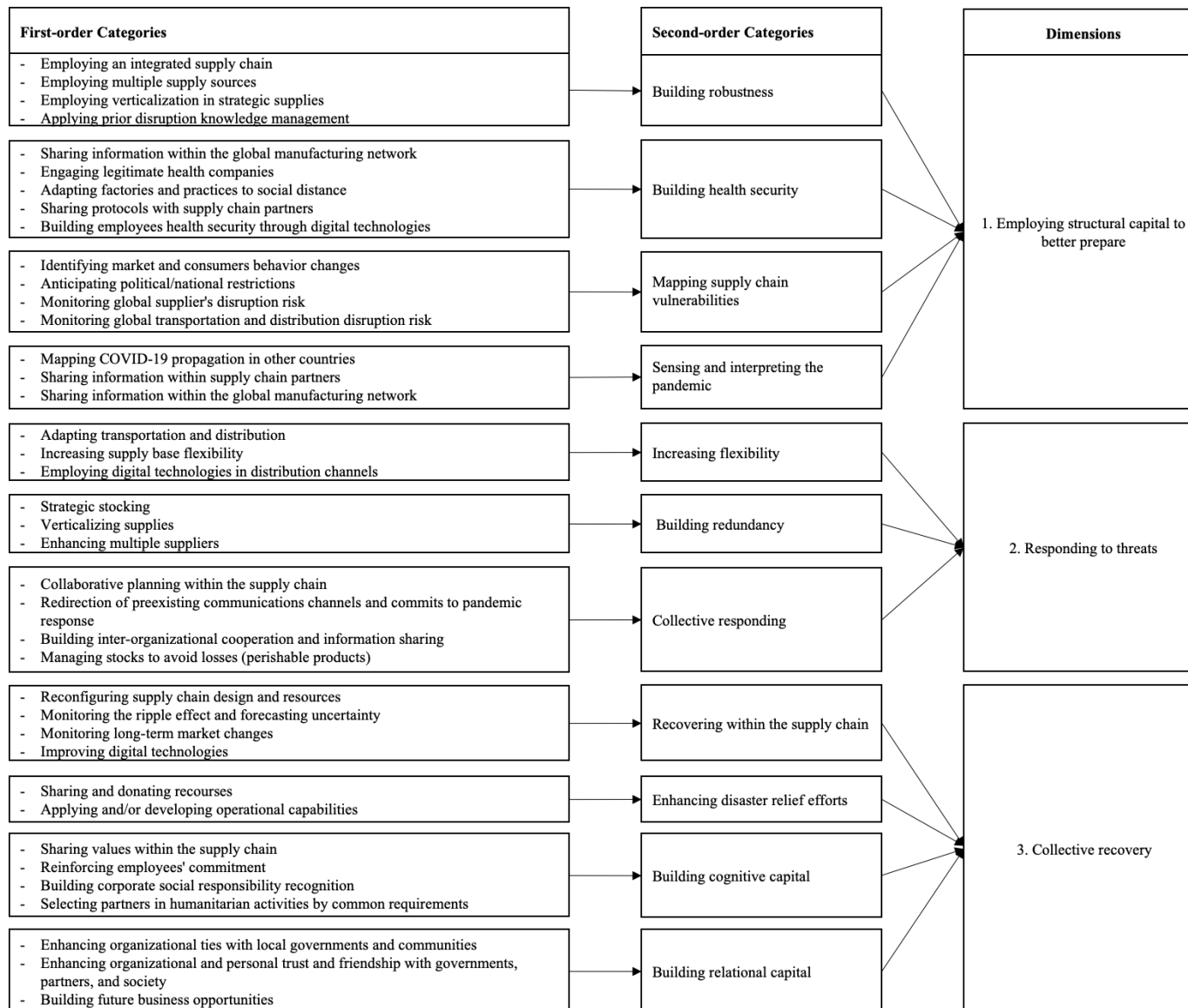


Figure 4.2. Data Structure

Collective Recovery

To fully recover from the pandemic, we found that the case companies applied capabilities that allowed them quickly returning to their original positions (Craighead et al., 2007). However, unlike from previous disruptions they had experienced, such as natural and man-made disasters, our findings suggest that the case companies respond to the COVID-19 pandemic not only by recovering within supply chains but simultaneously influencing the recovery of society as well. Although the case companies adopted measures to reduce the spread of COVID-19 within their operations, complete recovery still depends on the flexibility of the restriction measures imposed by the government, which, in turn, depends on the control of the disease in society. Therefore, the case companies had to apply their resilience capabilities in their operations, supply chains, and stabilize their whole environment.

The case companies engaged their supply chain and cross-sector partners at the supply chain level in their contingency planning. Internally, they redesigned their supply chains to include multiple and local suppliers (BEER1; FOOD1; FOOD2; TOBC1), monitored production flows to accommodate forecasting uncertainty and anticipate possible disruptions (AUTO1; BEER2), and adapted their portfolio to the additional needs and restraints (AUTO1; BEER2; FOOD1; FOOD2; PHRM1; TOBC1). BEER1, BEER2, and FOOD1 supported their supply chain partners by developing national campaigns to support bars and restaurants in their reopening, in collaboration with companies from other industries that were also dependent on these distribution channels.

All the companies in this study supported social initiatives by donating money or their products during the pandemic; however, a few also applied their operations capabilities to supply or develop essential products, such as PPEs, hand sanitizers, 70% alcohol, masks, or ventilators (AUTO1; AUTO2; BEER1; BEER2; TOBC1). Our results suggest that one of the restraints to using operations capabilities in disaster relief was capacity utilization needed for regular production. According to interviewees from the electronics, food, and pharmaceuticals companies, their operations were highly demanded during the pandemic, because they were essential products. On the other hand, the automotive, beverage, and tobacco companies were idle for at least at some point during the pandemic and, for this reason, more prone to use their operations to relieve the impact of the pandemic on society (Figure 4.3).

Our data suggest that the extent of pandemic relief efforts is a crucial factor in defining its actual impact on society. Individual company efforts focused their aid on locations and

regions where the company or its supply chains operate, often those communities surrounding its factories or distribution centers. In doing so, these companies enhanced their ties with governments and local societies. However, their impact was limited to mitigating the progress of COVID-19 only in regions, not focused on the regions of greatest need. Our results suggest that building a collaborative network with cross-sector partners and competitors allows coordinating and integrating efforts nationally, leading to superior results in mitigating the spread of the pandemic.

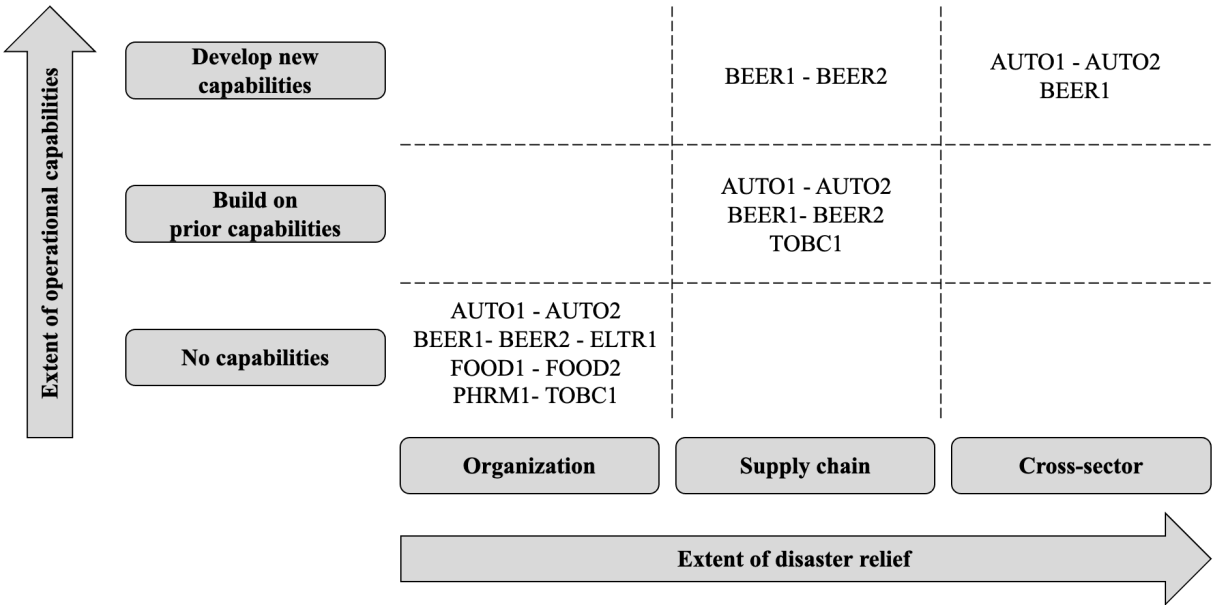


Figure 4.3. Operations Capabilities Applied to Pandemic

The companies established these disaster relief networks based on a common goal, for example, for helping the same bars and restaurants (BEER1; BEER2; FOOD1). They set minimum requirements for participants based on their importance in their industry or their operations capabilities, in other words, by their potential to contribute to joint cognitive capital (AUTO1; AUTO2). According to an interviewee, there was substantial potential to developed other partnerships within their networks, especially with non-competitors from other industries. These networks could build on their previous ties of trust between employees and organizations and reinforce to their relational capital over the aid between these organizations, society, and the government with potential business opportunities. For example, the automotive companies developed a network to refurbish ventilators, building upon a preexisting committee focused on building public policies for innovation in this industry. These ties of trust that already existed between the engineers helped in starting the network, and the media attention attracted other

companies to join the initiative: “Because they trusted us [through previous ties], we set up this network [...]” (AUTO2E1*).

The case companies shared their values not only with their partners but also with society by participating in humanitarian aid. As people and companies recognized their culture and operations capabilities, this reinforced or positively evolved their recognition for corporate social responsibility. “It was very cool [to be part of the ventilator recovery network], but I was not particularly surprised, either. It is part of the AUTO2 culture” (AUTO2E9). Such initiatives also reinforce ties with their employees, increasing their pride in their work and the company and potentially attracting talented workers.

DISCUSSION

The COVID-19 pandemic provided a test of our understanding of supply chain resilience (Handfield et al., 2020; Ivanov & Dolgui, 2020). The traditional capabilities of preparation, response, and recovery (Johnson et al., 2013, Piprani et al., 2020; Ponomarov & Holcomb, 2009) were put to a test against this unique situation (Handfield et al., 2020; Hoek, 2020; Ivanov, 2020). Our understanding of supply chain resilience needs to enlarge to accommodate the unique attributes of the pandemic. Our findings suggest that key constructs are social capital broadly applied in the resilience process, promoting better recognition of potential threats, early protection, and collective response and recovery.

Companies must sense and interpret the early vulnerabilities in their supply chains to better prepare for disruptions (Chowdhury & Quaddus, 2016; Sáenz & Revilla, 2014). However, unlike typical disruptions such as natural and man-made disasters (Büyüktaktakın et al. 2018; Gou & Lam 2019; Parvin et al. 2018; Scholten et al., 2014; Ye et al., 2020), the impact of the pandemic reached companies earlier than the disease itself reached their countries. The automotive, electronic, and pharmaceutical companies had weeks and even months to adapt their production processes before the first case was confirmed in Brazil in the middle of February 2020. They suffered early from supply chain vulnerabilities due to disruptions by their strategic suppliers in Asia, Europe, and North America, where the pandemic took hold first. Therefore, our findings suggest that the companies that were highly dependent on global suppliers were affected earlier than those that were more dependent on domestic suppliers, being forced to adapt their production to the running out of parts and raw material months early. Thus:

Proposition 4.1. Higher dependence on global suppliers is associated with earlier vulnerability in the supply chain during a global supply chain disruption

The OSCM literature had previously established the importance of social capital in the supply chain resilience process (Johnson et al., 2013; Zhou et al., 2014), highlighting collaboration as part of the response and emergence of relational capital during the recovery (Gölgeci & Kuivalainen, 2019; Piprani et al., 2020). However, our findings suggest that social capital plays a more important role than previous studies reported (Piprani et al., 2020).

Although the companies applied their capabilities to recognize potential threats and anticipated changes by applying their knowledge based on prior disruptions (Chowdhury & Quaddus, 2016; Piprani et al., 2020), there had been no planning to effectively prepare for the COVID-19 pandemic (Moritz, 2020). The Brazilian subsidiaries had some prior knowledge of operating in the pandemic context, thus they relied on their ties and networks for looking to seek information and built on their experience. The structural social capital previously established in their respectively manufacturing networks allowed them to absorb knowledge from those subsidiaries from early affected countries, resulting better visibility and agility. Therefore, our findings suggest that the structural capital embedded in their manufacturing networks was an effective source of predisruption knowledge for the Brazilian subsidiaries, allowing them to establish an early response against the pandemic. Thus, we establish the following proposition:

Proposition 4.2. The higher structural capital embedded in global manufacturing networks is associated with effective early responses to potential disruptions.

Social capital is not only applied within the boundaries of manufacturing networks or supply chains. The OSCM literature has described that companies collaborate to access resources when they are under a threat. However, most previous studies have focused on their interaction with their supply chain partners (Gunasekaran et al., 2015; Kim et al., 2015; Villena et al., 2011; Yan & Dooley, 2013). Only a few including relationships beyond the supply chain in their analysis (Gabler et al., 2017; Johnson et al., 2018; Lawton et al., 2020; Medel et al., 2020). Our results suggest that companies tend to extend their efforts beyond their supply chains to collectively respond to and recover from common threats. In other words, companies that

suffered a drop/volatility in demand and global supplier disruptions were more prone to collaborate in response and recover from the supply chain disruptions alongside their cross-sector partners, competitors, and government institutions, resulting in a more stable environment for them all. Thus:

Proposition 4.3. A higher collaborative response is associated with a greater supply chain impact

In pursuit of a more stable environment, the case companies engaged in disaster relief efforts to influence society's recovery, support the health system, mitigate virus transmission, and supply essential products, such as PPEs, hand sanitizer, masks, and ventilators. Although the humanitarian supply chain literature already describes how private companies voluntarily engage in disaster relief (Gabler et al., 2017; Johnson et al., 2018; Medel et al., 2020), we propose that humanitarian effort is fundamental to resilience in a pandemic context. Our findings suggest that companies' humanitarian effort improved both health system conditions and virus spread, which positively affected the governments' decision on lifting restrictions, leading the entire ecosystem to become more stable conditions for supply chain operations. However, some preconditions favor companies' engagement beyond donations and application of operations capabilities to disaster relief efforts. Companies that had idle capacity in at least one point of the pandemic engaged in humanitarian efforts more than those that faced increasing demand over time. It is reasonable that companies with higher demand employed their capacity to cope with it, donating their essential products instead applied their capacity to produce new ones, such as hand sanitizer. Thus, it is possible to establish the following proposition:

Proposition 4.4. Idle capacity is associated with greater engagement in disaster relief efforts

Structural capital plays a crucial role in the decision to integrate network efforts for disaster relief through the existence of prior ties, emerged from personal and organizational bounds (Gunasekaran et al., 2015; Johnson et al., 2013; Nahapiet & Ghoshal, 1998; Yan & Dooley, 2013). Cognitive capital established minimum requirements and values for accepting participants in these networks, mostly based on companies' operations capabilities and prior reputation in their respective markets. Our results suggest that those interactions enhance previous ties by improving trust, friendship, and reciprocity; in other words, networks focused

on disaster relief build and improve relational capital through inter-organizational relationships and society. Thus:

Proposition 4.5. Higher social capital is associated with quicker collective recovery of supply chains

Previous studies established that joint efforts positively influence disaster relief (Gabler et al., 2017; Johnson et al., 2018; Medel et al., 2020); however, we found that the actual impact on society depends on the extent of the network. Individual companies' efforts tended to be locally focused on governments and communities surrounding their operations, such as factories, headquarters, and logistics structure. However, collaborative networks containing cross-sector companies, NGOs, and government institutions employed their efforts more nationally, generating better results for aid of the general population. Since the pandemic, disaster relief has come to be perceived as part of the supply chain resilience process by managers, reducing the disease's spread and leading to a more stable environment for operations. Thus:

Proposition 4.6. Higher disaster relief efforts are associated with higher collective supply chain resilience

CONCLUSIONS

Our multiple case study contributes to the OSCM literature by answering recent calls to better understand supply chain resilience in the unique context of the pandemic (Choi et al., 2020; Queiroz et al., 2020; Singh et al., 2020). Companies had limited resilience planning based on their experience with prior disruptions, causing them to rely on other subsidiaries as a source of information and experience. Therefore, we contribute to the OSCM literature by addressing two gaps.

First, we highlight social capital as an important asset to supply chains during highly disruptive events, such as the COVID-19 pandemic. By analyzing how inter-organizational networks were employed in this context, we expand the understanding of resource sharing during the phases of supply chain resilience. Social capital promotes the anticipation of threats, establishment of early protection, and collective response and recovery. Our findings enlarge previous research focused on collaborative response and social capital building during recovery

(Gölgeci & Kuivalainen, 2019; Johnson et al., 2013; Piprani, et al., 2020; Zhou et al., 2014). We highlighted how social capital emerges from relationships with cross-sector organizations, competitors, and government institutions, employed in supply chain resilience during the pandemic.

From relationships beyond supply chain boundaries, we make our second contribution by showing that companies included disaster relief efforts as part of their supply chain resilience process. Those efforts positively affected the environment include themselves. According to Glynn (2021), the pandemic showed that resilience must be regarded in a broader view, including efforts to reduce damages in the environment, so-called “collective resilience”. Considering a supply chain perspective, our results have shown that companies engaged in individual or joint efforts under common uncertainties can contribute to stabilize the entire environment, taking a broader perspective of supply chain resilience. For that reason, our study contributes by bringing to the OSCM field the concept of “collective supply chain resilience”, which applies understand resilience during a highly disruption event.

As in Poe’s tale of the Red Death, there is no safety in a sick environment. Although past studies have focused on supply chain resilience in triads and buyer-supplier relationships, it is not enough in a pandemic context because of its unique characteristics. It is time to develop the understanding that supply chains are embedded in a whole ecosystem composed of other companies and society. Embracing disaster relief is a path to for a company to return to a stable position and achieve a better position after the pandemic.

Managerial Implications

Our study has important managerial implications. We highlighted the importance of social capital in a highly disruptive event. The OSCM literature describes that social capital can be applied by companies in the recovery stage; however, our findings suggest that social capital can be applied to better prepare and respond to disruptions. Managers who are responsible for managing supply chain disruptions must be aware that partners can provide information and resources to better understand disruptions as well as to joint respond to them. We suggest that relationships and ties beyond supply chains could be intensively applied by companies in such disruptions, promoting better resilience.

We identified that companies employed resources to recovery their supply chains. However, given the pandemic’s attributes, disaster relief must be seen as part of more extensive

supply chain resilience. Managers should seek to stabilize the entire environment, better controlling the spread of the virus beyond their supply chain boundaries. On the other hand, companies can capitalize on their cross-sector partners, competitors, and government institutions' relationships to access resources. Managers must understand the importance of enhancing operations capabilities for disaster relief, more than only obtain organizational and personal recognition.

Limitations and Future Research Directions

Our study has limitations that point to unanswered questions for future research. The COVID-19 pandemic has presented a set of challenges to OSCM researchers and practitioners. It would be interesting to compare the impact of the pandemic on subsidiaries that were early and late feeling the impact of COVID-19 in the same manufacturing network. For example, Chinese companies had to develop most of their response based on little or any information. What resources did they access from their manufacturing network? It could be revealing to study the difference in social capital exchanges between subsidiaries in early and late affected countries.

Also, there is a great deal more to learn about how social capital built during the pandemic can be employed in other contexts such as future disruptions or business opportunities. For example, automotive companies engage in a complex network to refurbish ventilators, including cross-sector organizations such as electronics and airline companies. Substantial contributions can be expected in how those ties can be applied in the future to develop new solutions to future disruptions. These non-answered gaps are subjects to be explored in future related research. Therefore, the COVID-19 pandemic suggests a rich research agenda for OSCM researchers.

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Appendices Four

Appendix 4A - Research protocol

Research proposal

This study aims to understand how supply chains employed social capital to build resilience during the COVID-19 pandemic and how companies were enhancing disaster relief as part of their own supply chain resilience processes.

Research question

Therefore, the research was guided by the following questions: (RQ1) How do companies employ social capital to building supply chain resilience in a pandemic context? (RQ2) How companies employed disaster relief as part of their supply chain resilience process?

Theoretical bases of the research

- Supply chain resilience
- Social capital

Selection of cases

The main criteria for the selection of companies were:

- Companies that operate in a highly affected country (Brazil)
- Companies based on the product essentiality in pandemic and its dependency on global suppliers
- Leaders in the national market and the top five of the largest producers in each industry

Data collection

- Interviews with managers recorded and transcribed
- At least five interviews in each case

Data Analysis

- Definition of codes in an open way through the technique of content analysis
- Analysis based on within-case and cross-case analysis

Semi-structured Questionnaire

Introduction

Full name

Position

Respondent (code)

Company (Code)

The interviewee's history in the firm

Disruption impact

1. How does Covid19 affect your company?

(Identify how delivery, quality, flexibility, and cost were affected by this crisis)

2. How were demand and supply affected by this crisis? Did your supply chain need to be reconfigured?

(Identify if the disruption was from the supply or demand side)

3. Had your company adapted practices and technologies to mitigate these risks? Were these practices and technologies expand to the supply chain?

(To understand if companies will change lean manufacturing practices and improve to digital technologies)

4. Did your company adopt practices and technologies? Did your supply chain partners adopt practices and technologies?

(To understand if the company must learn new practices or adopt to operate in this partnership)

Supply chains supporting disaster relief

5. Did your company support any relief disaster effort to contain the pandemic?

(Identify how company capabilities supported disaster relief efforts)

6. Had your company included supply chain partners (suppliers and distributors) in disaster efforts?

(To understand how supply chain partners were involved in the efforts)

7. Had your company included cross-sector partners in disaster relief efforts?

(To understand how cross-sector partnerships were involved in the efforts)

The role of government institutions in supply chain resilience

8. Your government developed any public policy to support your company? How were these policies different from other past crises?

(To understand how national regulative institutions support the company during the crisis)

9. How do these policies help your company in the short and long terms?

(To identify and understand your institutions affect different phases of resilience)

10. Was there any public policy specifically to protect your suppliers from bankruptcy?
After this crisis, will your company invest more to develop regional or local suppliers?
Is there government support for that strategy?

(To understand if companies will reconfigure to regional or local SCs and if local institutions will support that)

Closing the interview

11. To continue this research, could you suggest a colleague to be interview?

(Seek to snowball the sample)

Appendix 4B - Representative informant quotes underlying second-order categories

Dimension 1: Employing networks to better prepare	
Building robustness	<p><i>We keep our suppliers up to date, saying how many parts we need because suppliers must produce early (AUTO1E11).</i></p> <p><i>We took measures in the past to have dual sourcing, but not everybody [in the industry] did the same (FOOD2E3).</i></p> <p><i>It is not due to the pandemic because this [can] factory has been in existence for a long time. It is a very complex and expensive thing to do (BEER1E1*).</i></p> <p><i>We don't have any impact because we don't buy from suppliers. We only buy from ourselves [companies from the same group] (ELTR1E3).</i></p> <p><i>Our factory is 90% automated. Where there is human contact, there are few people. So, in addition to writing down all the security measures for entry, exit, distance, we used those disinfection corridors in various areas of the factory, and the issue of having two employees in the same environment was avoided (PHRM1E2).</i></p>
Building health security	<p><i>The pandemic was already at its peak there [Europe], which was arriving here in Brazil. The Brazilian subsidiary already took protocols that were being practiced in Europe. [...] We were ahead of many companies in Brazil; we had minimal impact on the operation. [...] No people getting Covid-19 here (FOOD2E5).</i></p> <p><i>When China and Europe had returned the operation with social distance, the consumption of masks busted. Here in Brazil, [...] we bought machinery and set up a factory of surgical masks inside our plant. To you have an idea, we could supply masks for our entire operations in South America. All because of the consumption we saw of it [in China and Europe] (AUTO1E10).</i></p> <p><i>Our security practices follow strict government and corporate protocols around the world (AUTO2E6).</i></p> <p><i>So, we had a large hospital from São Paulo in all TOBC1 units, which literally did a consultancy in each unit. So, we could minimize any impacts (TOBC1E1*).</i></p> <p><i>Another initiative was a partnership with [a large hospital from Sao Paulo] to comply with some security protocols [...] It is a partnership to help bars to comply with security protocols in the reopening (BEER2E8).</i></p>

Dimension 1: Employing networks to better prepare

Mapping supply chain vulnerabilities *This research [conducted by a European subsidiary] shows that most couples who planned to have children this year in Europe: 20% keep the plan, 40% postponed it for at least two years, and 40% canceled the idea of having children. [...] We sell infant formula; if you don't have children, you don't have a demand. So, I think it impacts the pandemic that ends up being direct in our daily lives, but it impacts people's behavior, too (FOOD2E3).*

There was a crisis committee that met every day. Now it is less frequent, but at the beginning of the crisis, it met every day. We had much early action in the operations to guarantee continuity, guarantee the employees' health, etc. That happened before the crises in Brazil, before a lockdown was declared, etc. So, it helped a lot, and we had much exchange of experiences. We brought much learning from there [Europe and China]. [...] The operation [in Brazil] wasn't affected by the Covid-19 itself (FOOD2E2).

There [another Latin American country], the government closed the factory for 60 days. Totally closed, nobody worked, and only the surveillance personnel were controlling the factory. All production [that local subsidiary did] in [that country] came to Brazil during this period (TOBC1E6).

[The direct impact of the pandemic was in] March in Brazil, but we already started to sense the pandemic in December and January because a large part of the inputs is imported mainly from China (AUTO1E7).

There were delays not because the factories were closed or people didn't work, but the airport was closed [in India] (PHRM1E2).

Air transportation was most impacted and is still being impacted by the pandemic. The airlines reduced flights by around 90% (ELTR1E3).

We shared experiences that the corporative brought to us from China and Europe that had the waves before us. So, just as we had the crisis committee here, there was an international committee either. So, we learned from China and Europe that suffered first; we brought it here and adapted it (AUTO1E10).

Sensing and interpreting the pandemic *In January, we held the first emergency meetings to understand why China closed. [...] When it happened a few weeks later, COVID-19 was already in Brazil. We got into the pandemic for good, and we ended up stopping [the production line] (AUTO1E11).*

We had parts to produce or in transit until the 22nd week [2020]. From this week, all the cars are incomplete, and we change the production mix. [...] The parts that were in transit arrived, but we stopped production (AUTO1E11).

Dimension 1: Employing networks to better prepare

While Brazil was crawling, Europe deals with a critical scenario. So, we said that the pandemic would eventually come, and we could structurally prepare for the arrival (FOOD2E3).

We have operations in China and Europe. So, we saw how these areas behaved (BEER1E7).

[Asian] factories stopped first. Auto parts [factories] stopped. Everyone stopped, [including] suppliers of electronic components (AUTO2E1).*

We import inputs from Asia and Europe, which were impacted earlier than here in South America. So yes, we had problems before the pandemic arrived here because of imported materials (AUTO1E8).

Dimension 2: Responding to threats

Building redundancy

The global headquarter came and said that: "such ingredient is in short supply. The supplier is saturated..." Then, we increased the stock (FOOD2E3).

I have breweries that need cans. We transfer cans from one brewery to another. If we have comfortable stocks in one brewery, I must send them to the other. I must do this often due to the supplier's inability to attend. We must fill this type of shortage [with inventory management] (BEER1E1).*

With Covid-19, the number of processed foods increased, and the world's cans ran out. At that moment, there is a war to try to get a can, so our can factory started at a good time. Our plant does not meet even 10% of our needs, but it will help (BEER1E6).

Nowadays, it is much more to develop local suppliers, regional partners, close to the business, where I can have greater local control, linked to the global [supplier]. Moreover, that can also impact the environment, reduce carbon footprint, reduce gas emissions, and everything in between. (FOOD2E3).

Because you can't just develop a second source of supply [only in times of crisis], you must keep it active. It means that if I have an input in Brazil, which is 25% more expensive than the imported one, I still must buy something to keep my supplier active, because otherwise, if I need it, I don't have it (FOOD1E7).

Dimension 2: Responding to threats

We had a contingency plan very well designed to have not [just] one specific supplier but a pool of suppliers. So, we managed to put this contingency plan into practice, which helped us a lot. So, we did not drop in our production volume due to the lack of raw material. What happened was a contingency of some inputs, mainly for us to be able to maintain the level of operation running a little longer, already counting with slightly greater adversity (TOBC1E1)*

For example, while the United States had still closed its borders, we anticipated [the purchase of] these items so that when the time came, we would not have as much impact, like the others [competitors] are suffering (AUTO1E9).

First, we increased inventories of everything that was imported. For all imported inputs, we tried to increase the stock (FOOD1E7).

It would be best if you created can stocks. We must have an empty can on the floor because otherwise, the supplier will not have to deliver, and we will stop the line (BEER1E1).*

Collective responding

We also shared information and gave support to our suppliers because we knew that the speed of the queue was going to be the speed of the slowest (AUTO1E10).

We have a marketing campaign alongside large [cross-sector] companies in Brazil to help the reopening of bars, [through] distribution of hand sanitizer to the bars, [...] increased payment deadlines... This is a campaign that brought together several teams [from BEER1] (BEER1E8).

So, there was also a specific help to retailers, [minimize] this drop in revenue to help them [small retailers] to be able to keep their business and, consequently, their business with TOBCI. So, there was support such as increased credit, postponement of payment terms, bonuses, engagement, and relationship with our client (TOBC1E1).*

India would no longer export chloroquine for some time. The value of this raw material came to triple. We worked alongside the Brazilian embassy to release the cargo that had been purchased for some time (PHMR1E4).

Sunday morning, [an employee from the Ministry of Economy] called me and [asked] if I could coordinate this [network for recovery of respirators]. On Monday, there were already six [companies] that join into it. During the week, I talked to many others... (AUTO2E1).*

However, [Asia] recovery was faster than here in Brazil. When the pandemic arrived here in Brazil, and we had quarantine, lockdown, and everything... The factories there had already been restored (ELTR1E2).

Dimension 2: Responding to threats

Increasing flexibility

The great lesson of the pandemic was perhaps the most resilient chains. Moreover, clearly, the most resilient chains are the chains with the most redundancy. In other words, I will not necessarily stop buying abroad, but I want to have this national option. This national option is often more expensive, so I buy 50/50 [of each] (FOOD1E7).

We bought a startup [company]. It is basically for the management of several actions in the pandemic. We provide an application to make online menus. So, customers don't have to pick up the [physical] menu when they go to the point of sale. [Also], it does reservation management. The restaurant says that there are ten tables that night, and the customer can book in advance. So, you can guarantee that there will be no more people there than should be. Clients can do marketing campaigns on Instagram directly from this app, and you can also deliver from it (BEER1E4).

So, even now, we tried to develop our online channel during the pandemic because you eliminate a link [in the chain]. The flow goes from industry to direct consumer (ELTR1E2).

In this pandemic, we can see the strength of the online channel. Before the pandemic, physical stores served, for example, 75% of the total. During the pandemic, this has already turned to 80% online and 20% retail [in physical stores] (ELTR1E1).

In the sales force, we need to invest in digital platforms to have this relationship with doctors. The [new] technologies were basically applied in the virtual relationship (PHRM1E2).

Dimension 3: Collective recovering

Building cognitive capital

The [our] team is proud of these [disaster relief] efforts. [It] generates pride [in employees] for participated in a company that cares. Because, basically, that is what we are showing [to society] that we care. If you look at the whole, we contribute to the market, which also [it] contributes to you. So, this is kind of a circle (BEER1E9).

I did not participate directly in any [humanitarian efforts], but [...] I have colleagues who participated. They not only value and are proud to participate in these company's support, but they can also be these agents of transformation (AUTO1E12).

If we had stayed hidden, I would have felt worse. [...] We did it [delivered respirators], [I felt] like a little hero, I felt good (AUTO1E11).

The word that sums it all up is empathy. We indeed leave the general public with more empathy. [...] There was a ranking that was recently released [...] of companies most remembered at the time of the pandemic (AUTO1E6).

Dimension 3: Collective recovering

BEER1 always had the perception of the general public [market] that [it] just wants to make money, and the president was determined to help change that perception. Also, take advantage of and do some community aids. Since BEER1 is Brazilian and BEER2 [its direct competitor] is foreign and has done absolutely nothing to help anyone (BEER1E4).

A natural movement of a company now we live. [It] wanted to have a good environmental perception, a good social, economic perceptions, etc. Moreover, the company has a much more aggressive perception of [how it treats] workers and competition, of oppressing suppliers, of the company that counts every cent. This is cool, but this is not politically correct for you to grow the way you did. So, they're trying to change that perception a little bit. I think that's basically it (BEER1E1).*

The leading companies immediately entered [in the respirator recovery network]. As soon as the first results started in the media, those who did not enter at first saw that they could be helping and ended up joining [us]. We started with ten big companies and ended up with more than 40 if I'm not mistaken. So, you can see that business has spread throughout the country (AUTO1E6).

The others [companies that didn't join the respirator recovery network at first] after everyone entered started looking for us: "how do I get in?" [...] It is the result of not being recognized as someone who helped when [the society] needed it. So, everyone was in the media, and these guys [companies] were not. We had a daily report [with the government], and the guys were not part of it. So, it was better to be a part of it than not doing it. [That's why] the guys entered (AUTO2E1).*

We had actions based on the [beer brand]. Then, we started selling on the restaurant voucher that you consumed R\$100 paying R\$50 when the restaurant opened again. So, [another beer brand] was also more focused on bars and not restaurants (BEER1E7).

Only large companies [were invited to participate] because we needed to have agility, capacity, and certifications. [...] So, it is easier to get a company that already has ISO 9000, 14000, compliance ... everything in its blood. So, it is easier to take a structured company, give them training and start running (AUTO2E1).*

So, when you talk about a multinational automaker, a large company knows that everything is controlled, everything has compliance. So, it's easy to deal with. If it had any other type of company, the business would go wrong (AUTO2E1).*

Building relational capital

The crisis committee, being multidisciplinary, helped a lot to coordinate [disaster relief efforts]. We operate in poor regions like here, where AUTO1 already has some social projects in progress. This pre-existing tie with the society in those places was employed for us [in the crisis committee]. This tie unfolded in the setting up of field hospitals, provision of parts and accessories, and cars [ambulances] for people who were on the front line [health agents] (AUTO1E10).

Dimension 3: Collective recovering

TOBC1 used its [logistic] capillarity to help society. It does not produce and suppl products but supports the distribution of [flu] vaccines in all states. We distributed vaccines nationally, and we could help the government itself (TOBC1E1).*

Phone calls formed the network. I called my contacts from industry associations, the guys said: "let's do it!" And done! We had 12 recovery points [factories] in one week and started to operate (AUTO2E1).*

Along with other initiatives, it opened a field hospital for COVID-19. If I'm not mistaken, BEER1, a bank, and a steel company participated in this construction. Vaccine factory also [...] BEER1 is developing together with other companies (BEER1E9).

We opened the proximity app for several companies to use, such as telephone, food, chemical, and construction companies. They all used the same app to avoid spreading the disease [among their employees] (BEER1E9).

AUTO2 helped a lot in the coordination [of the national respirator maintenance network] organized by [the engineer's name from AUTO2], and the other companies were invited. I also coordinated [...], a lot of interaction with the government too (AUTO1E6).

This is a campaign made by eight large companies [from different industries] to give credit and assistance to small retailers to reopen small retailers. Special conditions for purchase, repurchase, easy credit, PPEs [donation], cleaning [protocols]... (FOOD1E7).

A task force [network] was created by WhatsApp [...] Saturday morning; the government people called me to be part of this group that would articulate the increase in production of the [respirator] factories in Brazil. In one week, we started with 12 points from Brazil. Within a month, we had almost 30 repair points in the country. After two months, we had 41 repair points in the country (AUTO2E1).*

Because they trusted us [through previous ties], we set up this network and managed to help and get back to the new reality in a certain way (AUTO2E1).*

An airline called saying it had the aircraft maintenance team idle because it has no aircraft flying and wanted to set up a recovery center [for respirators]. Then I said that I needed to move goods between capitals: "I know you have such a network, why not help?" So, [this company] also joined and was part of the volunteering [network]. We start with what we have and what we don't have, running after partners who can make it possible (AUTO1E6).

Dimension 3: Collective recovering

We had national factories that manufactured between 150 to 200 ventilators per month. However, suddenly, we had to make 1500 to 2,500 ventilators a month. So [the government] turned to the automakers because they can set up factories for mass production (AUTO2E1).*

People came from all the automakers in Brazil. We shared information: “I bought this, I have it here, I have it there, buy it here, put it there ...” So, it was very fast. [...] We called, and the guys [companies] went (AUTO2E1).*

Enhancing disaster relief efforts

We distributed tons of basic food baskets that some NGOs bought, and they would like to distribute to the nearby community, and there was no transportation. TOBC1 provided 100% of this labor to be able to deliver (TOBC1E1).*

Here in São Paulo, in partnership with [an important hospital] and with [a large company in the steel sector], we built a 100-bed hospital in 33 days with our engineering team. It is not a field hospital, but it is for later. It is a pre-molded hospital, very cool. [...] The [steel company] gave the steel, we gave part of the money and ceded the entire engineering team, the pre-molding company used its know-how [in construction], and the [important hospital] is managing this hospital (BEER1E9).

FOOD2 donated R\$ 3 million to [a state where it has a factory] (FOOD2E3).

There was also an action that ELTR1 took in the education area. It donated tablets and notebooks to some [public] schools so that students can study at homeschooling (ELTR1E2).

[We invested] a few million in distributing basic food, creating portable washbasins for the population... On the production line, for example, [we learn] how to manufacture alcohol gel, we did not do that (PHRM1E3).

*TOBC1 did not supply products or produced them on a large scale. However, we have a research center and an area for developing [cigarettes'] essences where we developed alcohol and distribute it to local communities (TOBC1E1 *).*

Basically, they took the plastic they use in the guarana bottle, which was in lower demand, and made face shields in a factory. We took alcohol that we would use for [beer making], which is also in low demand, and made hand sanitizer. We didn't have this expertise before; I don't know how they did it (BEER1E4).

We have [a drink of] cassava in some states. In one of these states, we took this cassava and turned it into soaps to donate to needy communities and partnership with a company that produces soap (BEER1E9).

Dimension 3: Collective recovering	<i>I saw BEER2 delivering water to the community. I saw BEER2 delivering a mask and hand sanitizer to the community (BEER2E11).</i>
Recovering within supply chains	<p><i>Today, we aim to obtain more regional sources of supply and link a little bit of global [dual sourcing] (FOOD2E3).</i></p> <p><i>The company is seeking for new suppliers. We were even talking that this month we are having problems with disposable suppliers there, for example. I can't tell you the details, but BEER2 is already making this move (BEER2E10).</i></p> <p><i>What we have been suffering in the entire chain is due to the lack of material. Not [just] us, the whole market is suffering from this. As demand stopped for a long time, the supply chain was short of parts, impacting some production lines. [...] It did for almost everyone. Today, for example, cardboard is hard to find. (ELTR1E3).</i></p> <p><i>Moreover, the can is the most expensive component of beer today [...]. This plummets our profitability. That month there was a strong movement of strong return from glass bottles. So, the company decided to reduce their price to increase the volume [sold], thus equalizing profitability (BEER1E1*).</i></p> <p><i>We have a vast partnership with a company that develops Business Intelligence tools, and we are making a massive, huge information revolution. We have [implemented the system] in all areas; it is surreal. I own an operation, and I have a screen that accompanies ten distribution centers. I can follow from end to end (BEER1E7).</i></p> <p><i>We are now also investing heavily in digital, forcing retailers to make purchases through digital media. These are things that might take a few more years to be further developed; they were accelerated by the pandemic [...] BEER has a website [...]. On this website, the customer can make his purchase. Everything is there; everything appears right, the delivery date, the payment term ... Another promotion, more aimed at VIP bars, is encouraging these bars to create digital menus (BEER1E8).</i></p> <p><i>We suffered and adjusted [production], and there were also the most severe problems of suppliers with cash flow problems. So, we helped them with the know-how to give them access to some lines of credit that perhaps their finance specialists did not know about some lines that the government provided (AUTO1E10).</i></p> <p><i>The factories, in the beginning, had many difficulties because, like us here, they [suppliers] also gave their employees a vacation. So, we suffered periods of difficulty to buy. Now, we are also having this difficulty [to refuel], but it is due to the very high volume of sales throughout the state (BEER1E8).</i></p>

Dimension 3: Collective recovering

The dependence became greater for disposable [aluminum cans]. The market was not prepared for this [increased sales of canned beer]. We certainly had problems (BEER2E10).

It depends a little on the characteristic of the company. Some companies were in a more just-in-time process. They had less inventory because inventory generates cash spending and is reflected in the financial result. So, this company felt [the lack of inputs] earlier and other companies with six months of inventory and started [to lack inputs] when the pandemic was reaching the downward curve. I tell you, this [security stock] runs between 2 and 10 months or so (PHRM1E5).

The worst input is milk, but at the same time, I have a safe stock of powdered milk, for example. We do this type of thing to ensure the variation in demand that we have (FOOD2E2).

5. CHAPTER FIVE – GENERAL CONTRIBUTIONS AND CONCLUSIONS

*[...] BEER1, a bank, and a steel company participated in those constructions
[field hospital and vaccine factory during the pandemic]
(Beverage manager - BEER1E9)*

*It's very similar to a soccer team. [If] I'm Flamengo, am I share information with Atlético Mineiro? [...] I'm not
going to tell the whole secret. [...] I share information about technologies [that I applied in cargo theft
response] but not about our internal practices
(Beverage manager - BEER2E11)*

This dissertation investigated the dynamic between companies and the external environment, responding to threats emerging from it and building inter-organizational support beyond supply chain boundaries under uncertainty. I developed multiple case studies to explore this phenomenon, guided by the following research question: *How do companies and their supply chains interact with the environment under uncertainty?* The three essays have specific purposes in answering the main research question. The first essay aims to understand how companies develop their operations strategies to adapt to institutional uncertainties caused by weak institutions and how they build influence over those institutions. The second essay aims to understand how companies respond to cargo theft risk under distrusting inter-organizational relationships. Last, the third essay aims to understand how supply chains employed social capital to build resilience, enhancing relationships within and beyond their supply chains during the COVID-19 pandemic. The following sections provide a summary of each essay's contributions, the general contributions of this dissertation, managerial implications, and future research directions.

Summary of individual essay contributions

The recent operations and supply chain management [OSCM] literature has shown the importance of the external environment for supply chains (Dmitrijeva, Schroeder, Bigdeli & Baines, 2020; Ivanov, 2020; Liu, Aroean & Ko, 2019; Macdonald, Zobel, Melnyk & Griffis, 2018; Mollenkopf, Ozanne & Stolze, 2021), especially considering the mutual and complex relationships between them, however, researchers still have limited understanding of how dynamics affect supply chains (Ivanov, 2020). Few studies have considered the harmful effects

that have emerged from the environment for OSCM (Daghar et al., 2021; Durach & Machuca, 2018; Fan & Stevenson, 2018; Friday et al., 2018), and even fewer highlight the potential support for companies from other agents in the environment (Bonatto et al., 2020; Singh & Singh, 2019). My findings suggest that companies and their supply chains are embedded in a complex and mutual set of inter-organizational relationships, including several agents in the environment in which they operate, as summarized in Figure 5.1.

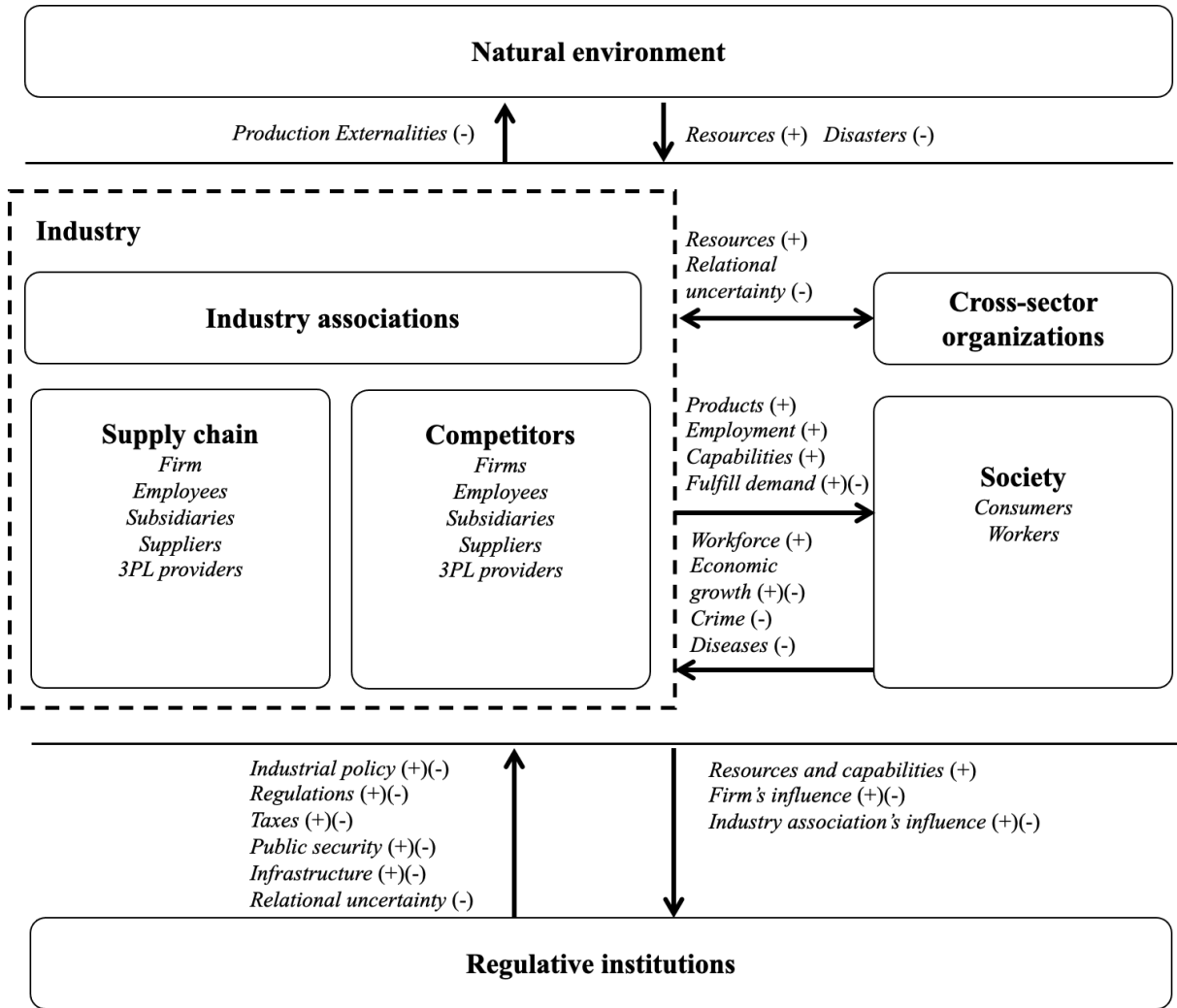


Figure 5.1. Influences in Extended Inter-organizational Supply Chain

In the first essay, I showed how weak institutions generate uncertainty for multinational companies [MNCs] and their supply chains. Institutional uncertainties can affect MNCs' operations performance, and these uncertainties can spread to other agents in the environment as relational uncertainties, especially suppliers. Moreover, the essay reveals that those companies build influence over weak institutions in times of need, seeking support by building

industrial policies or seeking resources from those institutions. Therefore, I highlighted how companies perceive institutions as a simultaneous source of threats and support.

The dual role of weak institutions was carefully addressed by the second essay, which concerned how companies enhance government institutions and cross-sector partners to respond to the threat of cargo theft. That essay examines companies embedded in a high-risk environment for cargo theft attacks that emerged from weak government institutions, especially those related to police protection and legal power. I expanded the understanding of the cargo theft phenomena by conceptualizing it as a risk that arises from weak institutions. Due to its violent nature, companies need to learn how to work with government institutions in responding to the threat of cargo theft. That led me to propose that companies rely on inter-organizational relationships to respond to intentional threats. However, weak institutions open the door for opportunistic and unlawful behaviors that reduce trust and, consequently, destroy social capital. The results suggest that relational governance can be employed to improve trust and social capital, leading the companies to develop better SCRM knowledge and achieve greater risk resilience.

I addressed supply chain resilience to external threats in the third essay, highlighting social capital as an essential asset to the three phases of supply chain resilience during highly uncertain events, specifically the COVID-19 pandemic. My research found that companies rely on cross-sector organizations, competitors, and government institutions to promote their supply chain resilience. Information and resource sharing supported the anticipation of threats, early protection, and the development of collective response and recovery. The results showed that companies incorporated disaster relief efforts as part of their supply chain resilience process to stabilize their environment due to the nature of the pandemic. I propose that resilience must be understood from a comprehensive perspective, bringing to the OSCM field the concept of “collective supply chain resilience”. I believe this concept is suitable for understanding resilience in this type of disruption.

In sum, my findings highlight those inter-organizational relationships are sources of both threats and resources for companies and their supply chains. For example, companies employ resources that emerge from society, such as the workforce for production. However, the same employees responsible for companies’ activities are those who could be part of a cargo theft scheme or could spread diseases in the workplace. My three essays contribute to the literature by addressing the potential dual role of the external environment as a source of both threats and resources for companies, specifically under weak institutional support (Kelling,

Sauer, Gold & Seuring, 2020; Lee, Abbey, Heim & Abbey, 2016; Zhou, Su, Yeung & Viswanathan, 2016) and during the Coronavirus [COVID-19] pandemic context (Craighead, Ketchen & Darby, 2020; Gunessee & Subramanian, 2020; Hoek, 2020; Ivanov, 2020; Ivanov & Dolgui, 2020). Therefore, researchers should stop ignoring the external environment, incorporating threats that emerge from it in OSCM research (Dmitrijeva et al., 2020; Macdonald et al., 2018; Liu et al., 2019). I hope that this leads our field to more realistic research, better contributions to the literature, and more practical business applications.

General theoretical contribution

New findings emerged from my research by comparing the results of the three essays. In the face of threats, companies must decide how they will respond to them, and if they will collaborate or not with other companies (Table 5.1). In the second essay, for example, the automotive companies responded to cargo theft alongside an external risk management consulting, reducing its impact to an acceptable level. Due to cargo theft lower impact on its operations, the companies did not establish relationships beyond their supply chains, such as the police or competitors.

On the other hand, the tobacco company relied on government institutions and cross-sector partners to respond to cargo theft attacks. Because of cargo theft's violent nature, the tobacco company realized that it did not possess the resources to properly respond to it. Moreover, the automotive industry jointly built on industrial policy with the government through its national association, the National Association of Motor Vehicle Manufacturers [ANFAVEA], composed of 26 manufactures that represent 18% of the industry of transformation in Brazil (ANFAVEA, 2021). In both cases, the companies need resources from other organizations, which include legal, police, or policy powers from the government institutions and the power of influence from their competitors. Therefore, companies are much more prone to collaborate in the face of the need to respond to a common threat. This is essential in establish collaborative efforts, resulting in mutual benefits. Thus:

Proposition 5.1. A higher collaborative response is associated with a higher need for resources from other organizations in the face of threats

Proposition 5.2. A higher collaborative response is associated with mutual benefits during a common threat

Even when a company decides to collaborate with other organizations, there are different levels at which joint efforts could be made. Although companies enhanced government institutions and cross-sector organizations in their collaborative cargo theft response, they did not include other organizations in the external environment, such as competitors. It seems that they were just trying to reduce the attacks in their own operations, not to respond to the public security problem. They were trying to navigate in a very challenging environment without getting harmed by it. However, if the environment was not stabilized, their collaborative risk response could lead criminals to steal cargo from those with a lack of resources and technologies, such as small and medium-sized companies. Therefore, the benefits from this collaboration were limited to those within their network.

On the other hand, companies that employed a collective response to threats, enhanced inter-organizational relationships more broadly. During the COVID-19 pandemic, they provided essential goods and employed their operations capabilities, sharing information and resources to create and maintaining critical infrastructure. Specifically, the network created by automotive companies, government institutions, and cross-sector partners rebuilt ventilators for the entire country, employing previous ties from a public policy committee. Unlike the companies that donated products to communities surrounding their own operations, the automotive network extended its benefits to stabilize the entire environment. It is similar to the beverage company (BEER1) that built a vaccine factory alongside its cross-sector partners. Glynn (2021) suggests that collective resilience must include companies, institutions, communities, and society, unlocking needed resources in need and working together as a community in times of great uncertainty. Thus:

Proposition 5.3. Higher collective response is associated with diffuse loss in the environment

Proposition 5.4. Higher collective response is associated with extended benefits to the entire environment

Proposition 5.5. Higher collective response is associated with a more stable environment

Table 5.1 – Individual, Collaborative, and Collective Response

	Individual response	Collaborative response	Collective response
Cargo theft context	AUTO1; AUTO2; ELTR1; FOOD2; PHRM1	BEER1; BEER2; FOOD1; TOBC1	None
The COVID-19 pandemic context	ELTR1; FOOD1; FOOD2; PHRM1	BEER2; TOBC1	AUTO1; AUTO2; BEER1
Aim	Reduce the impact to an acceptable level for the company/SC	Restore/create competitiveness for the company/SC/network	Restore/stabilize the entire environment
Nature of the threat	Lower impact on the company/SC Concentrated loss in the company/SC	Higher impact on the company/SC	Multiple impacts on the companies/SCs and their common market (consumers) Diffused loss in the environment
Strategic level	Non-strategic in terms of competitiveness or social responsibility	Very strategic in terms of competitiveness	Very strategic in terms of social responsibility
Geographic extent	Limited extent (operations/local)	Limited extent (local/regional)	Broader extent (national)
Potential network extent	The company/SC and its commercial relationships	Those who possess needed resources: SC partners, cross-sector companies, and government institutions	Directly or indirectly everyone in the environment: SC partners, cross-sector companies, NGOs, government institutions, and society
Collaboration with competitors	No collaboration beyond SC boundaries	Less prone to share costs and benefits with competitors	More prone to share costs and benefits with competitors

	Individual response	Collaborative response	Collective response
Benefited agents	The company/SC and its commercial relationships	Those within the network	The entire environment
Level of trust required	Lower level of trust beyond SC boundaries	A minimum level of trust acquired by relational governance mechanisms	Higher level of trust from previous relationships

Note. SC – Supply chain.

Managerial implications

My dissertation has managerial implications as well. As global supply chains expand their operation worldwide, they must adapt to additional challenges in this diverse environment. OSCM practitioners must identify threats but also business opportunities from the external environment, seeking, in advance, to improve firms' competitiveness in environments characterized by weak institutions, violence, unlawful behavior, and potential diseases spread. Co-evolutionary, institutional, social capital theories provide useful guides for managers to navigate in uncertain environments.

Managers need to be aware about the potential benefits of inter-organizational relationships with other companies, within and beyond their supply chains. They should enhance relationships with other agents to access needed resources, developing mechanisms that reduce opportunistic and unlawful behavior. My results showed that relationships beyond supply chains can be intensively employed by companies under threats, promoting faster response and better resilience. It also proposed that joint efforts are very effective for building new opportunities, such as industrial policies.

Supply chains must position themselves to not only provide their direct customers during times of plenty but also to be part of a community and society during times of need. During times of great uncertainty, companies should enhance their operations capabilities to provide essential goods, share information and resources, and create and maintain critical infrastructure for society. Companies should seek to stabilize the entire environment, more than only obtain organizational recognition.

Limitations and future research directions

This dissertation has limitations that point to unanswered questions for future research. First, although the interviews provided insights about supply chain aspects, I only interviewed buying companies. Understanding those insights through supplier's or multi-tiers' perspectives could bring new insights to our findings, especially in the first and third essays. Second, all companies have operated in the same global environment for decades, adapting their resources to the environment over time. It could be interesting to compare the same company embedded in two or more institutional environments characterized by solid and weak intuitions. For example, compare practices employed for a subsidiary that operates in Brazil and another in the United States, especially for their response to the threat of cargo theft. Also, future research

could compare their response strategy to those employed by new entrants to the Brazilian market. I question: would companies from environments characterized by stable institutions be more to respond to institutional uncertainties in Brazil?

There is a great deal more to be revealed about whether relationships built during times of need will prevail or evolve when there is less uncertainty, especially for those built during the COVID-19 pandemic. Substantial contributions can emerge in how those relationships can be applied to develop new solutions to future threats. Those non-answered questions lead to exciting opportunities to explore in future research. Therefore, the dynamic between supply chains and the external environment suggests a rich agenda for OSCM researchers.

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