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Responding to Supply Chain Disruptions: A Behavioural Approach

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**Responding to Supply Chain Disruptions:
A Behavioural Approach**

by

Mehrnoush Sarafan Chaharsoughi

Thesis

submitted for the degree of

Doctor of Philosophy

University of Bath
School of Management

September 2018

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- Chapter 3 is based on a pre-printed manuscript, which will be shortly submitted for publication. I declare that I contributed to 70% formulation of ideas, 80% design of methodology, 70% experimental work, and 70% presentation of data in journal format;
- Chapter 4 is based on a pre-printed manuscript, which will be shortly submitted for publication. I declare that I contributed to 70% formulation of ideas, and 70% presentation of data in journal format;
- Chapter 5 is based on a pre-printed manuscript, which is under review in Journal of Operations Management. I declare that I contributed to 60% formulation of ideas, 60% experimental work, and 55% presentation of data in journal format.

Mehnoush Sarafan

September 2018

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Abstract

This thesis aims to understand the impact of behavioural factors on supply chain disruption responses. It constitutes three studies that each investigate a key behavioural factor that shapes managerial decisions and direct organisational actions at a particular phase of a supply chain disruption, that is 1) discovery, 2) recovery, and 3) redesign. While discovery refers to the period of time when firms become aware of an impending disruption, recovery and redesign are concerned with remedial actions in the short- and long-term aftermath of an event. The three studies are as follows:

- 1) Study 1 uses a vignette-based experiment to examine the effect of individual-level cultural values on managerial responses to an impending supply chain disruption. The findings from this study show that uncertainty avoidance is positively related to managerial perception of risk and supplier switching intention in the face a disruption. Moreover, collectivism is negatively related to disruption risk perception and supplier switching intention, but only when the level of uncertainty in a situation is high.
- 2) Study 2 draws from construal level theory to develop a set of propositions on the interplay between a supplier's recovery actions and buyer's responses during disruption recovery. Overall, the propositions highlight that the effect of a supplier's particular action on buyer's behaviour is dependent on spatial, temporal and social distance from a disruption triggering event.
- 3) Study 3 applies attribution theory to investigate the link between disruption characteristics (severity and controllability), blame, and supply base redesign in the aftermath of a disruption. Using a vignette-based behavioural experiment, the study finds that severity does not have a significant effect on blame, whereas, controllability is positively related to people's attribution of blame. Subsequently, the study applies a cross-sectional survey to examine the impact of blame on redesign decisions in real-life organisational settings. The findings show that attribution of blame only leads to redesign decisions when the level of trust in the supplier is low.

Chapter 1 Introduction to this Thesis

1.1 Background to research

Supply chain disruptions refer to unexpected interruptions of “the normal flow of goods and materials within a supply chain” (Bode & Wagner, 2015; Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007, p. 132) that have the potential to cause short- and long-term losses in sales (Hendricks & Singhal, 2005), shareholder wealth (Hendricks & Singhal, 2003; Jacobs & Singhal, 2017), and buyer-supplier relationships (Reimann, Kosmol, & Kaufmann, 2017; Wang, Craighead, & Li, 2014). Over the last two decades, the increasing globalisation of and competition in markets have stimulated concerns around efficiency and effectiveness of business (Wagner & Bode, 2006). As a result, firms have initiated strategies, such as outsourcing, lean operations, agile logistics, close collaboration with exchange partners, and multi-enterprise IT systems that have contributed to responsiveness and profitability in stable environments, but have also created uncertain and complex supply chain structures exposed to various sources of disruption (Boyson, 2014; Christopher & Peck, 2004; Hendricks & Singhal, 2005; Pettit, Croxton, & Fiksel, 2013). Moreover, the widespread economic and operational impacts of events, such as natural disasters, financial crises, and political upheavals have highlighted the vulnerability of global supply chains to a range of unexpected macro events for which prevention is simply not feasible (Hohenstein, Feisel, Hartmann, & Giunipero, 2015; Macdonald & Corsi, 2013).

In response, operations and supply chain management scholars have offered various strategies in regards to supply chain structures (Ang, Iancu, & Swinney, 2017; Tang & Tomlin, 2008), operational resources (Hendricks, Singhal, & Zhang, 2009; Yang, Aydın, Babich, & Beil, 2009), and firms’ capabilities (Braunscheidel & Suresh, 2009; Tomlin & Snyder, 2006) to create supply chain robustness and resilience (Hohenstein et al., 2015; Ponomarov & Holcomb, 2009; Tang, 2006). For instance, Van Mieghem (2007) takes a network view to find optimal safety capacities and inventories that reduce financial risks in supply chains, whereas, Braunscheidel and Suresh (2009) study the effect of organisational market and learning

orientations on agility capabilities and risk mitigation. These studies have contributed significantly to risk planning and the design of mitigation strategies in advance of a disruption. However, we know very little about what organisations do when disruptions happen (Bode, Wagner, Petersen, & Ellram, 2011; Macdonald & Corsi, 2013; Reimann et al., 2017; Sodhi, Son, & Tang, 2012). This is surprising, because organisational responses to a disruption have been seen as a key determinant of the overall costs and supply chain performance following the event (Bode et al., 2011; Ivanov, Dolgui, Sokolov, & Ivanova, 2017; Sáenz & Revilla, 2014; Sheffi & Rice Jr., 2005).

Importantly, the literature has provided limited insights into the role of the individual manager who is responsible for making decisions and coordinating response actions (Ambulkar, Blackhurst, & Cantor, 2016; Bode & Macdonald, 2016; Cantor, Blackhurst, & Cortes, 2014; Polyviou, Rungtusanatham, Reczek, & Knemeyer, 2018; Tokar, 2010). In other words, individuals have not been the main phenomenon under study or, if considered, have been seen as rational decision-makers (Ancarani & Di Mauro, 2012; Bendoly, Donohue, & Schultz, 2006). That is, they are able to identify risks, evaluate all possible alternatives and make “optimal” decisions (Boudreau, Hopp, McClain, & Thomas, 2003; Gino & Pisano, 2008). However, there is evidence that individuals often violate these assumptions in systematic ways, especially when facing uncertainty (Bendoly et al., 2006; Carter, Kaufmann, & Michel, 2007; Loch & Wu, 2007). The advance of research in behavioural operations has suggested that because of the limitations in human beings’ cognitive resources (*i.e.* bounded rationality), managers are unable to attend to all information in the environment and instead, rely on a range of socio-psychological processes to interpret an event and make decisions (Kahneman & Tversky, 1974; Simon, 1979; Tokar, 2010). This is important in uncertain disruption environments, because it could introduce systematic biases into the decision-making process and subsequently, influence the effectiveness of disruption responses (Polyviou et al., 2018). Therefore, to improve the understanding and predictability of organisational responses, studying the behaviour of an individual manager seems essential (*cf.* Bendoly et al., 2006; Carter et al., 2007; Tokar, 2010).

1.2 Background of problem in practice

Over the last two decades, supply chain risk management has become a focal concern for practitioners (Croson et al., 2013; Sodhi et al., 2012). The operational and economic impacts of events, such as the 2011 Japanese earthquake and tsunami, the 2015 explosion at the Port of

Tianjin, the 2016 bankruptcy of Hanjin Shipping (one of the world's largest container carriers), and the 2018 shortage of electronic components (such as, capacitors, resistors, and memory) on global supply chains have made organisations aware of the vulnerability of their operations (Hendricks and Singhal, 2005; Ho et al., 2015; Tang, 2006). As a result, they have designed risk management frameworks to identify vulnerable areas in supply chain, analyse historical records, estimate the probability and potential damages of disruption on various functions within the organisation, evaluate an expected value and use a set a “optimal” strategies to mitigate risk (Waters, 2011). Although these have shown significant value in the management of events for which historical information about the cause, consequences, and potential resolutions are available (Tazelaar and Snijders, 2013; Ellis et al., 2011), they may not be effective in situations of disruption. In other words, due to the unexpected and uncertain nature of disruption environment, the implementation of formal approaches that are based on estimating objective risks and calculating “optimal” solutions is not possible nor effective (Waters, 2011).

Facing a supply chain disruption, it is often a responsibility of the individual manager, who is in charge of coordinating supply and demand of the product/component, to detect risk and activate mitigation plans, such as rerouting transportation, adding inventory, and supplier switching (Ambulkar et al., 2016; Bode and Macdonald, 2016; Ellis et al., 2011). Given uncertainty of the causes and consequences, and the lack of clear decision-making structure, managers often perform such tasks in an ad-hoc fashion (Bode and Macdonald, 2016; Jüttner, 2005). Recent empirical evidence has shown that that individual managers respond to such events in systematically different ways (Ellis et al., 2010; Polyviou et al., 2018). Therefore, to improve the effectiveness and predictability of disruption management processes, understanding the root causes of such variations is important. From a practical point of view, understanding the underlying factors that lead to heterogeneity of disruption responses is the first step in the process of controlling and governing them (Carter et al., 2007). Such understanding, coupled with detailed insights into the moderating impact of contextual and situational factors could facilitate the design of intervention strategies and decision environments that minimise variations (*e.g.* decision biases) and result in “desired” behaviour (Schorsch et al., 2017; Tokar, 2010).

In a recent survey of 772 executive managers, McKinsey & Company finds that participants rated “reducing decision biases” as their primary aim for improving performance (Bhagat and Kehoe, 2014). Through the application of de-biasing approaches, such as screening and

training programmes for managers, firms are able to reduce variations in decision-making behaviour and improve control over decision outcomes (Tokar, 2010). The following quote from the CEO of the KNRM (Royal Netherlands Sea Rescue Institution) highlights the importance of such approaches in dealing with unpredictable situations: “you can’t predict the details of every emergency that we will respond to, therefore, we can’t rehearse every eventuality and we don’t try to. What one can do is select the right people for the job and present them with ever-changing training scenarios so that they become used to making decisions under stress’ i.e. quality people and repetitive training” (Preston, 2017).

1.3 Research problem

This thesis takes a behavioural lens to understand the underlying factors that influence managerial decisions and drive organisational actions in the event of a supply chain disruption. Accordingly, it seeks to answer the following question:

Research Question: “How do behavioural factors impact supply chain disruption responses?”

In answering this question, the thesis is built on three studies that each investigates a key behavioural factor in shaping managerial decisions at a particular phase of disruption response, that is 1) discovery, 2) recovery, and 3) redesign. While discovery involves preventive actions when organisations become aware of an impending disruption, recovery and redesign are concerned with remedial responses in the immediate and long-term aftermath of an event (Macdonald & Corsi, 2013). Past research has shown that the successful management of a disruption depends on organisational responses at these sequential phases (Blackhurst, Craighead, Elkins, & Handfield, 2005).

Study 1 draws from the advance of behavioural research and cross-cultural studies to investigate the effect of individual-level cultural values on managerial perception of risk and responses to an impending disruption. Traditionally, it has been assumed that, when faced with a risk, managerial decisions are shaped by objective evaluations of the probability and impact using statistical analysis and quantification techniques (Tazelaar & Snijders, 2013). However, extant behavioural research has suggested that the uncertainty of a disruption environment and individuals’ bounded rationality lead managers to rely on subjective evaluations of risk, that are shaped by a range of socio-psychological factors (DuHadway, Carnovale, & Kannan, 2018; Ellis, Henry, & Shockley, 2010; Kull, Oke, & Dooley, 2014; Sitkin & Pablo, 1992). Culture,

in particular, has been shown to affect managerial risk perception by driving their attention to important cues in the environment and facilitating sense-making when situations are ambiguous (Gibson, Maznevski, & Kirkman, 2009; Weber & Hsee, 2000). This is especially important in the supply chain context, where firms are increasingly trading with exchange partners who are located around the world and hold different cultural values (Ribbink & Grimm, 2014). Therefore, Study 1 uses a behavioural experiment to answer the following question:

Research Question for Study 1: “How do individual-level cultural values influence responses to an impending supply chain disruption?”

Study 2 applies construal level theory to investigate the effectiveness of a supplier’s recovery actions on buyers’ responses during disruption recovery. When a supply chain disruption occurs, a key challenge for a buying firm is whether to cooperate or disengage from the supplier who has caused the event (Polyviou et al., 2018). Within the literature, scholars have used the terms bridging and buffering to refer to alternative cooperative and non-cooperative actions (Reimann et al., 2017). There is evidence that the outcome of such actions have a determining impact on the overall costs of a disruption, and the performance of the focal buyer-supplier relationship following the event (Bode et al., 2011; Ivanov et al., 2017; Reimann et al., 2017; Sheffi & Rice Jr., 2005). Given their value, extant literature has investigated the effect of a range of pre-established organisational and relational factors on shaping alternative bridging and buffering responses (Bode, Huebner, & Wagner, 2014; Bode et al., 2011; Kaufmann, Carter, & Rauer, 2016). However, these studies have largely overlooked the role of a supplier’s recovery actions in the wake of a disruption (Reimann et al., 2017; Wang et al., 2014). This is surprising, especially given that supply chain disruptions are dyadic by nature (Bode et al., 2011) and hence, the actions of the supplier during an event could alter buyers’ perceptions of, and reactions to, the incident (Primo et al., 2007; Urda & Loch, 2013; Wang et al., 2014). Therefore, Study 2 draws from construal level theory and construal fit hypothesis to develop a set of propositions that provide insights into the following question:

Research Question for Study 2: “How do a supplier’s recovery actions influence buyers’ responses during disruption recovery?”

Study 3 draws from attribution theory to examine the effect of attribution of blame on post-disruption redesign responses. Extant supply chain risk literature has previously focused on the

proactive design of resources and operational capabilities to build supply chain resilience (e.g. Blackhurst, Dunn, & Craighead, 2011; Craighead et al., 2007; Hohenstein et al., 2015; Tang, 2006). However, less attention has been paid to the post-disruption redesign decisions to improve resilience (Blackhurst et al., 2005). This is important, because there is evidence showing that such responses are a key determinant of supply chain performance when facing similar events in the future (Sáenz & Revilla, 2014). Therefore, Study 3 draws from attribution theory to argue that blame is an underlying factor that motivates post-disruption redesign decisions (Weiner, 1972; Weiner, 1985). According to the theory, people seek blame attributions following the occurrence of negative and unexpected events, such as a supply chain disruption (Coombs, 2007). Attribution of blame helps people to understand why an event happened and thus, take appropriate remedial actions (Driedger, Mazur, & Mistry, 2014; Rosenthal & Schlesinger, 2002). The theory suggests that the extent of blame itself, is determined by characteristics of an event (e.g. severity and controllability) (Weiner, 1995). Therefore, drawing from attribution theory, Study 3 uses a behavioural experiment and cross-sectional survey to answer the following question:

Research Question for Study 3: “How does attribution of blame influence buyers’ redesign responses in the aftermath of a disruption?”

1.4 Units of analysis

The thesis focuses on managerial decision-making in response stages of supply chain disruption. In making such decisions, organisations assign an individual manager as a recovery lead to evaluate a situation, make appropriate decisions, and coordinate response actions (Polyviou et al., 2018; Bode et al., 2016). However, individuals do not make decisions in isolation. They are organisational entities whom their judgement and responses are influenced by a specific context of their organisation, supply chain relationships, and disruption environment. The thesis applies socio-psychological theories to understand the impact of individual and contextual factors in such decision-making processes. In line with respective theories used in each paper, the thesis applies various units of analysis related to response decisions and context of the decision. Table 1:1 provides a summary of applied units of analysis.

Table 1:1 Units of Analysis in the Thesis

	Unit of analysis	Context of the decision
Study 1	Individual manager	Disruption environment (situational uncertainty)
Study 2	Individual manager; disruption event	Disruption environment (suppliers' recovery actions)
Study 3	Disruption event	Supply chain relationship (inter-firm trust)

1.5 Overview of contribution

This thesis makes three main contributions to the literature. First, it advances theoretical understanding of individual and contextual factors that influence supply chain disruption responses (*cf.* Bode et al., 2014, 2011; Polyviou et al., 2018; Reimann et al., 2017). While extant supply chain risk research has mainly investigated the effect of organisational resources and supply chain capabilities on planning and prevention of disruption risks (*e.g.* Bode and Wagner, 2015; Brandon-Jones et al., 2014; Ho et al., 2015; Knemeyer et al., 2009; Tang, 2006), less attention has been paid to the antecedents of organisational responses when such events happen (Bode et al., 2011; Reimann et al., 2017; Sodhi et al., 2012). This is important in today's business environment, where the uncertainty and complexity of the integrated supply chain make the occurrence of disruptions inevitable (Macdonald & Corsi, 2013). When a disruption happens, organisational actions are a key factor in determining the consequences and firms' performance following the incident (Bode et al., 2011; Macdonald & Corsi, 2013; Reimann et al., 2017; Sáenz & Revilla, 2014; Sheffi & Rice Jr., 2005). Therefore, to address the gap, the three studies within this thesis take a behavioural approach to understand the underlying factors that shape responses at three different stages of a supply chain disruption.

Second, the thesis contributes to the burgeoning stream of behavioural research by reemphasising the importance of individual-level behaviour in driving organisational responses to supply chain disruptions (*cf.* Ambulkar et al., 2016; Cantor et al., 2014; DuHadway et al., 2018; Ellis et al., 2011, 2010; Polyviou et al., 2018). Traditionally, research has assumed that when facing risks, managerial decisions are based on an objective rational process and hence

the outcome is “optimal” (Ellis et al., 2010; Gino & Pisano, 2008; Tokar, 2010). However, the advance of behavioural operations studies has shown that this may not always be the case (Bendoly, Croson, & Schultz, 2009; Bendoly et al., 2006; Carter et al., 2007). In other words, managers have individual and social preferences that may not conform to the profit-maximising objectives of a firm (Loch & Wu, 2007). In addition, because of the uncertainty in the environment and individuals’ bounded rationality, managers are influenced by a range of behavioural factors that could result in suboptimal decisions (Kahneman & Tversky, 1974; Simon, 1979). Therefore, to improve the predictability and effectiveness of supply chain disruption responses, understanding such behavioural factors are of significant importance (Gino & Pisano, 2008; Tokar, 2010). The three studies within this thesis make contributions to the extant literature by highlighting the socio-psychological factors which influence managers’ decisions relating to disruption response.

Third, the findings contribute to the behavioural theories used as the basis of this thesis. In particular, Study 1 draws from cross-cultural studies to develop a set of hypotheses on the relationship between cultural dimensions, *i.e.* uncertainty avoidance and individualism-collectivism, and disruption risk perception. The relationship between these dimensions and risk perception has been previously investigated in various decision-making contexts (*e.g.* Bontempo et al., 1997; Rieger et al., 2015; Weber and Hsee, 1998; Xue et al., 2014), however, these studies have mainly used Hofstede’s country-level value scores as a proxy for culture (Kirkman, Lowe, & Gibson, 2017). Although this provides insights into the mechanism of cultural effects, it might not capture possible within-country variations of sub-cultures (Yoo, Donthu, & Lenartowicz, 2011). This is especially important in today’s globalised environment, where people may be exposed and influenced by a range of different sub-cultures (Taras, Kirkman, & Steel, 2010; Taras, Roney, & Steel, 2009). Therefore, Study 1 examines the effect of culture, as reflected in individuals’ value orientation, to extend previous country-level findings to the individual-level “container” of culture (Gelfand, Aycan, Erez, & Leung, 2017; Kirkman et al., 2017, p. 19). Additionally, it makes a further contribution to cross-cultural research by integrating the moderating impact of situational uncertainty and examining not only *whether culture matters*, but also “when and how culture matters” the most (*cf.* Gibson et al., 2009; Kirkman et al., 2017, p. 15; Nouri et al., 2013). Similarly, Study 3 advances the application of attribution theory by incorporating a supply chain-specific factor, *i.e.* trust, into the relationship between blame and behaviour (Martinko, Harvey, & Douglas, 2007). While previous research has shown the effect of blame attribution on various operations and supply

chain decisions (e.g. Hall and Johnson-Hall, 2017; Mir et al., 2017; Ro et al., 2016), the findings from Study 3 show that the impact is contingent upon the level of trust in the relationship. In other words, blame only matters when the prior level of trust in the relationship is low. Therefore, Study 3 findings contribute to attribution theory by highlighting not only whether blame matters in redesign decisions, but also *when it matters the most*.

1.6 Overview of methodology

Study 1 used a vignette-based experiment (Eckerd, 2016; Rungtusanatham, Wallin, & Eckerd, 2011) to examine the impact of cultural values, *i.e.* uncertainty avoidance and individualism-collectivism, on disruption risk perception and supplier switching intention under two conditions of situational uncertainty. The experimental scenario was based on an impending labour strike at a supplier's plant, and developed using news reported in online media. Situational uncertainty was manipulated in terms of variations around the consequences of the potential disruption (*cf.* Johnson and Slovic, 1995). In the low uncertain condition, the scenario specified the exact duration for the strike ("*a potential strike will last for 4 weeks*") while the high uncertain condition provided a possible range of the strike duration ("*such events could last between 1 week to 2 months*"). Cultural values, disruption risk perception, and supplier switching intention were measured adapting existing survey measurement tools (Jia, Khan, & Litt, 2015; Mir et al., 2017; Yoo et al., 2011). The study recruited 220 operations and supply chain managers through a survey firm, Qualtrics, which has been increasingly used by operations and supply chain management scholars to run experiments (*cf.* Kaufmann, Rottenburger, Carter, & Schlereth, 2018; Schoenherr, Ellram, & Tate, 2015). The application of a vignette-based experiment in Study 1 provided a controlled set-up to rule out the potential effect of other contextual factors on disruption responses and hence, established internal validity in the findings (Eckerd, 2016).

Study 3 applied a vignette-based experiment and cross-sectional survey in two consecutive stages (*cf.* Chua, 2012; Duclos et al., 2013; Hewlin et al., 2017; Sutanto et al., 2013). In the first stage, an experiment was used to examine the relationship between disruption characteristics, *i.e.* severity and controllability, and people's attribution of blame. The vignette was drawn from the news reported in media describing the occurrence of a labour strike at a supplier's plant. Severity was manipulated at two levels (*i.e.* low and high) around the amount of the firm's slack inventory. In addition, controllability was manipulated to convey the extent of supplier's control over the causes of the strike. Attribution of blame was measured adapting

existing multi-item survey tools (Klein & Dawar, 2004; Lei, Dawar, & Gürhan-Canli, 2012). The study sample was 137 MBA students in a UK-based business school. The use of experiment provided a controlled environment to restrain endogeneity issues caused by a potential correlation between controllability and blame (Coombs & Holladay, 2002). In the second stage, Study 3 examined the impact of blame and prior trust on redesign decisions using cross-sectional survey. The aim of this stage was to capture the reality of redesign decisions in organisational settings. All variables in the survey were measured using existing multi-item measurement tools. The data was collected through a self-administrated mail-based survey from 115 operations and supply chain managers working in the UK manufacturing sector.

1.7 Overview of findings

Study 1 findings show that people with high uncertainty avoidance orientation tend to perceive higher levels of disruption risk compared to their counterparts in a similar situation. However, there are no significant differences between the effect of uncertainty avoidance on risk perception across the two conditions of uncertainty. Moreover, compared to individualists, collectivists are likely to perceive lower disruption risk, but only under high uncertain circumstances. Study 1 does not find a significant relationship between individualism-collectivism and disruption risk perception in low uncertainty conditions. Furthermore, the findings show that for both cultural values, higher levels of disruption risk perception lead to higher supplier switching intention in the face of an impending event.

Study 2 develops a set of propositions that investigate the relationship between a supplier's recovery actions and buyers' bridging and buffering responses. When a supply chain disruption occurs, the supplier provides a range of psychological and tangible actions to ameliorate the situation and enhance buyers' negative perceptions of the supplier caused by the event (Reimann et al., 2017; Wang et al., 2014). While psychological actions focus on social repairs by apologising and providing explanations, tangible actions are intended to recover operational and financial losses by strategies, such as replacement and compensation (Liao, 2007; Reimann et al., 2017). Drawing from construal level theory and construal fit hypothesis, Study 2 proposes that psychological actions are more effective in enhancing a buyer's satisfaction with the supplier's actions when the disruption is spatially, temporally, and/or socially (*i.e.* psychologically) close. On the other hand, if the disruption is psychologically distant, tangible actions could be relatively more effective in enhancing a buyer's satisfaction with the supplier's activities. Moreover, Study 2 propositions show that higher levels of satisfaction

with the actions are associated with bridging responses, such as resource sharing and collaborative risk management, whereas a relatively lower level of satisfaction leads to buffering responses, such as supplier switching and adding slack resources.

The experimental findings of Study 3 show that disruption controllability is positively associated with the perception of the supplier's blameworthiness, but that the severity of a disruption does not have a significant effect. Moreover, the results of the survey in Study 3 highlight the contingent effect of attribution of blame on supply base redesign. Buyers only act upon their attribution of blame when the level of prior trust in the supplier is low.

1.8 Overview of structure

This thesis constitutes 6 chapters. The current chapter (**Chapter 1**) has introduced the background of research, and provided an overview of research problem, contributions, methodology, and findings of the thesis. The remaining chapters are organised as follow.

Chapter 2 is based on two main parts. In the first part (Section 2.1), the researcher reviews the context for this thesis. In particular, it discusses the concept of risk (2.1.1), supply chain risk (2.1.2), and supply chain risk management (2.1.3). This is followed by an overview of research gaps (2.1.4), related to supply chain disruption response and individual-level behaviour. Lastly, the researcher discusses the aim of the thesis, and provides an overview of each paper (2.1.5). In the second part (Section 2.2), the researcher discusses the research paradigm for this thesis; Section 2.2.1 and 2.2.2 review the concept of research paradigm, and various research inquiries in management studies. Subsequently, Section 2.2.3. discusses the philosophical point of view and methodologies chosen for this thesis.

Chapter 3 presents the first empirical paper within this thesis that aims to investigate the effect of individual-level cultural values on supply chain disruption responses at the discovery stage.

Chapter 4 is a conceptual paper on the effect of a supplier's recovery actions on buyers' responses during a supply chain disruption.

Chapter 5 is the second empirical paper that examines the effect of blame and trust on supply base redesign decisions following the occurrence of a disruption.

Chapter 6 provides a discussion on the theoretical contributions (6.1) and practical implications (6.2) of this thesis. Moreover, it discusses the limitations of the research and offers opportunities for future studies (6.3).

Chapter 2 Context and research paradigm for this thesis

This chapter constitutes two main parts. In the first part (Section 2.1), the researcher provides an overview of the context for this thesis; Section 2.1.1 and 2.1.2 describe the concept of risk and supply chain risk. Section 2.1.3 reviews the extant literature on different stages of supply chain risk management, *i.e.* risk identification, risk evaluation, risk mitigation, and risk monitoring. Section 2.1.4 identifies two gaps in the literature, related to supply chain disruption response stage and individual-level behaviour. Lastly, Section 2.1.5 discusses the aim of this thesis, and provides an overview of the three studies within the thesis. In the second part (Section 2.2), the researcher discusses the research paradigm for this thesis; Section 2.2.1 and 2.2.2 review the concept of research paradigm, and different research inquiries in management studies. Subsequently, Section 2.2.3 discusses the philosophical perspective of this thesis.¹

2.1 Part 1: context for this thesis

The aim of this section is to discuss the theoretical background for the three studies within this thesis. First, it provides an overview of the concept of risk, supply chain risk, and supply chain risk management. This will be followed by a discussion on research gaps in regards to supply chain disruption response and individual-level behaviour. Lastly, the researcher provides an overview of the three studies within this thesis.

2.1.1 The concept of risk

During the eighteenth century, the concept of risk emerged in the scientific discourses, extracted from new ideas in mathematics relating to probability calculations (Yates & Stone, 1992). Since then, scholars have extensively discussed and defined risk in different fields of research and business contexts (Aven, 2016; Baird & Thomas, 1990; Harland, Brenchley, & Walker, 2003; Knight, 1921; Markowitz, 1952; Shapira, 1995; Slovic, 1987). An extensive

¹ Parts of this chapter is based on an accepted book chapter, which will be shortly published in “Sarafan, M., Squire, B., and Brandon-Jones E., (forthcoming). A behavioural view of supply chain risk management. In: Zsidisin, G., and Henke, M. (Eds). Revisiting supply chain risk.”

review of the literature on risk reveals many discussions but few clear and precise definitions. In the discipline of management, Markowitz (1952, p. 89) was one of the first scholars to deal directly with the concept of risk in portfolio decisions, defining it as the “variance of return”. His definition has been adopted in various fields to study contract portfolios and portfolio selection decisions (Choi, Li, & Yan, 2008; Kauffman & Sougstad, 2008; Lee & Chien, 2014). An often-cited definition of risk in the management literature has been proposed by March and Shapira (1987, p. 1404) as “variation in the distribution of possible outcomes, their likelihoods, and their subjective values”. According to these definitions and common practices in fields, such as finance, risk refers to variation and hence, involves both “downside” and “upside” outcome potentials (Choi & Chiu, 2012; Kahneman & Tversky, 1979; Reboredo, Rivera-Castro, & Ugolini, 2016).

Nonetheless, the majority of management scholars have used risk to refer to a probability of *negative* deviation from performance outcome variables (Merkelsen, 2011; Mitchell, 1999; Reuer & Leiblein, 2000; Scheibe & Blackhurst, 2018). For instance, Lowrance (1980) defines it as a measure of the likelihood and consequences of adverse effects, Goedde-Menke *et al.* (2014) use risk to refer to the chance of bank failures following the 2008 financial crisis, and Kolbel *et al.* (2017) apply the term to explore the effect of media coverage of corporate social irresponsibility on the potential for stakeholder sanctions. The negative view of risk is also closely related to common perceptions of the concept. Empirical findings of a study by March and Shapira (1987) show that the majority of managers overrate the “downside” potential of risk and refer to risk as a negative variation in performance outcomes, such as revenues, and profits.

2.1.2 The concept of supply chain risk

Within supply chain management research, Harland *et al.* (2003, p. 52) adopt the *downside* view and define supply chain risk as “the chance of danger, damage, loss, injury or any other undesired consequences”. Wagner and Bode (2006) also argue that the downside view of risk is more in line with the reality of business and the supply chain environment. As a result, the majority of definitions found in the supply chain risk literature use the term to refer to the *likelihood* and *impact* of the occurrence of *an undesired event* (Heckmann, Comes, & Nickel, 2015; Ho *et al.*, 2015).

Risk faced by supply chains can be categorised into operational and disruption risks (Tang, 2006; Kleindorfer and Saad, 2005). The former refers to the risk posed by a mismatch between supply and demand that could lead to obsolescence, stock-outs, reworking stocks, and penalties for unsatisfied demands (Christopher & Lee, 2004; Sodhi, 2005; Tang & Musa, 2011). Such risks may be caused by inherent uncertainties in the external environment (*e.g.* demand uncertainty, supply uncertainty, cost uncertainty), and/or inadequate capability in internal people, processes and systems (Chen & Yano, 2010; Xiao, Shi, & Yang, 2010; Yu, Zeng, & Zhao, 2009; Zsidisin & Ellram, 2003). For instance, market dynamism, the bullwhip effect, demand seasonality, forecasting errors, and new product introduction could result in excessive or mismatched inventory that in turn, increases a firm's susceptibility to negative operating performance (Hahn & Kuhn, 2012; Singhal, Agarwal, & Mittal, 2011; Tang & Musa, 2011).

On the other hand, disruption risk is posed by an interruption of normal operational activities, and is caused by triggering events happening at various internal and external supply chain entities (Blackhurst et al., 2005; Reimann et al., 2017). For instance, triggering events such as natural disasters, transportation delays, port closures, and supplier quality failure could delay/disrupt the normal flow of components and materials through a supply chain (Mitroff, Ian, 2003; Heckmann, Comes and Nickel, 2015). Empirical evidence has shown that firms face a \$50-100 million cost impact for every day that their supply chain is disrupted (Rice and Caniato, 2003). Furthermore, an analysis of a sample of 827 disruption announcements made between 1990-2000 by Hendricks and Singhal (2003) indicates that such announcements could reduce stock returns by an average of 33-40 % when compared to their industry peers. Firms experiencing a supply chain disruption also tend to under-perform their competitors in a range of operating performance outcomes, such as revenue, sale, and operational costs (Hendricks & Singhal, 2005). The literature has also found evidence for the negative impact of supply chain disruption on exchange relationships (Reimann et al., 2017; Wang et al., 2014), and a firm's reputation in the market (Ivanov, Sokolov, & Dolgui, 2014; Tang, 2006).

2.1.3 Supply chain risk management

Given the publicity, as well as the high business impact associated with disruption risk (Hendricks & Singhal, 2005; Jacobs & Singhal, 2017), supply chain risk management has become a central task and topic of interest for supply chain practitioners and scholars (Croson, Schultz, Siemsen, & Yeo, 2013; Sodhi et al., 2012). Supply chain risk management is the integrated process of 1) identification, 2) evaluation, 3) mitigation and 4) monitoring of supply

chain risk (Kern, Moser, Hartmann, & Moder, 2012; Norrman & Jansson, 2004) that aims to reduce supply chain vulnerability (Knemeyer et al., 2009; Tang, 2006), improve resilience (Hohenstein et al., 2015; Ponomarov & Holcomb, 2009), and ensure business profitability (Fan & Stevenson, 2018). Extant literature has offered various frameworks to assist managers in these four stages of risk management (*e.g.* Blackhurst, Scheibe and Johnson, 2008; Manuj and Mentzer, 2008; Neiger, Rotaru and Churilov, 2009; Ho *et al.*, 2015). The following sections will provide a brief overview of past studies in each of these areas.

- Supply chain risk identification

Risk identification refers to the process that leads to a register of risks related to all operational activities of a firm and every link along their supply chain (Waters, 2011). The literature has offered numerous techniques and frameworks to assist managers in identifying supply chain exposure to various sources of risk (*e.g.* Jüttner, Peck and Christopher, 2003; Kayis and Dana Karningsih, 2012). Among these, risk mapping has been used as an important tool to systematically demonstrate the sources and potential impact of supply chain risks (Lavastre, Gunasekaran, & Spalanzani, 2012; Lin & Zhou, 2011). For instance, past research has used Fault Tree Analysis (FTA) and Event Tree Analysis (ETA) as common graphical techniques to link the causes of disruption risk to their potential consequences for a supply chain (Norrman & Jansson, 2004; Waters, 2011). Scholars have also provided various frameworks to identify sources of disruption at different stages of the supply chain (*i.e.* supply, internal, demand, network environment), and classified uncertainties that lead to disruption (*e.g.* Jüttner, 2005; Rao and Goldsby, 2009; Rangel, de Oliveira and Leite, 2015). For example, Simangunsong et al. (2012) provide an overview of supply chain uncertainty sources related to the focal company (*e.g.* manufacturing process and organisational/behavioural issues), internal supply chain (*e.g.* infrastructure and facilities), and external factors (*e.g.* government regulation and macroeconomic issues). Moreover, Neiger et al. (2009) develop a formal risk identification procedure that provides a multidimensional view of supply chain risk considering the inter-connection of supply chain processes, their objectives and risk sources.

- Supply chain risk evaluation

Risk evaluation most commonly refers to a process of estimating the likelihood and potential consequences of a risky event, and assigning significance to the overall risk (Yates & Stone, 1992). Extant research has provided a variety of qualitative and quantitative techniques to

evaluate sources of risk within a supply chain (*e.g.* Zsidisin et al., 2004; Aqlan and Lam, 2015). Among these, some have relied on structured decision-making techniques, such as the Delphi method (Markmann, Darkow, & von der Gracht, 2013), and multi-criteria scoring procedure (Blackhurst et al., 2008; Chopra & Sodhi, 2004) to integrate expert opinions and prioritise risk according to company-specific objectives. Others have used statistical and analytical approaches to quantify the importance of risk (*e.g.* Tomlin and Snyder, 2006; Kull and Talluri, 2008). For example, Hallikas et al. (2004) develop a risk register framework that evaluates risk based on the estimation of the likelihood and consequences using historical firm- and/or industry-specific information. Similarly, Bhattacharya et al. (2010) use country-specific third-party indices to assess risk associated with different supply chain locations. The majority of these techniques have assumed that information about the sources of risk is always available and can be used to quantify the probability and consequences of potential risks (Tazelaar & Snijders, 2013). However, there is limited historical information (if any) on risk posed by events, such as cyber-attack, and thus using traditional approaches is not always possible. Accordingly, Simchi-Levi et al. (2014) propose an alternative method to measure and prioritise the sources of risk based on the estimated recovery time of a supply chain entity in the case of an unexpected event.

- Supply chain risk mitigation

Risk mitigation refers to the process whereby supply chain members decide to accept an assessed risk, or implement strategies to minimise the probability and/or potential consequences of its occurrence (Nishat Faisal, Banwet, & Shankar, 2006; Norrman & Jansson, 2004). Extant research has provided a diverse set of strategic and operational tools, such as multiple sourcing (Hendricks et al., 2009; Sting & Huchzermeier, 2014), slack inventory (Chopra & Sodhi, 2004), back-up production facilities (Kleindorfer & Saad, 2005), supply base flexibility (Tang & Tomlin, 2008), alternative transportation routes (Tang, 2006), and risk sharing (Nishat Faisal et al., 2006) to mitigate supply chain disruption risks. There is evidence that the application of these strategies could improve supply chain robustness and resilience in the face of risk (Carvalho, Barroso, Machado, Azevedo, & Cruz-machado, 2012; Das & Lashkari, 2017). Nonetheless, it is often difficult to justify the costs involved in the implementation of these strategies, as disruptions are uncertain events and therefore, may never be realised (Tang, 2006; Zsidisin et al., 2000).

To assist firms in such decision-making, supply chain scholars have applied various analytical techniques and simulation modelling to identify optimal solutions, where risk and costs of a disruption can be reduced simultaneously (Kim & Tomlin, 2013; Snyder et al., 2016; Tomlin, 2006). For example, DeCroix (2013) uses dynamic programming to propose an optimal level of inventory for a multi-stage multi-echelon assembly system facing random supply disruptions. Similarly, Dong and Tomlin (2012) use a discrete-time Markov process to identify an optimal combination of buffering and insurance strategies in managing a firm's exposure to disruption risk. Past studies have also provided risk mitigation guidelines based on factors, such as the nature and sources of risk (Cucchiella & Gastaldi, 2006; Ritchie & Brindley, 2007), and inter- and intra-firm resources (Zsidisin & Ellram, 2003; Zsidisin et al., 2000). For example, Knemeyer et al. (2009) propose mitigation strategies for low-likelihood, high-impact risks based on vulnerability analysis of key supply chain locations and threats, as well as evaluation of risks by managers. While, Manuj and Mentzer (2008) suggest risk management strategies based on organisations' temporal focus, flexibility of operations, and external supply chain environment.

- Supply chain risk monitoring

Risk monitoring refers to the process whereby the sources of supply chain risk are assessed continuously, using data management systems (Tummala & Schoenherr, 2011) and monitoring capabilities (Klassen & Vereecke, 2012). Extant research has suggested the application of advanced information system technology and early warning tools to observe trends (Blackhurst et al., 2005; Craighead et al., 2007; Heckmann et al., 2015), and/or routine monitoring activities to identify risks during the "incubation" stage (Blackhurst et al., 2008; Bode et al., 2014, p. 25; Lavastre et al., 2012). These studies have highlighted the importance of risk monitoring as part of a supply chain risk management process in order to review and update risk mitigation practices, and build resilience (Fan & Stevenson, 2018). For instance, Craighead et al. (2007) discuss the value of early warning capabilities for timely discovery and reducing the severity of a disruption, while Brandon-Jones et al. (2014) find empirical evidence on the positive effect of visibility and information sharing resources on supply chain robustness and resilience.

2.1.4 Research gaps

Extant literature has provided significant insights into the causes and consequences of supply chain disruption (*e.g.* Hendricks and Singhal, 2005; Simangunsong, Hendry and Stevenson,

2012; Rangel, de Oliveira and Leite, 2015). Accordingly, scholars have offered a range of strategies, such as multiple sourcing and adding back-up production facilities, to reduce a firm's exposure to internal and external sources of disruption (*e.g.* Tang, 2006; Hendricks, Singhal and Zhang, 2009). This has contributed to the design of robust and resilience supply chain structures that are less vulnerable to unexpected events (Blackhurst et al., 2011; Brandon-Jones et al., 2014; Hohenstein et al., 2015). However, the occurrence of some events is still inevitable (Macdonald & Corsi, 2013). When a disruption happens, it is often a responsibility of the individual manager to evaluate the situation, make decisions, and lead organisational actions (Ambulkar et al., 2016; Bode & Macdonald, 2016; Polyviou et al., 2018). There is evidence that shows organisational disruption responses could have a major impact on the consequences of the event and performance of a firm following the disruption (Bode et al., 2011; Ivanov et al., 2017; Sáenz & Revilla, 2014; Sheffi & Rice Jr., 2005). However, past supply chain risk studies have largely overlooked the management of disruption at this stage (Bode et al., 2011; Reimann et al., 2017; Sodhi et al., 2012). In particular, we know very little on how individual managers, as organisational decision-making agents, make decisions and direct response actions (*cf.* Ellis, Shockley and Henry, 2011; Cantor, Blackhurst and Cortes, 2014; DuHadway, Carnovale and Kannan, 2018; Polyviou et al., 2018). The aim of this section is to discuss the gaps found in relation to supply chain disruption response stage and individual-level behaviour, respectively.

- Supply chain disruption response

The studies of supply chain risk management have contributed to the understanding of proactive planning and design of operational resources and capabilities to manage disruption exposure and improve supply chain resilience (Hohenstein et al., 2015; Knemeyer et al., 2009; Manuj & Mentzer, 2008; Ponomarov & Holcomb, 2009). However, less attention has been paid to organisational responses to an actual supply chain disruption event (Bode et al., 2014, 2011; Ivanov et al., 2017; Norrman & Jansson, 2004; Reimann et al., 2017; Sodhi et al., 2012). In other words, existing risk management models and frameworks have been mainly concerned with strategies to plan and avoid disruption risk (Macdonald & Corsi, 2013). However, in today's supply chain environment, where firms are highly dependent on exchange partners, it is virtually impossible to predict and assess every single disruption risk scenario (Christopher & Peck, 2004; Harland et al., 2003; Hendricks & Singhal, 2005; Tang, 2006; Wagner & Bode, 2006). Disruptions caused by major triggering events, such as Hurricane Katrina in 2005, the

Icelandic volcano eruption in 2010, Tianjin port explosion in 2015, and Hanjin bankruptcy in 2016 have shown that organisations do not simply have the ability to prevent certain events from occurring (Macdonald & Corsi, 2013). As a result, firms face the critical challenge of responding to an event in order to minimise the adverse effects of the disruption (Bode et al., 2014; Cantor et al., 2014; DuHadway, Carnovale, & Hazen, 2017), return the operations to normal as quickly as possible (Ivanov et al., 2017, 2014), and ensure similar events do not happen in the future (Blackhurst et al., 2005; Hohenstein et al., 2015).

There is anecdotal and empirical evidence that shows organisations respond to a supply chain disruptions differently (Ambulkar, Blackhurst, & Grawe, 2015; Bode et al., 2014, 2011; Ellis et al., 2010; Sheffi & Rice Jr., 2005). Traditionally, research has attempted to shed light on such differences using case-based data and expert opinions (Blackhurst et al., 2005; Craighead et al., 2007; Norrman & Jansson, 2004). For instance, Norrman and Jansson (2004) focus on Ericsson's redesign strategies in the aftermath of a major incident at its supplier plant to highlight the role of buyer-supplier collaboration in dealing with the disruption, while Blackhurst et al. (2005) rely on practitioners' perspectives to identify operational capabilities required for the successful management of a disruption. Despite important insights provided by these studies, there is still limited theoretical understanding of the underlying factors that shape organisational responses to a supply chain disruption (Reimann et al., 2017). Given the implications of such responses for the overall costs of a disruption (Ivanov et al., 2017, 2014), supply chain resilience (Hohenstein et al., 2015; Sáenz & Revilla, 2014; Williams & Shepherd, 2016), and firm's performance in the market (Bode et al., 2011; Sheffi & Rice Jr., 2005), there is need for research in this area (Bode & Macdonald, 2016; Bode et al., 2011; Reimann et al., 2017; Sodhi et al., 2012).

- Individual-level behaviour

Extant literature has mainly focused on the management of risk from the organisational and system level perspectives (Bode & Wagner, 2015; Harland et al., 2003; Kim, Chen, & Linderman, 2015; Manuj & Mentzer, 2008), and overlooked the role of individual managers in risk-related decision-making (Ambulkar et al., 2016; Cantor et al., 2014; DuHadway et al., 2018). Within these studies, scholars have developed a range of models and frameworks that guide organisations to make decisions based on their operational resources, relationship governance, and supply chain structure (Ambulkar et al., 2015; Ang et al., 2017; Craighead et al., 2007; Gümüş, Ray, & Gurnani, 2012; Hendricks et al., 2009; Knemeyer et al., 2009; Sheffi

& Rice Jr., 2005). The majority of these models have made several implicit and explicit assumptions about the nature of human behaviour in the system, that is people are 1) not the main phenomenon under study, 2) deterministic in their behaviour (*e.g.* they do not make mistakes, they are never influenced by their environment, beliefs, and values), 3) independent and not affected by each other, 4) unchanging in their abilities and behaviours, and 5) emotionless (Boudreau et al., 2003). More specifically, these models have assumed that managers can detect risk signals and react to relevant information in the environment; have consistent preferences; are not affected by biases and utilise all relevant information and variables to make “optimal” decisions (Gino & Pisano, 2008).

However, the advance of research in behavioural operations (BeOM) has shown that people often violate these assumptions in a systematic manner, especially under situations of uncertainty (Bendoly et al., 2006; Carter et al., 2007; Kahneman & Tversky, 1982; Loch & Wu, 2007). These studies have drawn from behavioural economics and socio-psychological perspectives to argue that because of limitations in their memory, information gathering, and computing ability, managers are incapable of attending to and evaluating all possible alternatives when facing uncertainty. Furthermore, people may have individually-motivated goals and inconsistent preferences that result in suboptimal decisions (Ancarani & Di Mauro, 2012; Loch & Wu, 2007). Leveraging this perspective, operations and supply chain management scholars have examined the underlying mechanisms that systematically shape behaviour in newsvendor problems (*e.g.* Schweitzer and Cachon, 2000; De Véricourt et al., 2013), make-or-buy decisions (*e.g.* Mantel, Tatikonda and Liao, 2006), supplier selection (*e.g.* Riedl *et al.*, 2013; Kull, Oke and Dooley, 2014), the bullwhip effect (*e.g.* Bolton and Katok, 2008; Croson *et al.*, 2014), and buyer-supplier relationships (*e.g.* Liu et al., 2012; Eckerd et al., 2016). For instance, in explaining behavioural sources of the bullwhip effect, Sterman and Dogan (2015) find that scarcity, especially when there is uncertainty about final demand, may cause anxiety, fear or panic, leading individuals to place much larger orders than they need when it is not optimal to do so. In a similar vein, some studies have demonstrated the impact of cultural differences, risk perception, and managerial illusions of control on the outcome of supplier selection decisions (Carter, Maltz, Maltz, Goh, & Yan, 2010; Kull et al., 2014).

The findings from these studies have contributed to the traditional operations and supply chain management literature by covering not only the properties of operations and supply chain systems - *e.g.* structure, strategy, design - but also the characteristics of human agents - *e.g.* biases, personalities, preferences - who operate in such systems (Tangpong, Hung, & Li, 2014).

This has in turn, led to a better understanding of the underlying mechanisms of supply chain performance, as well as exploring intervention and institutional strategies such as training programmes and decision support systems that can reduce the effect of human biases (Bendoly et al., 2006; Gino & Pisano, 2008; Loch & Wu, 2007). Given the high uncertainty and the enduring importance of individual managers involved in supply chain risk-related decision-making (Bode & Macdonald, 2016; Ellis et al., 2011; Polyviou et al., 2018; Reimann et al., 2017), there is a need for research on the underlying behavioural factors that systematically influence managerial decisions in the face of risk (Cantor et al., 2014; Reimann et al., 2017). Failure to account for individual-level factors, such as risk perception and social preferences, may lead to inaccurate risk management models that are not effective in practice (Bendoly et al., 2006; Tokar, 2010).

- Summary of research gaps

To summarise, extant supply chain risk literature has provided academics and managers with a range of useful models and frameworks to identify, assess and mitigate potential disruptions (Ho et al., 2015; Snyder et al., 2016; Tang, 2006). These studies have shed significant light on organisational and system-level factors that prescribe optimal strategies to build robust and resilient supply chains (Craighead et al., 2007; Das & Lashkari, 2017; Kim et al., 2015; Manuj & Mentzer, 2008). However, we still know very little about organisational responses in the face of an actual supply chain disruption (Bode et al., 2011; Reimann et al., 2017). In particular, how individual managers, who are responsible for the management of such events (Ambulkar et al., 2016; Bode & Macdonald, 2016; Polyviou et al., 2018), make decisions and direct organisational actions (DuHadway et al., 2018; Ellis et al., 2011). Given the consequences of such decisions on the performance of a firm and supply chain, there is a need for research in this area.

2.1.5 This thesis

This thesis draws from the burgeoning stream of work in BeOM to investigate the underlying behavioural factors that influence managerial decisions and direct organisational actions in the response stage of a supply chain disruption. In doing so, it aims to make two main contributions to the extant literature. First, by incorporating theories from behavioural research, it advances the theoretical understanding of individual and contextual factors that influence supply chain disruption responses (Adobor & McMullen, 2018; Brandon-Jones et al., 2014; Mentzer &

Kahn, 1995). Second, it highlights the significance of incorporating individual-level behaviour into the formal models and frameworks in order to improve the effectiveness and predictability of disruption responses (Bendoly et al., 2006; Tokar, 2010).

In particular, this thesis is formed of three behavioural studies that investigate the underlying socio-psychological factors that shape individual manager's decisions at three stages of disruption responses, that is discovery, recovery, and redesign (Figure 1). While discovery is concerned with organisational preventive actions when they become aware of an impending disruption, recovery focuses on a firm's immediate responses to minimise the consequences and return the operations to normal as quickly as possible (Macdonald & Corsi, 2013). Moreover, redesign refers to post-disruption remedial actions to address the latent problem and improve resilience (Blackhurst et al., 2005). This structure is motivated by previous works that argue that the successful management of a disruption depends on organisational actions at these consecutive stages (Blackhurst et al., 2005; Bode & Macdonald, 2016; Macdonald & Corsi, 2013). Therefore, each study within this thesis focuses on a key behavioural factor most relevant to individual managers' behaviour at a particular stage of supply chain disruption management. The following sections will provide an overview of each study, in order.

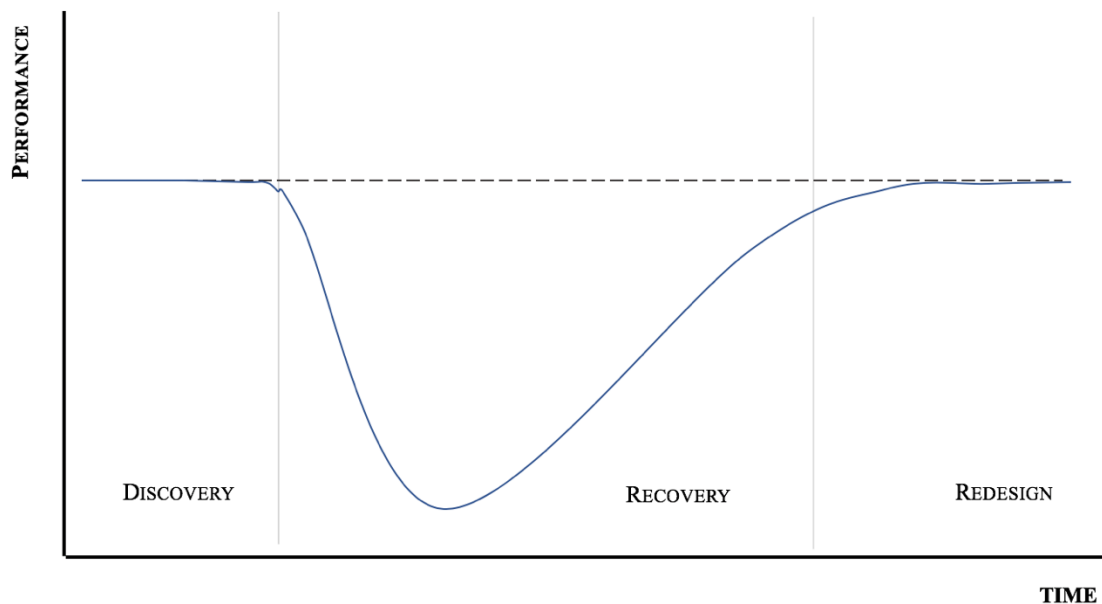


Figure 2:1 Schematic Representation of Supply Chain Disruption Management

Adapted from Sheffi & Rice (2005)

- Study 1: discovery

Discovery refers to the point in time when firms become aware of an impending supply chain disruption that could potentially cause delays or stoppage in their operations (Blackhurst et al., 2005). Some events send early warning alerts before their actual occurrence (Bode et al., 2014; Mitroff & Anagnos, 2001). For instance, prior to the 2002 West Coast port strike, there were a stream of news reports discussing a possible strike for around 6 months prior to the actual event (Tang, 2006). To avert and/or minimise the consequences of such events, extant literature has offered various strategies, such as contingent rerouting and slack resources (Hendricks et al., 2009; Tomlin, 2006). However, a successful application of these strategies depends on supply chain managers and their ability to evaluate and act upon risk signals as soon as appeared in the environment (Ambulkar et al., 2016; Bode et al., 2014; Cantor et al., 2014). Traditionally, research has assumed that disruption risk can be assessed using statistical techniques and analytical approaches and hence, the subsequent responses are optimal and effective (Tazelaar & Snijders, 2013). However, due to the uncertainty of the environment and managerial bounded rationality, this may not always be the case (Ellis et al., 2010, 2011; Kull et al., 2014).

Study 1 draws from the findings of behavioural studies to argue that managerial decisions in the face of a disruption is determined by their subjective as opposed to objective assessment of risk (DuHadway et al., 2018; Ellis et al., 2010; Tazelaar & Snijders, 2013). The advance of research has shown the effect of a range of psychological and sociological factors in shaping subjective perceptions of risk (DuHadway et al., 2018; Sitkin & Pablo, 1992). Culture, in particular, has been shown to significantly influence risk perceptions by directing an individual's attention to important cues in the environment and making sense of otherwise ambiguous information (Gibson et al., 2009; Kitayama, 2002; Rieger et al., 2015; Weber & Hsee, 2000). This is important in the supply chain environment, where an ever-increasing number of firms are integrated with partners located around the world that hold different cultural values (Ribbink & Grimm, 2014). Within such an environment, the outcome of many locally-made decisions about a disruption could have consequences on the operations of other supply chain partners (Revilla & Sáenz, 2014). Research has previously examined the role of nationality and organisational culture on supply chain risk management practices (Dowty & Wallace, 2010; Revilla & Sáenz, 2014). However, there is still a paucity of research on the effect of culture on individual manager's decision-making in the face of a disruption. To address the gap in the literature, Study 1 examines the impact of culture, as reflected in

individual-level cultural values, on managerial perceptions of supply chain disruption risk and subsequently, responses to an impending event.

- Study 2: recovery

Recovery refers to the immediate aftermath of a disruption (Macdonald & Corsi, 2013). When a disruption happens, organisations face a key challenge of whether to collaborate or disengage with the supplier who has caused the event (Polyviou et al., 2018). The outcome of such decisions may have determining effects on the overall costs of the disruption and performance of the focal buyer-supplier relationship following the event (Bode et al., 2011; Ivanov et al., 2017; Sheffi & Rice Jr., 2005). To minimise negative relationship outcomes, suppliers take a range of psychological and tangible actions that resolve the situation and enhance buyers' satisfaction (Reimann et al., 2017; Wang et al., 2014). While psychological actions are concerned with social repair through apologising, accepting the responsibility, and providing explanations, tangible activities focus on recovering operational and financial losses by strategies, such as compensation, and replacement (Liao, 2007; Reimann et al., 2017). Extant supply chain risk literature has previously investigated a range of pre-established organisational and relational factors that shape alternative responses during recovery (Ambulkar et al., 2015; Bode et al., 2014, 2011). However, these studies have mainly overlooked the role of a supplier's recovery actions in the wake of such incidents. This is surprising, because disruptions are inter-organisational by nature (Reimann et al., 2017) and hence, the actions taken by the supplier in the wake of a disruption could alter buyers' perception and subsequently, drive alternative reactions to the event (*cf.* Wang, Craighead and Li, 2014).

To address the gap in the literature, Study 2 takes a behavioural perspective to explain the effect of a supplier's recovery actions on organisational responses through a buying manager's mental representation. That is defined as an individual's cognitive reflection of the information in the environment, and seen as a key psychological component of decision-making during a disruption (Ellis et al., 2011). When a disruption occurs, managers need to evaluate a stream of uncertain and ambiguous information about the event's losses and resolutions (Combe & Carrington, 2015). To make sense of this information and facilitate decision-making, they create a mental model that represents only some aspects of the information (Weick, Sutcliffe, & Obstfeld, 2005). Drawing from construal level theory, Study 2 develops a set of propositions that show spatial, temporal and social distances from a disruption triggering event have

systematic effects on the content of the mental representation (Trope & Liberman, 2003, 2010). This has important implications for disruption responses, because it could introduce biases into managerial evaluation of the disruption consequences and hence, influence the effectiveness of a supplier's resolutions on altering buyers' responses (DuHadway et al., 2018; Polyviou et al., 2018). Overall, the propositions argue that the interplay between supplier-side actions and buyer responses is dependent upon the contextual characteristics of a disruption triggering event.

- Study 3: redesign

Redesign refers to an extended post-disruption period that focuses on the reconfiguration of the supply chain (Blackhurst et al., 2005; Macdonald & Corsi, 2013). In the aftermath of a disruption, organisations may redesign their supply base or risk management practices to address the recent issue and prevent the reoccurrence of a similar event in the future (Blackhurst et al., 2005; Blackhurst et al., 2011). There is evidence that shows redesign decisions contribute significantly to supply chain resilience in the face of similar events in the future. For instance, after the 2005 Hurricane in the US, Cisco increased its slack resources and supply chain visibility that in turn, helps the company to minimise the consequences of the 2011 Japanese earthquake on the supply chain (Sáenz & Revilla, 2014). Although extant research has provided significant insights into the design of resources and capabilities to build resilience in advance of a disruption (Brandon-Jones et al., 2014; Hohenstein et al., 2015; Ponomarov & Holcomb, 2009; Tang & Tomlin, 2008), we still know very little on when and how managers choose to redesign for resilience following an event.

Study 3 draws from attribution theory to highlight blame as a key behavioural factor that motivates post-disruption redesign decisions (Shaver, 1985; Weiner, 1995). According to the theory, following a negative and unexpected event (such as supply chain disruption), people seek blame attribution to understand why an event happened and who was responsible (Coombs, 2007; Hamilton, 1987; Seeger, Ulmer, Novak, & Sellnow, 2005). This attribution in turn, helps individuals to identify plausible causal explanations and hence, implement appropriate remedial actions (Driedger et al., 2014; Rosenthal & Schlesinger, 2002). Moreover, the theory suggests that attribution of blame is determined by several characteristics of an event, including locus, controllability and severity (Weiner, 1979, 1985). Study 3 fixes the locus by focusing only on supplier-induced disruptions and hence, investigates the effect of

disruption severity and controllability on blame attribution and subsequently, managerial redesign decisions following the event.

2.1.6 Units of analysis for this thesis

The thesis aims to understand the underlying behavioural factors that drive managerial responses to supply chain disruption. Facing a disruption, it is often a responsibility of the individual manager (*i.e.* recovery lead) to interpret the situation and make decisions (Polyviou et al., 2018). While psychological factors, such as risk perception and blame attribution, may motivate response actions, their ultimate impact on decision outcomes is moderated by the context in which the decision is made (*cf.* Schorsch, Wallenburg, & Wieland, 2017). Therefore, the three studies within the thesis apply theories from social psychology to investigate the effect of individual and contextual factors on supply chain disruption responses.

Study 1 examines the impact of psychologically held cultural values on supplier switching decision in the face of an impending disruption. Accordingly, the unit of analysis is an individual manager. Moreover, since such decisions are made under varying levels of situational uncertainty (Hult et al., 2010), the study utilises the disruption environment as context of the decision and investigates the impact of two levels of uncertainty on individual's decisions. The use of individual as the unit of analysis is a useful step to understand the importance of different types of actors (with varying cultural backgrounds) who are assigned the task of managing a supply chain disruption. However, the impact of such individual-level variables on decisions are static and cannot be changed via managerial action. Therefore, the application of disruption environment as the decision context provides the understanding of how and when informational support could reduce the psychological source of variations in disruption responses (DuHadway et al., 2018).

Study 2 draws from construal level theory to investigate the effect of suppliers' recovery actions on managerial responses (at the buying firm) during a disruption recovery. Consistent with previous research applying construal level theory, Study 2 selects two related units of analysis: the individual manager; and the disruption event. The relationship between the individual and disruption event is driven by the core principle of construal level theory; that is, psychological distances of a supply chain disruption influence individual's mental representations of the event. Moreover, the study acknowledges that disruption responses at the recovery stage are influenced by suppliers' recovery actions in the wake of the disruption.

Therefore, Study 2 includes the disruption environment as context of the decision, and investigates the impact of two types of suppliers' actions on managerial decision-making. Given that supply chain management involves the coordination of activities between these interdependent organisations (Jüttner, 2005), Study 2 provides insights regarding how the key actions/processes have to be performed to achieve "desired" behaviour in disruption situations (Schorsch et al., 2017)

Study 3 uses an experiment and cross-sectional survey to examine the link between disruption characteristics, attribution of blame, and post-disruption redesign decisions. The experiment focuses on the role of severity and controllability of a disruption event on blame attribution. Accordingly, it uses the disruption event as the unit of analysis. Subsequently, the survey examines the interaction between blame attribution for a particular event and inter-firm trust in driving redesign decisions. Therefore, it utilises the disruption event as the unit of analysis, and inter-firm trust as context of the decision. By integrating these the moderating impact of relationship context, Study 3 provides insights into how suppliers could intervene and create a decision environment that reduces the effect of blame on costly redesign decisions.

2.2 Part 2: research paradigm for this thesis

The aim of this section is to discuss the philosophical point of view of this thesis, that informs the choice of research methodology and techniques in the next chapters. First, it provides an overview of the concept of research paradigm. This will be followed by a discussion on alternative inquiry paradigms in management studies. Lastly, the researcher discusses the ontological, epistemological, and methodological approaches of this thesis.

2.2.1 The concept of research paradigm

The concept of paradigm has been suggested by scholars (*e.g.* Kuhn, 1962; Burrell and Morgan, 1979) as a basis for examining the underlying assumptions of social and organisational theories (Shrivastava & Mitroff, 1984). It refers to a set of "basic beliefs (or metaphysics)" that guides the implementation of research by defining the nature of reality, the role of the researcher in relation to reality, and providing the range of appropriate methods to conduct the inquiry (Guba & Lincoln, 1994, p. 107; Shrivastava & Mitroff, 1984). In discussing basic assumptions inherent in research, paradigms have relied on three fundamental queries: a) ontological; b) epistemological; and c) methodological questions (Guba & Lincoln, 1994):

- a) the ontological issue is concerned with the essence of reality (Creswell, 2013), that is “what is there that can be known” (Guba & Lincoln, 1994, p. 108). Ontology of research contains the assumptions that a researcher holds about the way in which the world operates;
- b) the epistemological issue represents what is/should be considered as knowledge (Bryman, 2012). Epistemology of research is concerned with the answer to the question: “how we understand reality and communicate this to other people” (Solem, 2003, p. 440);
- c) the methodological issue focuses on the range of appropriate means to acquire knowledge about reality (Hassard, 1991). It provides a guideline on “how can the inquirer (would-be knower) go about finding out whatever he or she believes can be known” (Guba & Lincoln, 1994, p. 108).

2.2.2 Alternative inquiry paradigms

Management scholars have started to use the concept of paradigm since the publication of *Sociological Paradigms and Organisational Analysis* by Burrell and Morgan (1979). Influenced by Kuhn’s (1962) “pre-paradigm” idea, the authors argue that communities of management scholars hold incompatible basic assumptions about research that cannot fit into one prevailing paradigm. In other words, a diversity of theoretical and methodological approaches in management research (Pfeffer, 1993) has resulted in the presence of a number of paradigms. Several models and frameworks have been developed representing distinct paradigms based on the underlying ontological and epistemological assumptions of research. These have played an important role in the way theories have been generated, tested, and applied, as well as methodologies used in the process of research inquiry (Hassard, 1991; Shepherd & Challenger, 2013). The following sections will discuss the range of paradigms (Table 2:1), commonly found in management research (Guba & Lincoln, 1994; Miller & Tsang, 2011).

Table 2:1 Alternative Research Paradigms in Management Research

	Positivism	Post-positivism	Critical theory	Interpretivism
Ontology	Naïve realism (objectivism)	Critical realism	Historical realism	Relativism (subjectivism)
Epistemology	Objectivist (finding the “truth”)	Modified objectivist (findings are “probably true”)	Transactional/subjectivist (finding reality is value-mediated)	Subjectivist (findings are socially constructed)

Methodology	Experimental and hypotheticodeductive, e.g. experiment, survey, analytical methods	Modified experimental and hypotheticodeductive	Dialogic and dialectical	Phenomenological research; ethnographic studies
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**Adapted from Lincoln and Guba (1994)*

- **Positivism**

Positivism has been extensively applied in studies of social, and in particular, organisational science (Brannick & Coghlan, 2007; Burrell & Morgan, 1979). It adopts its worldview from a school of thought within the philosophy of science called “logical positivism” or “logical empiricism” (Lee, 1991). The worldview centres on “the unity of science” (Kolakowski, 1968, p. 178) and views the methods of natural science as the only appropriate models of research in social science (Lee, 1991). Ontologically, positivists believe in objectivism (or naïve realism) (Guba & Lincoln, 1994). In other words, they hold the view that external reality exists, and can be researched by an independent and value-free observer (Brannick & Coghlan, 2007). A positivist epistemology sees a researcher as “standing apart from the world and able to experiment and theorise about it objectively and dispassionately” (Hesse, 1980, p. vii). Therefore, positivist reality can be objectively observed and unbiasedly measured.

From a methodological point of view, positivism relies on the empiricist practice of deductive-nomological and hypotheticodeductive models (Brannick & Coghlan, 2007). It aims to identify causal relationships and explain the underlying laws that regulate human behaviour (Easterby-Smith, Thorpe, & Lowe, 1991). The hypotheticodeductive model involves formulation of hypotheses based on a theoretical framework, and quantitative operationalisation of the concepts to verify or disprove the hypothesised relationships (Lee, 1991). Positivists adopt methods such as survey, experiment, and analytical techniques, and believe that such reductionist approaches can facilitate the understanding of a topic.

- Post-Positivism

The main idea of post-positivism was originally put forward by two physicists who question the validity of positivists claims of “absoluteness and dogmatism” (Crotty, 2013, p. 29). They argue that due to the uncertainty of environment and human being’s knowledge, it is impossible to accurately determine the ontological and epistemological position of science. Proponents of this paradigm see a commitment to claims of absolute truth as unnecessary, and instead believe in “warranted assertions” (Kirby, 2013). The ontology of post-positivism is critical realism, that is external reality exists but it can only be imperfectly understood (Guba & Lincoln, 1994). The epistemology of post-positivism is modified objectivism (Guba & Lincoln, 1994). In other words, it believes in the idea that objectivity is a “regulatory ideal”, but rigour research can generate findings that are “probably true” (Guba & Lincoln, 1994, p. 110). Proponents of this worldview hold to a “fallibilistic epistemology” (Miller & Tsang, 2011, p. 144). That is, they acknowledge researchers’ knowledge of the world is socially influenced, *i.e.* their background knowledge and experiences impact what they choose to study and to which elements of the data they pay more attention (Kirby, 2013).

From a methodological point of view, post-positivism uses modified experimental or manipulative approach (Guba & Lincoln, 1994). It adopts hypotheticodeductive approaches as a way to falsify (rather than verify) hypotheses (Guba & Lincoln, 1994). In addition, post-positivism advocates “critical multiplism” that facilitate the understanding of the context of research by collecting and integrating situational information and reintroducing discovery as part of the process of research inquiry.

- Interpretivism

Interpretivism (or constructivism) has gained attention by organisational research scholars as an alternative to traditionally dominant positivism paradigm (Lee, 1991). It takes a worldview that centres on people and the artefacts (*e.g.* social and physical) they create in their social world (Meredith, Raturi, Amoako-Gyampah, & Kaplan, 1989). Hence, interpretivism views the methods used in studying natural reality as fundamentally inadequate for social science research (A. S. Lee, 1991). Ontologically, it believes in subjectivism (or relativism) (Guba & Lincoln, 1994). In other words, interpretivists understand “social reality by interpreting the meanings held by the social actors or members of the social group” (Brannick & Coghlan, 2007, p. 64). From an epistemological point of view, interpretivism holds a view that

researchers are engaged participants, and their critical observation of the culture, shared values, and language of the phenomenon under study is essential to the process of research inquiry (Lee, 1991).

Methodologically, interpretivists see research as a product of intersubjective experience (Guba & Lincoln, 1994). Thus, researchers are urged to enter into the research site with few or no presumptions, and instead allow the key theoretical themes and concepts to come out of empirical evidence (Brannick & Coghlan, 2007). Theory in this sense is a way to organise and make sense of a research experience, rather than something that needs to be constructed, tested, verified, refuted, or else guide a study (Putnam, Bantz, Deetz, Mumby, & Van Maanan, 1993). Interpretivism is often associated with research approaches such as phenomenology and ethnography, which discuss “credibility, transferability, dependability, and confirmability rather than reliability and validity” (Brannick & Coghlan, 2007, p. 65).

- Critical theory

Critical theory has been developed as a “meta-theoretical paradigm” that integrates positivism and interpretivism perspectives to place knowledge in a broader context and explain its contribution to the process of social evolution (Meredith et al., 1989; Reed, 2005, p. 1623). The main premise of critical theory (and its related ideological positions) centres on the explanations of fundamental “generative mechanism” that shape people and the way in which they in turn create and transform the social world (Reed, 2005, p. 1623). Ontologically, critical theory believes in historical realism (Guba & Lincoln, 1994). In other words, it holds a view that reality once was unformed, but over time, a range of social, cultural, political, economic, and gender-related factors form and crystallise it into a series of structures that are now believed to be “truth” (*i.e.* natural) (Guba & Lincoln, 1994). Within the critical theory school of thought, ontology and epistemology are interrelated. That is, critical theorists adhere to the idea that researchers’ knowledge of the world is inevitably intertwined with the interaction between a particular researcher and a particular phenomenon under study (Miller & Tsang, 2011).

Methodologically, critical theory relies on dialogic and dialectical approaches of research (Guba & Lincoln, 1994). To reflect the transactional nature of its philosophical point of view, proponents of this view use dialogues with the subject under study in order to understand and explain the underlying mechanism of transformation of ignorance into what is known as reality. According to Giroux (1988, p. 213), critical theorists use dialectical methods to “uncover and

excavate those forms of historical and subjugated knowledges that point to experiences of suffering, conflict, and collective struggle”.

- Summary of alternative research paradigms

In summary, paradigms reflect meta-theoretical assumptions that represent researchers’ view of what considered to be valid and credible contributions to theory (Shrivastava & Mitroff, 1984). In addition, they determine the application of a particular research design and methods of inquiry (Cannella and Paetzold, 1994). Of the four paradigms discussed here, each also echoes different objectives for conducting research. For instance, while positivism aims to explain the underlying objective rules of behaviour, interpretivism is concerned with providing a credible understanding of a particular context under study. Post-positivism acknowledges the importance of social influence and context in explaining reality, and critical theory emphasises the role of historical context in generating social reality.

2.2.3 This thesis

Having reviewed dominant inquiry paradigms in management research, this thesis adopts a post-positivism perspective. This is motivated by the aim of the research, that is investigating behavioural factors that determine managerial responses to supply chain disruptions, and the researcher’s philosophical point of view. Ontologically, the researcher accepts the existence of “external reality” but acknowledges heterogeneity in individuals’ perception and behaviour due to uncertainty (*i.e.* critical realist). From an epistemological point of view, the researcher holds a view that all knowledge could be falsified depending on the contextual and situational characteristics of a study (*i.e.* modified objectivist). Therefore, the thesis takes a view that managerial perceptions of a supply chain disruption are different and subsequently, seeks to explain the underpinning factors that drive variations in a particular context. In regards to the methodology of this thesis, the researcher applies a hypotheticodeductive and experimental approach. In particular, empirical studies within this thesis draw from established behavioural theories to develop a set of hypotheses that could be tested using vignette-based experiments and a cross-sectional survey. Table 2:2 summarises the methodologies used to answer Study 1 and 3 research questions (RQs).

Table 2:2 Research Methodologies for Study 1 and 3

	Research question	Methodology
Study 1	“How do individual-level cultural values influence responses to an impending supply chain disruption?”	Vignette-based experiment
Study 2	“How does attribution of blame influence buyers’ redesign responses in the aftermath of a disruption?”	Vignette-based experiment; Cross-sectional survey

Study 1 uses a vignette-based experiment to examine the effect of cultural factors on individuals’ risk perception and supplier switching intention in the face of a supply disruption. The use of experiment is justified by the following: experiments provide an opportunity to identify causal relationships between psychologically held cultural values and decision outcomes (Field and Hole, 2003; Langdridge and Hagger-Johnson, 2009); their designs control for the impacts of other individual and organisational compounding variables (Katok, 2011); and they involve little cost to run compared to their alternatives (Siemsen, 2011). Moreover, experiments present unique set-ups that allow the researcher to manipulate disruption environment (Kull et al., 2014) and captures participant responses in the presence of varying levels of situational uncertainty. The use of experiments in operations and supply chain management studies has been gaining momentum during the last years, and provided opportunities for scholars to make new contributions to the field (*e.g.* DuHadway, Carnovale, & Kannan, 2018; Eckerd, Hill, Boyer, Donohue, & Ward, 2013; Kaufmann, Rottenburger, Carter, & Schlereth, 2018; Polyviou et al., 2018; Urda & Loch, 2013). Scholars have particularly, applied experiments to seek insight into the supply chain management decision making process (DuHadway et al., 2018; Hartmann and Moeller, 2014). For example, a recent study uses a vignette-based experiment to examine the effect of managerial anger on post-disruption non-retention decisions (Polyviou et al., 2018). Similarly, Hartmann and Moeller (2014) utilise experiments to study the effect of firms’ unsustainable actions on customers’ boycotting behaviour.

Different experimental approaches were considered in regard to the relationship under study. Table 2:3 provides a summary of the key characteristics, advantages, and limitations of each approach. Laboratory (lab) experiments were not deemed appropriate since they could not simulate many significant features found outside the laboratory, such as those found within

organisations (Greenberg and Tomlinson, 2004). While lab experiments could offer a high degree of control over all compounding variables, their artificial settings and lack of results generalisability constrain their application and efficacy in studying organisational phenomena (Bachrach and Bendoly, 2011; Katok, 2011). On the other hand, field experiments exchange some of the rigour of laboratory experiments in “the interest[s] of ensuring realism and robustness” (Bachrach and Bendoly, 2011, p. 5). They allow for manipulation of the variables of interest (*i.e.* independent variables) to measure the effect on dependent variable(s), but because it is difficult to control the impact of all extraneous variables (Langdrige and Hagger-Johnson, 2009), they tend to lack the same level of controls found in lab experiments (Greenberg and Tomlinson, 2004).

Table 2:3 Comparison of Different Experimental Approaches

	Lab experiments	Vignette experiments	Field experiments
Characteristics	Laboratory-based research; Ideally include both experimental and control groups; Random assignment to the two or more conditions	Can be conducted in both field and laboratory; Allowing for random assignment of participants	Carried out in the natural environment of those being studied; Flexible in the interest of ensuring realism and robustness; No random assignment of participants to experimental conditions
Advantages	All variables can be controlled; Easy to replicate; Can compare responses and therefore, analyse data easily	Bringing rigour and control of the true experiments to the natural realism of the field	More realistic; easier to generalise results compare to the lab experiments
Limitations	Cannot simulate many significant features found in organisations; Artificial settings and lack of generalisability	Lacks the high degree of control existed in true experiments; lacks the richness (realism) of field experiments	Difficult to control the impact of all extraneous variables

Situated between the two are scenario-based (*i.e.* vignette-based) experiments which provide an opportunity to combine the advantages of the rigour and control of the laboratory experiments with the natural realism of the field (Greenberg and Tomlinson, 2004). In a

vignette-based experiment, “human subjects are recruited to assume an a priori defined role in reviewing the scripted information about specific levels of factors of interest and, through this role, to then react and respond to this scripted information” (Rungtusanatham et al., 2011, p. 9). For the purpose of Study 1, the researcher applies a vignette-based experiment, since it allows for the examination of the relationship of interest, whilst controlling for other potential organisational and relational compounding effects (Rungtusanatham et al., 2011).

Similarly, Study 3 uses a vignette-based experiment in the first step, to establish causal relationships between event characteristics and blame attribution. This provides a number of methodological advantages; first, it allows the researcher to control for spurious causes and compounding effects (Siemsen, 2011). Second, manipulating controllability and severity constrains endogeneity issues caused by potential correlation between controllability and blame attribution (Coombs and Holladay, 2002). In the second step, the study applies a cross-sectional survey to capture post-disruption redesign decisions in a real-life organisational setting. The use of cross-sectional survey in this step allows the researcher to address some of the limitations of experimental approach relevant in the study; 1) while supply base redesign decisions are costly and could have long-term performance implications (Blackhurst et al., 2005), the stakes for making these decisions in an experimental setting may be quite small (Levitt and List, 2007); 2) experiments could not control over the full context within which such decisions are made (*e.g.* supplier’s past performance and relationship situations) (Bode et al., 2011).

Chapter 3 Study 1: Discovery

This declaration concerns the article entitled									
The effect of individual-level cultural values on responses to supply chain disruption									
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Draft manuscript	×	Submitted		In review		Accepted		Published	
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	Formulation of ideas: 70%								
	Design of methodology: 80%								
	Experimental work: 70%								
Statement from Candidate	Presentation of data in journal format: 70%								
	This paper reports on original research I conducted during the period of my Higher Degree by Research candidature								
Signed	Mehrnoush Sarafan				Date	28.09.18			

Data access statement:

Due to confidentiality agreements with research collaborators, supporting data can only be made available to bona fide researchers, subject to a non-disclosure agreement. Details of the data and how to request access are available at the University of Bath data archive: <https://doi.org/10.15125/12345>.

The Effect of Individual-Level Cultural Values on Responses to Supply Chain Disruption²

ABSTRACT

Studies of supply chain risk management have traditionally assumed that when confronted with risks, managers make decisions using an economic utility model, to best serve the long-term objectives of the firm. However, supply chain managers who make such decisions are human beings and their decisions regarding risks are biased. In particular, culture has been shown to have significant effects on people's evaluation of and responses to risk. This is of great importance in today's supply chain environment, whereby an ever-increasing number of firms are dealing with international partners, located around the world with different cultural values. Despite this important role, the supply chain risk literature has been silent on this matter. To address the gap, this study uses a behavioural experiment to examine the impact of individual-level culture on responses to a supply disruption risk.

Keywords:

Supply chain disruption, behavioural operations, culture

3.1 Introduction

To minimise the damaging consequences of supply chain disruptions (Hendricks & Singhal, 2003, 2005; Jacobs & Singhal, 2017), firms need to actively evaluate and manage the sources of risks threatening their supply chain (Bode, Huebner, & Wagner, 2014). Many of these events could be averted before their actual occurrence, or their impact could be minimised, if identified and acted upon by supply chain managers (Bode & Macdonald, 2016; Ellis, Henry, & Shockley, 2010; Mitroff & Anagnos, 2001). A rich body of supply chain risk literature has offered a range of risk management frameworks to assess and reduce the sources of supply chain disruption (Hallikas, Karvonen, Pulkkinen, Virolainen, & Tuominen, 2004; Ho, Zheng, Yildiz, & Talluri, 2015; Manuj & Mentzer, 2008), and utilised simulation and analytical techniques to find optimal mitigation strategies (Schmitt & Singh, 2012; Snyder et al., 2016;

² An earlier version of this chapter was presented during European Operations Management Association (EurOMA) annual meeting in 2018

Tomlin, 2006). Extant research has also offered design strategies that minimise the probability and/or impact of supply chain disruption risk using optimal numbers of suppliers (Allon & Van Mieghem, 2010), inventory and capacity levels (DeCroix, 2013; Van Mieghem, 2007; Yang, Aydin, Babich, & Beil, 2009), insurance premiums (Dong & Tomlin, 2012), and contractual governance (Ang, Iancu, & Swinney, 2017; Hu, Gurnani, & Wang, 2013).

The vast majority of these studies have implicitly or explicitly assumed that disruption risks can be assessed objectively (Ellis et al., 2010; Ellis, Shockley, & Henry, 2011; Tazelaar & Snijders, 2013), and hence the subsequent management responses are optimal and effective (DuHadway, Carnovale, & Kannan, 2018; Gurnani, Ramachandran, Ray, & Xia, 2014). There is abundant evidence however, that questions the validity of these assumptions (*e.g.* Simon, 1972; March and Shapira, 1987; Carter, Kaufmann and Michel, 2007). In many cases, such as cyber-attack and political upheavals, there is limited historical information on the risk to be evaluated objectively, if any (Ellis et al., 2011; Simchi-Levi, Schmidt, & Yehua, 2014). This coupled with decision makers' susceptibility to a range of affective and cognitive biases results in decision outcomes that may deviate from what is considered to be optimal (Bendoly, Donohue, & Schultz, 2006; Kahneman & Tversky, 1974; Tokar, 2010). Therefore, although these studies have contributed significantly to our understanding of the cause, effects, and *rational* management of supply disruption risk, we still know very little about how managers as organisations' decision-making agents view disruption risk, and when and why they choose to react to certain events (Ambulkar, Blackhurst, & Cantor, 2016; Bode et al., 2014; Cantor, Blackhurst, & Cortes, 2014; Ellis et al., 2011). Without understanding the underlying factors that shape such responses, it is hard to propose frameworks and strategies that are effective in the management of supply chain risk.

To address the gap in the literature, we build on the new stream of behavioural research (DuHadway et al., 2018; Eckerd, Boyer, Eckerd, & Hill, 2016; Ellis et al., 2010, 2011; Mir, Aloysius, & Eckerd, 2017; Oflaç, Sullivan, Baltacıoğlu, Ofla, & Sullivan, 2012; Ro, Su, & Chen, 2016) to examine the impact of psychologically held cultural values on managers' perception of, and responses to, supply chain disruption. When facing a disruption, a range of psychological and sociological factor influences individuals' decision-making through a mediating mechanism of subjective risk perception (Sitkin & Pablo, 1992; Sitkin & Weingart, 1995; Yates & Stone, 1992). Culture in particular, has been shown to systematically affect risk perception by directing individuals' attention to important cues in the environment and assist

in sense-making when information is missing or ambiguous (Gibson, Maznevski, & Kirkman, 2009; Weber & Hsee, 1998). This is of great importance in global supply chain, where the outcome of many locally made decisions about managing a disruption could influence the operations of exchange partners throughout a supply chain (Revilla & Sáenz, 2014). In response, extant literature has investigated the effect of nationality (Revilla & Sáenz, 2014), and organisational culture (Dowty & Wallace, 2010) on the variability of supply chain risk sources and the use of collaborative risk management resources in disruption situations. Limited attention has been paid to the role of culture in directing individual managers' responses to supply disruption risks. This is surprising, especially given that many of these decisions are made by individual agents who are responsible for managing supply chain operations (Ambulkar et al., 2016; DuHadway et al., 2018; Tokar, 2010). Our study aims to address this gap in the literature by focusing on an individual level of analysis (*cf.* Kirkman and Lowe, 2009).

We used a scenario-based behavioural experiment to study the effect of individual-level values on evaluations of risk and decision-making in a controlled decision-making situation (Eckerd, 2016; Rungtusanatham, Wallin, & Eckerd, 2011). Managers often make such decisions under uncertain conditions (Hult, Craighead, & Ketchen, 2010). Hence, to account for the moderating impact of uncertainty in the relationship between culture and managerial responses (*cf.* Gelfand *et al.*, 2017; Kirkman, Lowe and Gibson, 2017; Schorsch, Wallenburg and Wieland, 2017), we manipulated two distinct levels of situational uncertainty in the scenario. The results from our study show a positive effect of uncertainty avoidance and a negative effect of individualism-collectivism on disruption risk perception. While uncertainty avoidance is defined as the extent to which individuals can tolerate the lack of structure, clarity, and predictability in an uncertain situation (Steel & Taras, 2010), individualism-collectivism refers to the extent to which people are independent/interdependent of their social group (Oyserman, Kimmelmeier, & Coon, 2002). We find that uncertainty avoidant managers tend to perceive higher levels of disruption risk compared to their counterparts in a similar situation which in turn, leads to higher tendency to switch supplier in both low and high uncertain circumstances. Furthermore, we find support for the negative impact of individualism-collectivism values on disruption risk perception in high uncertain situations, that leads to lower switching intention. However, this was non-significant in relatively more certain circumstances.

Our findings contribute to the extant literature in three different ways. First, we provide empirical evidence on the importance of cultural factors in managerial perceptions of and responses to a supply chain disruption (*cf.* Ellis, Henry and Shockley, 2010; Ellis, Shockley and Henry, 2011; Tazelaar and Snijders, 2013). Second, by examining the moderating effect of uncertainty on the relationship between cultural values and disruption risk perception, we move beyond operations and supply chain management (OSCM) work regarding “does culture matter” (Metters, Zhao, Bendoly, Jiang, & Young, 2010, p. 183) and show “when and how it matters” the most (Gelfand et al., 2017; Kirkman et al., 2017, p. 15; Steel & Taras, 2010). Lastly, by studying the effect of psychologically held cultural values on perceptions of disruption risk, we contribute to previous research that has examined the effect of nationality (Revilla & Sáenz, 2014), and organisational culture (Dowty & Wallace, 2010) on supply chain risk management practices. Given that risk perception is a psychological component (Sitkin & Pablo, 1992) that is formed at the individual level, we claim that our findings offer a richer insight into the micro-foundations of decision-making in situations of supply chain disruption risk (*cf.* Reimann, Kosmol and Kaufmann, 2017).

The remainder of the paper is organised as follow. First, we review the extant research on supply chain disruption management, and culture. Subsequently, we develop hypotheses on the cultural determinants of disruption risk perception, the moderating effect of uncertainty on this relationship, and the behavioural consequences of individuals’ cultural values and disruption risk perception. Then, we overview the methods employed, and results of the analyses. Finally, we discuss the theoretical and practical implications of our findings, the limitations of the study, and opportunities for future research.

3.2 Literature review

3.2.1 Supply chain disruption management

Supply chain disruptions are unexpected triggering events that could happen throughout a supply chain and affect a normal flow of activities (Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007; Svensson, 2000). As a consequence, a firm may be exposed to a range of operational and financial issues, such as stock-outs (Wagner & Bode, 2008), unsatisfied demand (Wang & Tomlin, 2009), lower returns on sale (Hendricks & Singhal, 2005), and decreased shareholder wealth (Hendricks & Singhal, 2003). The extant research has offered various strategies, such as diversification (Hendricks, Singhal, & Zhang, 2009), excess

inventory (Tomlin, 2006), capacity restoration (Hu et al., 2013), and risk sharing (Wakolbinger & Cruz, 2011) to reduce the probability and/or the consequences of disruption. For instance, Knemeyer, Zinn, and Eroglu (2009) suggest a proactive use of excess inventory and flexible sourcing to minimise a firm's dependency on supply chain areas that are vulnerable to low-likelihood, high-impact events, such as earthquakes and flooding. On the other hand, Tomlin (2006) offers contingency approaches, such as temporary rerouting and demand management to deal with the consequences of low-probability events when they occur.

These strategies are guidelines that if used properly, could reduce a firm's exposure to disruption risks (Craighead et al., 2007), improve supply chain resilience (Brandon-Jones, Squire, Autry, & Petersen, 2014), shorten time to recovery (Sheffi and Rice, 2005), and reduce costly consequences of a disruption. However, to successfully implement such strategies, managers are required to evaluate risk and make crucial decisions when facing disruptions (Ambulkar et al., 2016; Ellis et al., 2010). Over recent years, supply chain academics and scholars have developed various risk management frameworks to assist managers in such decision-making tasks (*e.g.* Norrman and Jansson, 2004; Manuj and Mentzer, 2008). For instance, Blackhurst, Scheibe, & Johnson (2008) develop a multi-criteria-scoring procedure to assess and prioritise the sources of supplier risks in the automotive industry. Similarly, Dong and Tomlin (2012) apply an analytical technique to identify an optimal insurance deductible and coverage limit as well as an optimal inventory level for a firm facing a supply disruption risk.

The majority of these frameworks are based on objective and rational decision-making assumptions (Carter et al., 2007; Tokar, 2010). Objective implies that risk estimates are based on information that is generally accurate and can be reduced to quantifiable probabilities (Ellis et al., 2010; Tazelaar & Snijders, 2013), and rational means that managers have access to, and are capable of processing all relevant information to assess risk and make an optimal decision (Kahneman & Tversky, 1974; Simon, 1972). However, uncertainty in the supply chain environment and people's susceptibility to biases cause decisions to deviate from rational decision-making assumptions (Simon, 1972). Instead, a range of behavioural factors such as managerial past experiences, organisational contexts, and the characteristics of a market guide such decisions through a mediating role of subjective perceptions of risk (Ellis et al., 2010; Kull, Oke, & Dooley, 2014; March & Shapira, 1987; Sitkin & Pablo, 1992).

Risk perception is defined as decision makers' subjective assessment of the risk inherent in a situation (Sitkin & Pablo, 1992). It is a psychological component that is based on individuals'

patterns of thinking, reasoning, and in general their cognitive schemas (Breakwell, 2014). It has been shown that culture has a strong influence on the content and structure of the information within these schemas (Nouri et al., 2013) and therefore, affects the way people evaluate and make sense of risky situations (Gibson et al., 2009). This is of great importance in today's supply chain environment, since an ever-increasing number of firms are dealing with international partners, located around the world with different cultural values (Ribbink & Grimm, 2014). To date, the supply chain risk literature has been silent on this matter. We aim to address this gap by examining the impact of culture on managers' risk perception and mitigation choices in the face of a supply disruption.

3.2.2 Culture

Hofstede (1993, p. 89) defines culture as “the collective programming of mind which distinguishes the members of one human group from another”. It presents itself in a set of shared assumptions, values and principles (Schein, 1984) assisting its members to make sense of the social world (Hofstede, 1985). At the individual-level, culture is characterised as “articulated mental representations” (Oyserman, Kimmelmeier, et al., 2002, p. 114). In this way, it represents a set of internalised values, norms and scripts that guides individuals on how to behave in the social world, how to interact with others, and which aspects of information to give more attention. Extant research has shown the effect of culture on a range of individual and organisational outcomes, such as risk preferences (Weber & Hsee, 2000), trustworthiness (Özer, Zheng, & Ren, 2014), negotiation style (Ribbink & Grimm, 2014), and conflict management (Gelfand, Nishii, Holcombe, & Dyer, 2001). Within operations and supply chain management, scholars have studied the effect of culture on operational decisions, and the efficacy of practices in various contexts (Bockstedt, Druehl, & Mishra, 2015; Boscari et al., 2018; Metters et al., 2010; Naor, Linderman, & Schroeder, 2010; Pagell, Katz, & Sheu, 2005). For example, Kull and Wacker (2010) examine the impact of national culture on the effectiveness of quality management practices in East Asia, whereas, Khazanchi et al. (2007) focus on organisational culture and its role in the successful implementation of advanced manufacturing technology in a firm. Recently, some studies have also demonstrated the effect of nationality on individual outcomes, such as the newsvendor decision (Cui, Chen, Chen, Gavirneni, & Wang, 2013), and buyers' responses to a psychological contract breach (Eckerd et al., 2016).

The majority of these studies have assumed that culture is homogenous and have subsequently, used nationality as a proxy for culture (Tsui, Nifadkar, & Ou, 2007). In other words, they have overlooked the possibility of within country variation of subcultures (Erez & Gati, 2004; Taras, Roney, & Steel, 2009). Given today's mobility of people, diversity of workplaces, and global communication channels, individuals' cultural values are exposed to and shaped by various subcultures (Taras, Kirkman, & Steel, 2010). Hence, relying solely on national-level culture to understand people's behaviour in an organisational or individual context becomes less meaningful (Yoo, Donthu, & Lenartowicz, 2011). Instead, recent literature has suggested the application of micro-levels (*i.e.* culture as reflected in individuals' cultural value orientations) in exploring individuals' cognitive, emotional, or motivational responses in business contexts (Chipulu et al., 2014; Cleveland, Erdoğan, Arikan, & Poyraz, 2011; Han, Lalwani, & Duhachek, 2017; Kirkman & Lowe, 2009). Using this approach, scholars have found significant effects on employees' job attitudes (Kirkman & Shapiro, 2001), perceptions of justice (Kirkman & Lowe, 2009), negotiation behaviour (Volkema, 2004), transformational leadership (Shao & Webber, 2006), and responses to a service failure (Patterson, Cowley, & Prasongsukarn, 2006). Within the context of our study, we focus on culture at the individual level to examine the effect of cross-cultural differences in managerial perception and behaviour in the face of a supply disruption.

3.3 Hypotheses

3.3.1 The cultural antecedents of risk perception

Over time, the development of cultural frameworks has facilitated the study of culture at micro-levels (*e.g.* Hofstede, 1980; Triandis, 1989; Schwartz, 1999; House, Javidan and Dorfman, 2001). Within management research, the two most influential frameworks have been proposed by Hofstede (1980) and GLOBE scholars (House et al., 2001). Hofstede (1980) uses empirical data from more than 100,000 IBM employees across 50 countries to differentiate cultures based on five work-related values: individualism-collectivism, uncertainty avoidance, power distance, masculinity, and long-term orientation. Hofstede's cultural value dimensions capture the core conceptualisations of culture (Soares, Farhangmehr, & Shoham, 2007; Yoo, Donthu, & Lenartowicz, 2011), and hence have been used predominantly to study cross-cultural differences in various contexts (Taras, Roney, & Steel, 2009). Building upon the dimensions included in Hofstede's model, GLOBE researchers develop a framework with a particular focus on leadership behaviours (House et al., 2001). Their framework compares culture along

nine dimensions: institutional collectivism, in-group collectivism uncertainty avoidance, power distance, gender egalitarianism, humane orientation, assertiveness, future orientation, and performance orientations.

Various dimensions across the Hofstede and GLOBE frameworks represent different aspects of a culture in relation to people's desirable ways of behaving and interacting in the social world (Boscari et al., 2018; Keh & Sun, 2008; Oyserman, Kimmelmeier, & Coon, 2002). Nonetheless, the effect of some dimensions may be more pronounced in a particular context (Bockstedt, Druehl, & Mishra, 2015; Leidner & Kayworth, 2006). For instance, Handley and Angst (2015) show the importance of individualism-collectivism and uncertainty avoidance values in moderating the effect of governance on opportunistic behaviour in outsourcing relationships, whereas Bockstedt et al. (2015) examine the role of performance orientation and uncertainty avoidance in contestants' problem-solving efforts in innovation contests. For conceptual and empirical parsimony, we focus on specific dimensions of culture (i.e. individualism-collectivism, uncertainty avoidance) that are directly relevant to the evaluation of disruption risk perception (*cf.* Bontempo, Bottom, & Weber, 1997; Rieger, Wang, & Hens, 2015; Statman, 2008; Weber & Hsee, 2000). To identify these values, it is important to distinguish between people's evaluation of risk and their attitude towards risk. The former refers to individuals' assessment of the likelihood of negative events happening and the severity of those events (Jia et al., 2015). People may see an event as risky, because they feel nervous by the lack of knowledge, structure and resources to deal with the event and its consequences, or they may underestimate the riskiness of an event, because they are optimistic that the event will not happen to them or if it happens, they have capabilities and resources to control its consequences. On the other hand, individuals' attitude towards risk is mainly concerned with people's desire for stability and long-term planning as opposed to willingness to pursue uncertainties in a hope to achieve success (Hung et al., 2010). Table 3:1 provides a definition of various cultural values and their relevance to people's perception of disruption risk.

Table 3:1 Cultural Values and Their Relevance to Disruption Risk Perception

Cultural values	Definitions	Relevance to risk perception
Individualism-Collectivism	The extent to which people are independent versus interdependent to other members of their social group ³ (Oysermann et al., 2002)	<i>Individualism</i> : susceptible to optimism bias (underestimating the likelihood of experiencing negative events); susceptible to overconfidence bias (overestimating their ability to control the potential effects of a risky event) <i>Collectivism</i> : overestimating the help from social group members to bear the consequences of a risky event
Uncertainty avoidance	The extent to which people can tolerate the ambiguity and lack of clarity in uncertain situations (Bontempo et al., 1998)	<i>High UA</i> : intolerance to ambiguity of a disruption environment; nervous about the uncertainty and ambiguity of a disruption event (overestimating the riskiness of a disruption)
Power distance	The extent to which people expect and agree with unequal distribution of power in the social world (Hofstede et al., 1980)	Individuals' perception of the likelihood and/or impact of disruption risk is unlikely to be influenced by their values related to unequal distribution of power
Masculinity	The extent to which people value a distinction of gender roles in a society. In addition, masculinity reflects people's desire for the dominance of masculine values, such as assertiveness, and ambition as opposed to feminine values, such as empathy and equality in their social group ⁴ (Hofstede et al., 1980)	Individuals' perception of the likelihood and/or impact of disruption risk is unlikely to be influenced by their values related to the distinction of gender roles and dominance of masculine values in the social world
Performance orientation	The extent to which a social group encourages group members for performance	Decision-making in the context of this study is related to prevention of a

³ GLOBE (2001, p. 495) researchers have adapted these values from Hofstede's (1980) original framework and distinguished between institutional collectivism ("the degree to which organisational and societal institutional practices encourage and reward collective distribution of resources and collective action") and in-group collectivism ("the degree to which individuals express pride, loyalty, and cohesiveness in their organisations or families"). While this has implications in the context of group interactions and organisational behaviour, in the context of our study that focuses on individual-level behaviour, we decided to use them as a single construct.

⁴ GLOBE (2001, p. 495) researchers adapt this culture value and distinguish between gender egalitarianism ("the extent to which an organisation or a society minimises gender role differences and gender discrimination") and assertiveness ("the degree to which individuals in organisations or societies are assertive, confrontational, and aggressive in social relationships"). In the context of this study, neither of these values are seemed to be relevant to people's perception of disruption risk.

	improvement (House et al., 2001)	supply chain disruption and is not intended to be linked to individuals' performance evaluation. Hence, the perception of the likelihood and/or impact of disruption risk is unlikely to be influenced by the extent to which a social group encourages performance improvement
Humane orientation	The extent to which people value and encourage social group members for being altruistic, fair, friendly, and generous (House et al., 2001)	Individuals' perception of the likelihood and/or impact of disruption risk is unlikely to be influenced by the extent to which they value fair and friendly relationships in the social world
Future orientation	The degree to which individuals value engaging in future-oriented behaviours such as planning, and delaying gratification (House et al., 2001)	Future orientation values are likely to influence the extent to which people avoid (or pursue) uncertain events to maintain stability, perseverance, and respect traditions. However, such values are unlikely to directly influence the degree to which people see an event as less or more probable. In addition, the salient values in future oriented cultures are unlikely to have a direct effect on extent to which people perceive the consequences of a disruption as less or more severe

- Individualism-Collectivism

Individualism-Collectivism, as reflected in individuals' value orientation, primarily refers to the extent to which people are independent/interdependent of others in a cultural group (Oyserman, Coon, & Kimmelmeier, 2002). Individualism value focuses on personal achievements as the basis of one's identity (Triandis, 1989). The literature has conceptualised individualism as a worldview that values personal autonomy and personal control, and de-emphasises the social environment (Markus & Kitayama, 1991; Oyserman, Kimmelmeier, et al., 2002; Triandis, 1989). Consequently, individualism influences people's judgement and decision-making. For instance, individualists have been shown to be more prone to overconfidence and over-optimism biases (Chui, Titman, & Wei, 2010; Van den Steen, 2004). Overconfidence means that individuals fail to acknowledge their own limits of knowledge (M.

Simon, Houghton, & Aquino, 2000; Van den Steen, 2004), and base their judgements on the cases that are likely to improve their confidence (Russo & Shoemaker, 1992). Additionally, over-optimism means that they underestimate the likelihood of experiencing negative events (Weinstein & Klein, 1996), and overestimate their abilities to succeed (Alicke, Vredenburg, Hiatt, & Govorun, 2001; Van den Steen, 2004). In the context of supply chain disruption, this means that people with higher individualism value tend to feel in control of managing the consequences of a potential event (*cf.* Chui, Titman and Wei, 2010), and/or think that they are less likely than others to experience the negative consequences of an impending event. Consequently, it is expected that individualism will be negatively associated with perceptions of supply disruption risk (Rieger et al., 2015; Xue, Hine, Loi, Thorsteinsson, & Phillips, 2014).

On the other hand, the core principle of collectivism refers to people as interdependent and mutually obligate individuals (Oyserman, Kimmelmeier, et al., 2002). In this culture, consensus and compromises are valued (Li, Wang, Wang, & Shi, 2010), and people prioritise a social unit's common goals and fate to their own goals and personal achievements (Triandis, 1989). These values have implications for individuals' decision-making (Kagitcibasi, 1997). For instance, the strong social ties in collectivist cultures are seen as a *cushion* for its members, protecting them against potential negative consequences of a risky event ("cushion hypothesis") (Hsee & Weber, 1999, p. 172). Hence, when evaluating a potential risky event, people high on collectivism value view their social group members as a buffer that would step up and offer help if the event leads to financial losses (Rieger et al., 2015; Statman, 2008). Consequently, it is expected that in the context of a supply disruption risk, collectivism will be negatively associated with perceptions of risk.

In sum, the extant research has been inconclusive on the direction of the impact of individualism-collectivism on supply disruption risk (Rieger et al., 2015). Some have argued that the relative magnitude of the negative effect of individualism and collectivism on risk perception is situation-dependent (Choi & Geistfeld, 2004). Therefore, we develop the following competing hypotheses:

Hypothesis 1a. Higher individualism is associated with lower levels of perceived disruption risk

Hypothesis 1b. Higher collectivism is associated with lower levels of perceived disruption risk

- Uncertainty avoidance

Uncertainty avoidance refers to the extent to which individuals can tolerate uncertain and ambiguous situations (Steel & Taras, 2010). People high on uncertainty avoidance value feel more threatened by the ambiguity and unpredictability of uncertain situations (Bontempo et al., 1997). They actively seek security and value written rules, and structured relationships (Patterson et al., 2006). Whereas, people with low uncertainty avoidance are more comfortable in dealing with uncertain circumstances (Rieger et al., 2015). They are more contemplative of unstructured and ambiguous situations and generally accept some level of personal risk (Patterson et al., 2006; Shiu, Walsh, Hassan, & Parry, 2015). Research has found that cultural differences in this value, as reflected in the relative emphasis on “fear of failure versus a desire to achieve success” (Bontempo et al., 1997, p. 483), could result in systematic differences in perceptions of risk (e.g. Bontempo et al., 1997; Choi and Geistfeld, 2004). In the context of supply chain disruption, we argue that individuals with higher uncertainty avoidance orientation feel more nervous in dealing with the unpredictability of an impending event and hence, perceive higher levels of disruption risks compared to their counterparts in a similar situation. Therefore, we hypothesise that:

Hypothesis 1c. Higher uncertainty avoidance is associated with higher levels of perceived disruption risk

3.3.2 The behavioural consequence of risk perception

Facing a disruption, firms may have several mitigation strategies in place (e.g. multiple sourcing, transportation mix) to reduce the probability and/or the consequences of a supply disruption risk. Regardless of the approach, it is often a managerial responsibility to decide when and how to trigger an action (Ambulkar et al., 2016; Cantor et al., 2014). Managers may decide to ignore/absorb the risk by doing nothing or modify their supply base to hedge against the consequences of risk. Traditionally, the literature has assumed that such decisions are solely driven by objective evaluations of risk and managerial cost minimisation concerns (Gurnani et al., 2014). Instead, recent empirical evidence shows that managers’ subjective perception of risk also guides such decision-making. For example, Ellis et al. (2010) find that buyers tend to seek alternative sources of supply when perceiving relatively higher levels of disruption risk in the supply of a certain product from their supplier. Similarly, Kull et al. (2014) show that higher perceptions of risk in the context of supplier selection induces managers to choose a

more certain supplier (*i.e.* with predictable operating performance outcomes), even though it might be costlier to do so. The extant research has shown supplier switching as a common temporary strategy to hedge against the consequences of supply disruption risks and improve resilience (Park, Min, & Min, 2016; Whitney, Luo, & Heller, 2014). Zsidisin and Wagner (2010) show that the use of supply chain resilience practices could reduce managerial perceptions of risk. In the context of our study, we argue that higher perception of disruption risk leads managers to switch their supply to a less risky supplier in order to improve the firm's resilience and reduce their level of perceived risk:

Hypothesis 2. Higher perceived risk is associated with higher likelihood to switch suppliers in the face of disruption

3.3.3 Risk perception as a mediator

This section draws from Hypothesis 1a-c and Hypothesis 2 to develop a set of hypotheses for the mediating effect of disruption risk perception on the relationship between cultural values and supplier switching intention. It discusses the mediating mechanism for the relationship between individualism-collectivism and supplier switching intention, and uncertainty avoidance and supplier switching intention, in order.

- Individualism-collectivism

Building on the premise of Hypothesis 1a, and Hypothesis 2, we assert that the cultural value of individualism-collectivism indirectly impacts supplier switching intention through a mediating role of disruption risk perception. In other words, people higher on individualism value tend to be more overconfident and optimistic in their ability to control the consequences of a supply chain disruption (Chui et al., 2010). Hence, they perceive lower levels of disruption risk compared to their counterparts, which results in a lower switching intention (Cantor et al., 2014; Sitkin & Pablo, 1992; Sitkin & Weingart, 1995). On the other hand, the alternative hypothesis suggests that in bearing the consequences of a potential supply disruption, people with high collectivism orientation rely on the support from their social group members, and hence perceive lower levels of risk compared to their counterparts (Hsee & Weber, 1999; Weber & Johnson, 2009). Accordingly, they are less likely to switch to an alternative supplier in order to improve supply chain resilience (Ellis et al., 2010; Kull et al., 2014). In sum, consistent with Hypothesis 1a and 1b, we develop the following competing hypotheses:

Hypothesis 3a. Higher individualism is indirectly associated with lower supplier switching intention through the mediating mechanism of disruption risk perception

Hypothesis 3b. Higher collectivism is indirectly associated with lower supplier switching intention through the mediating mechanism of disruption risk perception

- Uncertainty avoidance

Similarly, we integrate our arguments from Hypothesis 1c and Hypothesis 2 to suggest that the cultural value of uncertainty avoidance indirectly influences people's supplier switching intention through a mediating role of perceived disruption risk. People higher in uncertainty avoidance value tend to feel nervous and threatened by the uncertainty and lack of structure involved in a situation (Bontempo et al., 1997; Liu, Meng, & Fellows, 2015; Qu & Yang, 2015; Rieger et al., 2015). In the context of supply disruption risk, this may mean that uncertainty avoidant managers are less tolerant to the unpredictability of an impending event and hence, perceive higher levels of risk compared to their counterparts. Therefore, they tend to switch to an alternative supplier with more predictable operating outcomes in order to reduce the level of perceived risk and uncertainty of the situation (*cf.* Sitkin and Weingart, 1995; Kull, Oke and Dooley, 2014). Therefore, we hypothesise that:

Hypothesis 3c. Higher uncertainty avoidance is indirectly associated with higher supplier switching intention through the mediating mechanism of disruption risk perception

3.3.4 Uncertainty as a moderator

The notion of uncertainty is inherent in every decision-making situation (Flynn, Koufteros, & Lu, 2016; Vilko, Ritala, & Edelmann, 2014), and has been shown to influence the outcome of various social and organisational decisions (Carpenter & Fredrickson, 2001; Kahneman & Tversky, 1982; Meyer, Dalal, & Hermida, 2010). In essence, uncertainty reflects the lack of information or knowledge, which translates into difficulties in accurately assessing current and future decision situations (Flynn et al., 2016; Gaba & Terlaak, 2013; Milliken, 1987). Within a supply chain environment, van der Vorst and Beulens (2002, p. 413) define uncertainty as decision-making situations where the decision-maker "... is unable to accurately predict the

impact of possible control actions on supply-chain behaviour; or, lacks effective control actions (non-controllability)”. This is closely related to Mischel’s (1977) conceptualisation of *weak situations* as circumstances in which there is unclear and ambiguous information about potential consequences of a success or failure. In such cases, the decision makers’ “subjective frame of reference”, instead of the objective features of the situation, becomes the basis of their decision-making (Finkelstein & Hambrick, 1996, p. 20). On the contrary, *strong situations* provide unambiguous and consistent cues regarding the desirability and consequences of potential behaviours (Meyer et al., 2010). These cues are, in turn, used as the most salient sources of information in decision-making in such situations (Cooper & Withey, 2009).

We draw from this perspective to argue that uncertainty moderates the relationship between managers’ cultural values and their perception of supply disruption risk. In the context of our study, we define uncertainty as a consequence of external factors such as supply variability that could result in a lack, variability or ambiguity of information (Flynn et al., 2016) needed to evaluate risk, make decisions, and confidently assign probabilities to their outcomes (Carpenter & Fredrickson, 2001). Uncertainty in this sense represents the extent to which a situation provides clear and unambiguous cues on the nature, probability or potential consequences of the event (Milliken, 1987). Hence, under high levels of uncertainty, individuals draw from their cognitive schema to substitute or complement the uncertain information, and make sense of the situation (Nouri et al., 2013). Since culture is shown to have a significant influence on the development and structure of these schema (Gibson et al., 2009), we expect that culture plays a stronger role in determining behavioural outcomes under relatively more uncertain situations (Erez, 2010). On the other hand, these schemas may be less relevant under certain circumstances, where more specific cues in the environment evoke similar responses to the situation (Nouri et al., 2013). Therefore, we hypothesise that:

Hypothesis 4. Uncertainty positively moderates the relationship between cultural values and disruption risk perception:

- a. *Uncertainty positively moderates the relationship between individualism-collectivism and disruption risk perception*
- b. *Uncertainty positively moderates the relationship between uncertainty avoidance and disruption risk perception*

3.4 Method

3.4.1 Overview

We used a scenario-based behavioural experiment to test our hypotheses (Bendoly et al., 2006; Eckerd, 2016; Rungtusanatham et al., 2011). The use of experiment allowed us to control for contextual and environmental factors that may confound individuals' perception of risk and affect their decision-making (Katok, 2011). In addition, it provided us a unique set-up to manipulate different levels of uncertainty in the scenario and capture responses in a controlled supply disruption environment (*cf.* Ro, Su and Chen, 2016; Mir, Aloysius and Eckerd, 2017).

3.4.2 Subjects and experimental design

A total of 220 experienced professionals were recruited through a survey research firm, Qualtrics. In recent years, Qualtrics has been commonly used by operations and supply chain management scholars to run experiments (*cf.* Schoenherr, Ellram and Tate, 2015; Kaufmann *et al.*, 2018)). Participants were required to have work experience in related operations and supply chain management areas (*e.g.* procurement and purchasing, operations and production, logistics and freight). We included a pre-screening test that automatically terminated the process for respondents who failed this criterion. In addition, we controlled for a potential effect of national-level cultural values by collecting data only from UK residents. The sample characteristics of the study were as follows: 52.72% female (*i.e.* 47.27% male); an average age of 41.7 years ($SD = 11.73$); and an average work experience of 16.77 years ($SD = 11.11$).

Drawing from news reported in the media, we developed a scenario that assigned respondents to the role of purchasing manager in a fictional manufacturer. The scenario described a situation in which the manufacturer is facing a possible labour strike at one of their supplier's plants. The vignette was composed of an introduction to the firm and their supply base, as well as information on the demand, suppliers' order allocation and purchasing costs. The subjects were told that their firm supplies 80% of its total order volume from a supplier with purchasing costs of £18. While, the rest of their order (*i.e.* 20%) is provided by another supplier with purchasing costs of £30 (*cf.* Gurnani *et al.*, 2014). In addition, they were told that the former is exposed to an impending disruption risk at their plant, whereas there is no information related to the riskiness of the latter. Facing a disruption, they were asked to rate the likelihood of switching to the less risky supplier. To control for the effect of contextual factors (*e.g.* sourcing difficulty, supplier dependability), subjects were told that the two

suppliers are comparable in terms of their quality and delivery performance measures and there would be no switching costs involved in the decision. In the context of our study, this is plausible since we are interested in ruling out other causal explanations (apart from risk perception) that may drive or constrain individuals' action upon supply disruption risk.

We drew from the theoretical conceptualisation of uncertainty in risk assessment literature (Guyonnet, Bourguine, Dubois, & Co, 2003) to carefully craft environmental uncertainty in terms of variations in possible consequences of risk (*cf.* Johnson and Slovic, 1995). Thus, in low uncertain situation, participants were provided with a single point estimate of strike duration (“*a potential strike will last for 4 weeks*”), while they were given a possible range of strike duration in the high uncertain scenario (“*such events could last between 1 week to 2 months*”). Each respondent received only one version of the scenario, resulting in a simple between-subject design. To assess the clarity and realism of the scenario, we asked operations and supply chain academics to comment on the realism, clarity and comprehension of the scenario prior to our data collection. The process helped us to ensure that the vignette “as written and presented, is clear, realistic, complete (in that it contains all information necessary for human subjects to assume their role and to consequently provide their reactions and responses), and is effective” (Rungtusanatham et al., 2011, p. 13). Table 3:2 provides a full description of the scenario.

After reading a scenario, we asked participants to answer a series of questions on their subjective perception of supply disruption risk, supplier switching intention, risk attitude, demographic characteristics, and manipulation and realism check. In addition, cultural value dimensions were measured using multi-item 7-point Likert scales. The results of the manipulation check indicated no concern pertaining the validity of our experimental manipulation ($M_{high} = 4.97$ vs. $M_{low} = 4.23$, $p < 0.001$). As for the realism check, we asked participants to indicate the extent to which they perceived the situation described in the scenario to be realistic and could imagine themselves in the situation. The results confirmed that participants found the scenario to be realistic ($M = 5.02$, $SD = 1.21$) (*cf.* Ro, Su and Chen, 2016; Mir, Aloysius and Eckerd, 2017).

Table 3:2 Description of the Vignette

You are a purchasing manager in a manufacturer called Bluelight, based in the South West of England. Your company manufactures professional lighting products used for road and urban lighting with an average demand of 10,000 units per month.

As part of your managerial role, you are responsible for monitoring and assessing risks threatening your product category. You have the authority to switch suppliers, and/or modify order volumes. In making decisions, you must take both product availability and cost implications into account.

Digital Control Units (DCUs) used in your product category are supplied domestically by two suppliers: 1) Accenco that accounts for 80% of your total order volume, and 2) Redex that accounts for 20% of your total order volume. Both suppliers are based in the UK. Due to different sourcing strategies and cost bases of each of your suppliers, DCUs cost £18 per unit from Accenco and £30 per unit from Redex. Both Accenco and Redex have always met your company's quality and delivery requirements.

Recently, you have been informed about an impending strike at Accenco's manufacturing plant over pay and working conditions. Your source within the company has informed you that if an agreement between Union members and Accenco is not reached, the members will go on a strike in two weeks. Based on his analysis of the situation, there is a 70% chance that there will be a strike.

Low uncertainty

The Union has announced that a potential strike will last for 4 weeks. Since a large proportion of Accenco's employees are members of the Union, your source is confident that the strike will stop production at Accenco, and hence disrupt the delivery of DCUs to your company for the whole duration.

High uncertainty

Currently, the effect of the strike on Accenco's operations is unknown. This could range between minor delays to total stoppage of the production at Accenco depending on the number of union members participating in the strike. Your source could not provide any information on the scope and length of the strike. However, drawing from your experience, such events could last between 1 week to 2 months.

Your decision

As a significant proportion of total product cost, DCUs have high holding cost. You therefore, maintain moderate levels of inventory for this component (approximately 15 days) at all time. Given the uncertainty around the extent and duration of a potential strike, your internal risk assessment is unable to determine whether this inventory would be sufficient if the strike occurs. In light of the potential disruption, how likely are you to switch your supply from Accenco to Redex?

3.4.3 Measurements and statistical models

To operationalise the constructs of individualism-collectivism and uncertainty avoidance, we adopted existing multi-item individual level cultural value measurement (CVSCALE) from Yoo et al. (2011). Participants were asked to respond to a series of statements regarding their principles at work on a 7-point Likert scale (1 = "strongly disagree"; 7 = "strongly agree") (see Table 3:3). We used this measure since past research has shown that although the use of Hofstede's country-level value scores is reliable at the national level, these are not valid at the individual level of analysis (Spector, Cooper, & Sparks, 2001; Yoo et al., 2011). The CVSCALE is a psychometrically sound measure that has been used and validated by scholars

who examine the effect of individual level cultural values on various consumer and organisational-related outcomes (e.g. Winterich and Zhang, 2014; Han, Lalwani and Duhachek, 2017; Simpson, White and Laran, 2018). We also contrast coded uncertainty as -1 for low uncertainty and +1 for high uncertainty in our analyses.

Furthermore, to measure our dependent variables – *i.e.* disruption risk perception and supplier switching intention – we adapted existing scaled items from earlier research. A 3-item disruption risk perception measure (Jia, Khan, & Litt, 2015) asked participants to respond to the following statements based on their subjective perception of the scenario: “*what is the likelihood of disruption from this supplier*” (1 = “extremely unlikely”; 7 = “extremely likely”), “*how serious are the consequences of disruption for your company*” (1 = “not serious at all”; 7 = “extremely serious”), and “*how threatening is the supplier's disruption for your company*” (1 = “not threatening at all”; 7 = “extremely threatening”). In addition, we used a single-item adapted from Mir et al. (2017) to measure individuals’ switching intention. We used a single item, since past research has shown that such measures are suitable for operationalising “concrete constructs” such as intention (Bergkvist, 2016; Bergkvist & Rossiter, 2007, p. 175).

We also controlled for other variables that may account for variations in the independent and dependent variables (Carlson & Wu, 2012). Past research has provided evidence on the systematic effect of individuals’ age, gender, work experience, and risk attitude on perceptions of risk and responses to risky situations (Cauffman et al., 2010; Finucane, Slovic, Mertz, Flynn, & Satterfield, 2000; Sitkin & Pablo, 1992). In particular, scholars have found that age is positively related to individuals’ perception of risk and subsequently leads to lower risk-taking behaviours (Cauffman et al., 2010; Rhodes & Pivik, 2011; Rieger et al., 2015). Extant literature has also provided evidence on systematic gender differences in perceptions of risk (Finucane et al., 2000; J. Flynn, Slovic, & Mertz, 1994). In other words, past studies have shown that, for many types of risk, women tend to perceive significantly higher levels of risk compared to men (Byrnes, Miller, & Schafer, 1999; Finucane et al., 2000). The advance of research in cross-cultural studies has also suggested that individual cultural values may be influenced by age and gender (Steel & Taras, 2010). Therefore, by controlling for these two variables, we suppressed their potential effect on the relationship between cultural values and disruption risk perception (Atinc, Simmering, & Kroll, 2012). Furthermore, Tazelaar and Snijders (2013) find that work experience is positively associated with intuitive judgements, and hence could influence people’s assessment of risk. Lastly, individuals’ risk attitude has been shown to systematically affect risk perception and managerial decision-making (Hung & Tangpong, 2010; Sitkin &

Pablo, 1992; Sitkin & Weingart, 1995). Hence, these two variables were controlled to examine the effect of cultural values on disruption risk perception above and beyond their impact.

Subsequently, age and years of work experience were kept as a continuous variable; gender was a categorical variable coded as 0, 1 (Female = 1); and general business risk propensity was assessed as a continuous variable using an existing measure in the literature (Hung, Tangpong, Li, & Li, 2012; Hung & Tangpong, 2010). Thus, participants were asked to respond on a 7-point Likert scale to statements regarding their attitude in their current job/role: “*I like to take chances, although I may fail*”; “*I like to try new things, knowing well that some of them will disappoint me*”; “*Although a new thing has a high promise of reward, I do not want to be the first one who tries it. I would rather wait until it has been tested and proven before I try it*”; “*To earn greater rewards, I am willing to take higher risks*”, “*I seek new experiences even if their outcomes may be risky*” (1 = “strongly disagree”; 7 = “strongly agree”). The main advantage of our measure over more common risk attitude measurement tools in the literature (e.g. Weber and Blais, 2006) is that the items are specifically designed to evaluate people’s risk attitude in multi-faceted decision-making situations of a business context and their validity has been assessed in a cross-cultural context (Hung et al., 2012; Hung & Tangpong, 2010).

Then, we ran a confirmatory factor analysis (CFA) to examine the reliability and validity of our reflective measures (*i.e.* individualism-collectivism, uncertainty avoidance, risk perception, risk attitude). Royston’s multivariate test indicated the presence of multivariate non-normality (*Royston’s multivariate normality* = 705.93, $p < 0.001$). Accordingly, we used maximum likelihood estimation with robust standard errors using the MLR estimator in *lavaan* (Version 0.6-1). The corresponding CFA results indicated acceptable measurement fit indices and psychometric properties for all constructs: $\chi^2/df = 1.38$ [$\chi^2(129) = 177.88$ ($p = 0.003$)] indicated a satisfactory fit between the predicted and observed model (Kline, 2005, p. 137); the comparative fit indices of TLI = 0.92 and CFI = 0.94 highlighted that our model has a better fit than the baseline model (Kline, 2005, p. 140); and RMSEA = 0.04 [90% CI = (0.03, 0.05)] showed an acceptable approximation fit (Kline, 2005, p. 139). Based on the CFA results shown in Table 3:3, all measurement indicators except one⁵ loaded on their hypothesised factors with a large and significant loading (all the p -values are smaller than 0.001). In addition, Cronbach’s alpha of all constructs showed values above the recommended cut-off point of 0.7, highlighting

⁵ One of the risk attitude item (“*although a new thing has a high promise of reward, I do not want to be the first one who tries it. I would rather wait until it has been tested and proven before I try it*”) loadings was below the threshold values of 0.5 (0.18). Given the context of the decision-making in our research, we decided to drop this item to maintain high convergent validity of risk attitude construct.

a high level of convergent validity and internal consistency (Hair, Anderson, Tatham, & Black, 1998, p. 612). Moreover, we evaluated discriminant validities of constructs using the average correlation among indicators across constructs, in relation to the average correlation among indicators within their respective construct (Henseler, Ringle, & Sarstedt, 2014). The results showed satisfactory discriminant validity for all factor scores.

Table 3:3 Confirmatory Factor Analysis

Measures and associated indicators	Coefficient alpha	λ^a	SE	z-value	R ²
Individualism-Collectivism	0.74				
Individuals should sacrifice self-interest for the group		0.56	_b	_b	0.31
Individuals should stick with the group even through difficulties		0.64	0.25	3.96	0.40
Group welfare is more important than individual rewards		0.50	0.17	4.98	0.25
Group success is more important than individual success		0.54	0.23	4.38	0.30
Individuals should only pursue their goals after considering the welfare of the group		0.53	0.17	5.14	0.29
Group loyalty should be encouraged even if individual goals suffer		0.63	0.17	6.18	0.4
Uncertainty avoidance	0.76				
It is important to closely follow instructions and procedures		0.59	_b	_b	0.34
It is important to have instructions spelled out in detail so that I always know what I'm expected to do		0.58	0.19	6.15	0.33
Rules and regulations are important because they inform me of what is expected of me		0.71	0.20	6.97	0.50
Standardised work procedures are helpful		0.62	0.16	6.74	0.38
Instructions for operations are important		0.66	0.19	6.57	0.44
Risk attitude	0.7				
I like to take chances, although I may fail		0.57	_b	_b	0.32
I like to try new things, knowing well that some of them will disappoint me		0.66	0.12	8.00	0.43
To earn greater rewards, I am willing to take higher risks		0.68	0.21	5.84	0.46
I seek new experiences even if their outcomes may be risky		0.79	0.25	5.49	0.63
Risk perception	0.81				
What is the likelihood of disruption from this supplier		0.62	_b	_b	0.39
How threatening is the supplier's disruption for your company		0.83	0.19	8.42	0.69
How serious are the consequences of disruption for your company		0.85	0.20	8.15	0.73

^a All factor loadings are significant at the $p < 0.001$ level (two-tailed).

^b Factor loading was fixed at 1.0 for identification purposes.

3.4.4 Findings

A hierarchical moderated regression was used to test hypotheses 1a-c and 3a-b. We started our analysis by running correlation tests that indicated some significant associations among our independent variables. Participants' age was positively correlated with their years of work experience ($r = 0.9, p < 0.001$)⁶ and negatively related to their risk attitude ($r = -0.18, p < 0.01$),

⁶ All correlations are based on *Pearson's* coefficient

highlighting that older people had more work experience and lower propensity to take risk. Additionally, individualism-collectivism was shown to be positively associated with uncertainty avoidance ($r = 0.48, p < 0.001$) and risk attitude ($r = 0.2, p < 0.01$). Lastly, subjects' risk attitudes were significantly related to their work experience ($r = -0.21, p < 0.01$) and uncertainty avoidance ($r = 0.26, p < 0.001$). To improve the interpretability of our results and reduce multicollinearity concerns, we standardised our independent variables (Aiken & West, 1991). The average variation inflation factor (VIF) was 5.27, representing that the variance of estimated regression coefficient for work experience is 5.27 times larger than it would have been if work experience was not correlated with other explanatory variables in the regression model. In the context of our study, where the relationship between work experience and disruption risk perception was not the main variable of interest, we assert that multicollinearity is unlikely to pose a threat to the validity of the findings (O'Brien, 2007; Wooldridge, 2016, p. 86).

The results of Shapiro-Wilk normality test (Royston, 1982) indicated non-normality of regression residuals ($W_{\text{model } 3} = 0.97, p\text{-value} < 0.001$). In addition, the results of Breusch-Pagan ($BP_{\text{model } 3} = 14.2, n.s$) and White's tests ($White's\ test = 525, n.s$) showed that our data is unlikely to violate the underlying homoskedasticity assumption of regression analysis (Breusch & Pagan, 1979; Wooldridge, 2016, p. 252). Moreover, we utilised Cook's distance measure to identify influential observations in our analyses. The Cook's distance (D) captures the impact of each case on the regression results based on two sources: 1) the extent of change in regression predicted values if the case is omitted; and 2) the case's distance from other observations (leverage) (Hair et al., 1998, p. 225). We found 11 influential observations with D values more than $4/n$. Further examination of these cases showed no concerns related to the style and pattern of participants' responses. Hence, we decided to keep these items in our sample. All in all, the diagnostic analyses suggested that the regression results may be unbiased but inefficient due to non-normality. However, a post-hoc analyses using robust regression indicated that our results are qualitatively robust to residual non-normality.

As shown in Table 3:4, Model 1 only included control variables. We found no significant effect of age, gender, work experience, and risk attitude on disruption risk perception. In the context of supply disruption risk, these findings showed that these characteristics play a trivial role in shaping managerial perceptions of risk. In Model 2, we added our independent variables. The incremental R-squared of Model 2 over the control model was significant ($p < 0.001$) that supports the significant effect of cultural values above and beyond individual characteristics in

shaping disruption risk perception. Our results showed a negative association between collectivism and disruption risk perception ($\beta = -0.167, p < 0.1$), in line with Hypothesis 1b. In addition, as predicted by Hypothesis 1c, we found support for the direct effect of uncertainty avoidance on disruption risk perception ($\beta = 0.402, p < 0.01$).

Table 3:4 Standardised Regression Results (for “Disruption Risk Perception”)

Variable	Model 1		Model 2		Model 3	
	Estimate	SE	Estimate	SE	Estimate	SE
Age	- 0.021	(0.193)	- 0.011	(0.186)	- 0.025	(0.186)
Gender	- 0.126	(0.176)	- 0.130	(0.177)	- 0.156	(0.178)
Work experience	0.107	(0.194)	0.108	(0.188)	0.118	(0.187)
Risk attitude	0.103	(0.087)	0.037	(0.087)	0.022*	(0.087)
Individualism-Collectivism			- 0.167*	(0.098)	0.031	(0.135)
Uncertainty avoidance			0.402***	(0.095)	0.321***	(0.126)
Uncertainty			- 0.106	(0.164)	- 0.105	(0.164)
Individualism-Collectivism × Uncertainty					- 0.394**	(0.188)
Uncertainty avoidance × Uncertainty					0.183	(0.188)
Constant	4.724***	(0.125)	4.779***	(0.145)	4.797***	(0.145)
R^2	0.014		0.091		0.110	
Adjusted R^2	- 0.005		0.061		0.072	
F	0.743 ($df = 4, 215$)		3.032*** ($df = 7, 212$)		2.874*** ($df = 9, 210$)	

Note: $n = 220$. Dependent variable is “disruption risk perception”.

All independent variables have been standardised.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-tailed).

In Model 3, we added the interaction terms into the regression. As hypothesised (Hypothesis 3a), we found a significant interaction between individualism-collectivism and uncertainty ($\beta = -0.39, p < 0.05$). However, the interaction between uncertainty avoidance and uncertainty was non-significant (Hypotheses 3b) ($\beta = 0.18, n.s.$).

We also tested Hypothesis 2 using a separate hierarchical regression (Table 3:5). We checked variance inflation factors (VIF) and heteroskedasticity of the residuals for both Model 4 and Model 5. The results verified the assumptions of multiple regression analysis. We first, included control variables, *i.e.* age, gender, work experience, and risk attitude, in Model 4 and found that only risk attitude had a significant relationship with supplier switching intention. This was consistent with the prediction of past studies (Ellis et al., 2010; Kull et al., 2014). The addition of disruption risk perception in Model 5 increased the adjusted R-square significantly ($\Delta R^2 = 0.18, p < 0.001$), highlighting the importance of risk perception in driving people’s

behaviour in the face of supply chain disruption. These results supported Hypothesis 2, *i.e.* disruption risk perception leads to significantly higher supplier switching intention.

Table 3:5 Standardised Regression Results (for “Supplier Switching Intention”)

Variable	Model 4		Model 5	
	Estimate	SE	Estimate	SE
Age	0.270	(0.227)	0.281	(0.205)
Gender	- 0.016	(0.207)	0.048	(0.188)
Work experience	- 0.228	(0.229)	- 0.283	(0.207)
Risk attitude	0.237**	(0.102)	0.185**	(0.093)
Disruption risk perception			0.636***	(0.091)
Constant	4.850***	(0.148)	4.816***	(0.134)
R^2	0.032		0.212	
Adjusted R^2	- 0.032		0.193	
F	1.754 ($df = 4, 215$)		11.494*** ($df = 5, 214$)	

Note: $n = 220$. Dependent variable is “supplier switching intention”.

All independent variables have been standardised.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$ (two-tailed).

- Spotlight analysis

To facilitate the interpretation of the interaction terms, we ran spotlight analyses to find the conditional effect of cultural values on disruption risk perception at two levels of uncertainty (Spiller, Fitzsimons, Lynch, & McClelland, 2013). As illustrated in Figure 3:1, a spotlight analysis revealed that the effect of individualism-collectivism on the perceived disruption risk is non-significant in certain situations ($slope_{low\ uncertainty} = 0.033$, n.s). However, this becomes negative and significant under higher levels of uncertainty ($slope_{high\ uncertainty} = -0.361$, $p < 0.01$), indicating that the direction and strength of the relationship between individualism-collectivism and risk perception is dependent on the level of uncertainty. Moreover, we found positive and significant effects of uncertainty avoidance on disruption risk perception at two levels of uncertainty; although the effect becomes stronger as the level of uncertainty in the environment increases ($slope_{low\ uncertainty} = 0.320$, $p < 0.05$; $slope_{high\ uncertainty} = 0.503$, $p < 0.001$) (Figure 3:2).

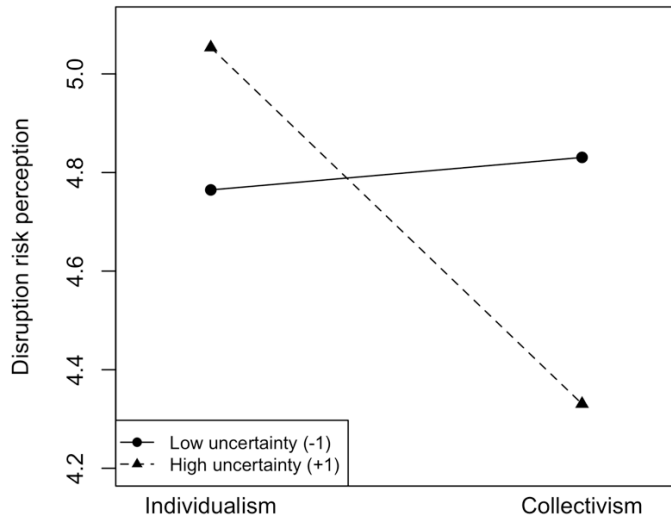


Figure 3:1 Spotlight Analysis (Individualism-Collectivism × Uncertainty)

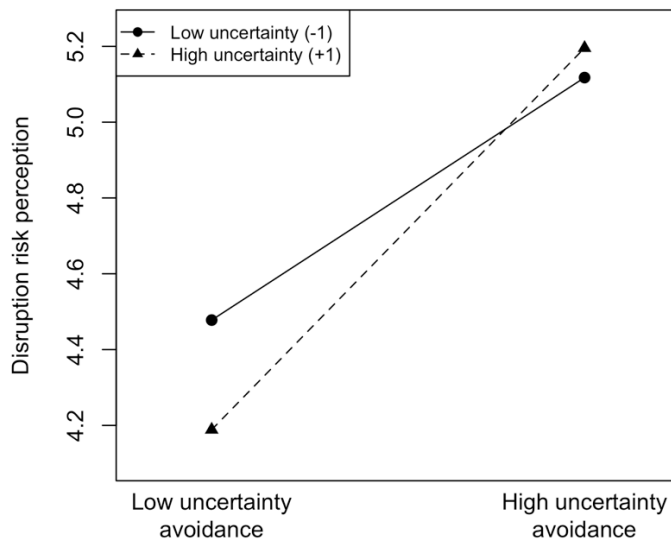


Figure 3:2 Spotlight Analysis (Uncertainty Avoidance × Uncertainty)

- Moderated mediation analysis

To test Hypotheses 4a and 4b, we used an “explicit procedure” to estimate the mediation model under various conditions of uncertainty (Rungtusanatham, Miller, & Boyer, 2014, p. 101). Bootstrapping method was applied to strengthen the statistical power of mediation effects and improve the validity and robustness of our statistical results (Malhotra, Singhal, Shang, & Ployhart, 2014). We used the *lavaan* package (Version 0.6-1) to reproduce Hayes (2013) macro PROCESS model results. The model coefficients are presented in Table 3:6. Using this

approach, mediation is presented if the 95% confidence interval (CI) (based on 5000 bootstrap samples) for the estimation of indirect effects does not contain 0 (Hayes, 2013). Due to the inclusion of moderating variables (*i.e.* uncertainty) in our model, we examined the existence of the mediation effects as a function of different levels of uncertainty (Davis-Sramek et al., 2017; Malhotra et al., 2014; Srinivasan & Swink, 2017). As shown in Table 3:6, the estimated indirect effect of individualism-collectivism on disruption risk perception was significant at high levels of uncertainty. However, we found a non-significant indirect effect under low uncertainty. This can be explained by the lack of a significant relationship between individualism-collectivism and disruption risk perception in these situations, and not the absence of mediation effect. Hence, our results supported Hypothesis 4a. Moreover, the results indicated that disruption risk perception mediates the effect of uncertainty avoidance on switching intention under both levels of uncertainty, *i.e.* Hypotheses 4b.

Table 3:6 Mediated Indirect Effects

Effect	Point estimate	95% bias-corrected confidence interval
IND-COL → Risk perception → Switching (low uncertainty)	-0.098	[-0.357, 0.162]
IND-COL → Risk perception → Switching (high uncertainty)	-0.281	[-0.512, -0.050]
UA → Risk perception → Switching (low uncertainty)	0.415	[0.037, 0.793]
UA → Risk perception → Switching (high uncertainty)	0.491	[0.172, 0.809]

3.5 Discussion

Given the global and diverse nature of the supply chain environment, there is a growing need to understand the effect of cultural factors on supply chain disruption management practices (Croson, Schultz, Siemsen, & Yeo, 2013; Metters et al., 2010). From a behavioural point of view, culture has been viewed as an important explaining factor and predictor of behaviour in this context (Dowty & Wallace, 2010; Zsidisin & Wagner, 2010). In particular, there is evidence that culture could significantly influence individuals' risk perception and risk-related decision-making, especially when facing uncertainty (Gibson et al., 2009; Rieger et al., 2015; Weber & Hsee, 2000). In such circumstances, culture provides a guideline for people that directs their attention to important cues in the environment and assists them in making sense of ambiguous and unclear information (Gibson et al., 2009; Oyserman, Kimmelmeier, et al., 2002). Despite this significant role, extant supply chain risk literature has largely overlooked the impact of cultural differences on managerial behaviour in disruption situations. Therefore,

the goal of our study was to examine the systematic effect of cultural values on the managerial assessments of risk and decision-making in the face of an impending supply disruption. In doing so, our findings provide several theoretical contributions and practical implications.

3.5.1 Theoretical contributions

First, our study contributes to the understanding of the antecedents of managerial responses to supply chain disruptions (*cf.* Ellis, Henry and Shockley, 2010; Ellis, Shockley and Henry, 2011; Polyviou et al., 2018). Research has previously suggested that organisational actions in the face of a disruption event are heterogeneous, and hence used a range of behavioural and contextual factors to explain such differences (*e.g.* Bode et al., 2011; Bode, Huebner and Wagner, 2014; Cantor, Blackhurst and Cortes, 2014; Reimann, Kosmol and Kaufmann, 2017). Our study draws from the advance of cross-cultural studies (Bontempo et al., 1997; Rieger et al., 2015; Weber & Hsee, 2000; Weber & Hsee, 1998; Xue et al., 2014) to show that such responses are, at least partly, explained by psychologically held cultural values. In particular, our findings provide evidence for the direct effect of individualism-collectivism on people's perception of supply disruption ($\beta = -0.167, p < 0.1$) (Hypothesis 1b). This is consistent with the prediction of "cushion hypothesis" that suggests higher collectivism is associated with lower levels of risk perception (Weber & Hsee, 2000; Weber & Hsee, 1998; Weber & Johnson, 2009). In other words, managers who are more interdependent and integrated with their group members tend to believe that their co-workers/collaborators would step up to help and share the responsibility if the impending disruption leads to losses. Therefore, they are more likely to estimate lower levels of disruption risk compared to their counterparts in a similar situation. Moreover, in line with past studies (Bontempo et al., 1997; Rieger et al., 2015), we find evidence on the positive relationship between uncertainty avoidance and disruption risk perception (Hypothesis 1c). In other words, people with higher uncertainty avoidance values feel more nervous when facing a supply disruption situation and hence, tend to perceive a higher level of risk compared to their counterparts. Subsequently, we find that higher perceptions of risk lead to higher switching intention ($\beta = 0.636, p < 0.01$) (Hypothesis 2). In other words, managers with higher perceived risk are likely to switch to a more expensive supplier with predictable operating performance outcomes to reduce the perception of risk and protect their company (*cf.* Kull et al., 2014; Zsidisin and Wagner, 2010). On the other hand, lower perceptions of risk lead managers towards remaining with the current supplier that may increase the exposure to a supply disruption.

Second, we contribute to the extant literature by showing that the effect of culture on behavioural outcomes is contingent upon contextual factors (Erez, 2010; Nouri et al., 2013). While past operations and supply chain management research has been mainly concerned with *whether culture matters* (Bockstedt et al., 2015; Khazanchi et al., 2007; Metters et al., 2010), our findings provide evidence on *how and when it matters the most* (Gelfand et al., 2017; Kirkman et al., 2017; Steel & Taras, 2010). In particular, we find a significant moderating effect of situational uncertainty on the relationship between individualism-collectivism and risk perception (Hypothesis 4a). In other words, while individualism-collectivism has a non-significant impact on the perceived disruption risk in low uncertainty circumstances ($slope_{low\ uncertainty} = 0.033$, n.s), the relationship becomes stronger and significant in high uncertainty situations ($slope_{high\ uncertainty} = -0.361$, $p < 0.01$). This is in line with the extant literature that suggests the effect of culture on behavioural outcomes is more pronounced in uncertain situations (Kirkman et al., 2017; Nouri et al., 2013). In other words, facing an uncertain situation, individuals tend to rely on their cognitive schema to fill the gap in information or make sense of an otherwise ambiguous cue in their environment (Gibson et al., 2009). Since cultural values are shown to have a strong influence on the content of this schema, individuals' evaluation of the situation is more likely to be culturally biased in such circumstances (Nouri et al., 2013). In the context of supply disruption management, this may have implications for the management of risk at the discovery stage of an event, when organisations become aware of an impending disruption (*cf.* Blackhurst et al., 2005). The information about an event tends to become clearer and unambiguous (*i.e.* more certain) as one gets closer to the event (Hult et al., 2010). Hence, our findings highlight the importance of managing cultural biases in evaluation of supply disruption risk at the early stages of a disruption discovery. Nonetheless, our findings do not show significant differences between the effect of uncertainty avoidance on disruption risk perception in low and high uncertain circumstances ($\beta = 0.18$, n.s) (Hypothesis 4b). This could suggest that uncertainty avoidant individuals perceive high levels of risk when facing an unplanned and unprepared for supply disruption, regardless of how much actual uncertainty is involved in the situation.

Third, our study contributes to previous research that has examined the diversity of supply chain risk management practices using nationality and organisational culture (Dowty & Wallace, 2010; Revilla & Sáenz, 2014). When facing a supply disruption, it is often individual managers' responsibility to assess the situation and shape adequate responses to mitigate risk (Ambulkar et al., 2016; Ellis et al., 2011; Polyviou et al., 2018). We draw from the advances

of cross-cultural research to argue that the use of individual-level cultural values provides a more accurate understanding of managerial behaviour in supply chain disruption situations (Kirkman & Lowe, 2009; Yoo et al., 2011). In other words, since risk perception is an individual construct, examining culture as reflected in individually held values offers richer insights into the systematic differences of supply chain disruption management decision-making. In particular, our study controls for the effect of country-level culture on decision-making by collecting data from a single country⁷. The standard deviation for uncertainty avoidance ($M = 5.47$, $SD = 0.83$) and individualism-collectivism ($M = 4.9$, $SD = 0.9$) measurements confirm the variations in the extent to which people within the country hold these cultural values. With regard to the supplier switching intention, our study finds empirical evidence on the systematic effect of individual-level cultural values on such responses (Hypothesis 3b-c). In other words, while collectivists tend to retain their current supplier in the face of an impending disruption ($P.E_{low\ uncertainty} = -0.098$, $95\% CI [-0.357, 0.162]$; $P.E_{high\ uncertainty} = -0.281$, $95\% CI [-0.512, -0.050]$), people high on uncertainty avoidance values are more likely to switch to an alternative source of supply in order to mitigate risk ($P.E_{low\ uncertainty} = 0.415$, $95\% CI [0.037, 0.793]$; $P.E_{high\ uncertainty} = 0.491$, $95\% CI [0.172, 0.809]$). These findings suggest the importance of integrating culture into the extant supply chain risk management models and frameworks in order to improve the efficiency and predictability of such practices (*cf.* Tokar, 2010).

Overall, the findings from this study contribute to the field of supply chain risk management by highlighting the important role of the individual manager responsible for managing a day-to-day operations of a product/component. When facing a disruption, our study shows that organisational responses could be significantly influenced by psychologically held cultural values. The same event could be interpreted and acted upon differently, depending on the extent to which the individual manager holds uncertainty avoidance and individualism-collectivism cultural values. This is of significant importance in supply chain environments, where the continuity of supply and demand depends on many locally-made decisions by cross-cultural managers throughout the supply chain. Therefore, to improve the performance of a chain and effectiveness of supply chain risk management, existing risk management tools and models may be adapted to reflect or minimise such cultural differences. Moreover, the findings highlight the moderating effect of situational uncertainty on the relationship between individualism-collectivism, disruption risk perception, and switching intention. In other words,

⁷ All respondents were current residents of the United Kingdom (83.64% UK nationals)

we find that reducing the level of uncertainty minimises the impact of individualism-collectivism on disruption responses. From a practical point of view, organisations may design intervention (e.g. informational support), or institutional control (e.g. well-structure continuity plans) to improve the certainty of disruption situations and decrease cultural variations of responses (Gelbrich, 2010; Juttner et al., 2005)

3.5.2 Managerial implications

From a managerial point of view, the results of our study highlight the importance of perception in managing supply chain disruptions. When facing a disruption, managers' behaviour is influenced by their subjective assessment of risk, that itself is shaped by cultural values. Given the high costs involved in such decision-making processes (Hendricks & Singhal, 2005; Jacobs & Singhal, 2017), it seems crucial that organisations understand the underlying cultural factors that lead to systematic differences, and develop techniques to counter biases (*cf.* Tokar, 2010; Tokar et al., 2012). This is of particular importance in today's business environment, where diversity of workplaces and workers has brought cultural characteristics to the forefront of issues faced by a supply chain (*e.g.* Cui et al., 2013; Eckerd et al., 2016; Ribbink and Grimm, 2014). The findings from this study could be used by companies to design supply chain risk templates that accounts for potential cultural variations in managerial evaluation of risk. Organisations may also utilise human resource management practices to educate employees about the underpinning factors that bias decision-making (*cf.* Ellinger and Ellinger, 2014). Past studies have suggested that informing managers about the sources and implications of individual's biases, and providing appropriate training programmes could reduce the effect of such biases in people's decision-making (Tokar, 2010).

Alternatively, firms may apply de-biasing techniques to reduce heterogeneity in perceptions of risk (Kaufmann, Carter, & Buhrmann, 2012; Kaufmann, Michel, & Carter, 2009). For instance, group decision-making may be used to reduce extreme perceptions of risk. Research has shown that decision-making in groups that are formed of people with opposing risk values could counteract individual level biases, and result in a balanced evaluation of risk (Pruitt & Cosentino, 1975; Stoner, 1968). Hence, in light of the findings from our study, organisations may pursue disruption-related decision-making in groups formed of individuals with opposing cultural values to minimise variations of responses to a supply disruption. Moreover, extant research has provided evidence on the role of accountability, decomposed decision-making, and training programmes in controlling the effect of biased decision outcomes (Ayers & Myers,

2012; Kaufmann et al., 2012). For instance, Morewedge et al. (2015) provide empirical evidence that suggests although training interventions have high upfront operational costs, they could significantly reduce the effect of biases and improve the efficiency of decision-making.

Lastly, our findings show that cultural differences are more pronounced under high uncertain circumstances. This may have implications for the design and application of early warning systems. In the early stages of a disruption discovery, information about the event tend to be uncertain and ambiguous. This becomes more certain and less ambiguous, as one gets closer to the actual point of the disruption. In light of our findings, this may suggest that cultural biases play a stronger role in the early stages of disruption discovery. Therefore, organisations could opt to reduce the level of uncertainty in these stages by presenting complementary information on the characteristics of the product (*e.g.* product purchasing criticality), supplier performance capabilities, and a firm's past experiences with similar events. This may, in turn, enhance the clarity of the decision-making situation and provide a richer basis for managerial objective evaluations of risk.

3.6 Limitations and opportunities for further studies

Our study is not without limitations. Due to our focus on the effect of individual-level cultural values on supply disruption responses, we controlled for a range of organisational and relational factors, such as control systems and inter-firm trust (Bode et al., 2014, 2011; Ellis et al., 2011). In addition, we assumed no administrative costs of switching and homogeneity of supplier performance in quality. In the context of our study, this was justified and allowed us to focus specifically on the purely individual level behavioural effects (*cf.* Mir et al., 2017). Although, we acknowledge that such events are inter-organisational by nature and hence, the shadow of the past and/or the shadow of the future may interact with managerial subjective evaluation of the situation in responding to the event (*cf.* Bode et al., 2011). Moreover, in dealing with the uncertainty and unpredictability of disruption situations, managers may be constrained by organisational control systems through for instance, discretion (Ellis et al., 2011; Sharma, 2000). Discretion is defined as “latitude of action” available to managers in a given situation (Hambrick, 2007, p. 335). Past research has shown that in high discretion contexts, managerial behaviour is more likely to be driven by their values (Hambrick, 2007). On the other hand, in low-discretion contexts, behavioural variability is constrained by organisational internal factors that encourage consistency and pursue homogenous actions (Meyer et al., 2010). Future studies may opt to study the interaction between these factors and

cultural values in shaping supply chain disruption responses. In addition, we encourage scholars to replicate our findings in other settings that assume administrative switching costs and competitive supplier performance outcomes.

Furthermore, to highlight the contingent effect of cultural values on risk perception, we manipulated uncertainty in terms of the variability of disruption consequences. Our choice was motivated by past research that has shown perceptions of risk outcome have a stronger role in shaping overall perceived risk (Ellis et al., 2010; March & Shapira, 1987). While our study contributes to the understanding of the importance of uncertainty in moderating the relationship between culture and behaviour, it does not represent the effect of culture in the presence of complex sets of situational factors (*e.g.* market dynamism, economic uncertainties). Building on the findings of our research, future studies could choose to examine the moderating effect of other forms of uncertainty on the relationship between culture and behavioural responses, as reflected in the probability and nature of the event, or a range of available responses (Milliken, 1987; Vilko et al., 2014).

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Chapter 4 Study 2: Recovery

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The Effect of a Supplier's Recovery Actions on Buyers' Responses During a Supply Chain Disruption: A Conceptual Paper⁸

ABSTRACT

When a supply chain disruption occurs, buying firms take a range of bridging and buffering actions to address the latent problem and minimise the overall costs of the disruption. The outcome of such responses could have a determining effect on the performance of the focal buyer-supplier relationship. Given the practical importance, scholars have investigated the impact of pre-established intra- and inter-organisational factors in shaping a buyer's alternative responses. However, we still know very little on the potential role of a supplier's recovery actions on altering the buyer's behaviour in the wake of such incidents. Our study draws from construal level theory and construal fit hypothesis to develop a set of propositions that demonstrate the interplay of supplier- and buyer-side actions during a supply chain disruption. Overall, our research propositions show that the effect of a supplier's particular recovery action on a buyer's responses is dependent on spatial, temporal, and social distance from the disruption triggering event.

Keywords:

Supply chain disruption, behavioural operations, construal level theory

4.1 Introduction

As companies become more global and integrated, the occurrence of supply chain disruptions becomes inevitable (Macdonald & Corsi, 2013). When a disruption happens, organisational actions are critical in minimising the overall costs of the event and sustaining the firm's position in the market (Bode, Wagner, Petersen, & Ellram, 2011; Ivanov, Dolgui, Sokolov, & Ivanova, 2017). A key decision facing a buying manager is whether to engage with or disengage from the supplier who has caused the disruption (Polyviou, Rungtusanatham, Reczek, & Knemeyer, 2018). For instance, while Nokia chose to disengage by switching the supply source after a fire incident at its supplier's plant (Yu, Zeng, & Zhao, 2009), Toyota took collaborative actions through sharing information, personnel and technical skills to recover from the fire at the Aisin Seiki plant (Borgatti & Li, 2009). Within the literature, scholars have used the terms bridging

⁸ An earlier version of this chapter was presented during EurOMA annual meeting in 2017

and buffering to highlight the extent of cooperativeness in a buyer's actions (Reimann, Kosmol, & Kaufmann, 2017). Bridging reflects a range of boundary-spanning activities to manage risk by intensifying information exchange, and resource sharing (Bode et al., 2011). Such actions are based on collaborative structures and hence, could improve commitment, trust, and mutual control underlying the focal buyer-supplier relationship (Kaufmann, Carter, & Rauer, 2016). On the other hand, buffering refers to a range of uncooperative activities to mitigate the consequences of a disruption, through various forms of slack resources and alternative suppliers (Reimann et al., 2017). Such approaches aim to reduce a firm's exposure to the supplier and hence, may escalate conflict in the relationship (Kaufmann et al., 2016; Reimann et al., 2017).

To avoid negative relationship outcomes (Zaefarian, Najafi-Tavani, Henneberg, & Naudé, 2016), suppliers take a range of psychological and/or tangible actions that ameliorate the situation and enhance a buyer's satisfaction (Miller, Craighead, & Karwan, 2000; Reimann et al., 2017; Wang, Craighead, & Li, 2014). In particular, psychological actions focus on recovering intangible (*i.e.* social) losses of a disruption, by apologising, showing concerns and providing explanations (Craighead, Karwan, & Miller, 2004). Whereas, tangible actions are intended to repair tangible (*i.e.* operational and financial) losses of the event through activities, such as prompt handling, product replacement and compensation (Liao, 2007; Reimann et al., 2017). Extant supply chain risk literature has highlighted the positive value of a supplier's recovery actions on reducing a buyer's dissatisfaction (Primo et al., 2007), mitigating trust damages (Wang et al., 2014), and repurchase intention (Wu, Hou, Fu, & Chang, 2013) following a supply chain disruption. However, our understanding of the interplay between different supplier-side recovery actions and buyer-side mitigation responses in the wake of a disruption is still limited (Reimann et al., 2017). In other words, we know very little on whether the application of a particular recovery action is associated with alternative bridging or buffering responses. Given the potential consequences of these responses on relationship performance (Hibbard, Kumar, & Stern, 2001; Reimann et al., 2017), studying this link seems an important research area.

To address the gap, our study takes a behavioural lens to argue that the effect of a supplier's recovery action on a buyer's decisions is mediated through managerial *mental representation*. This is defined as an individual's cognitive reflection of the information in the environment, and used as a means to drive decision-making during a disruption (Combe & Carrington, 2015; Dutton & Jackson, 1987; Ellis, Shockley, & Henry, 2011). When a disruption occurs, managers

face a stream of uncertain and ambiguous information about the consequences of the event and potential resolutions (Combe & Carrington, 2015). To facilitate decision-making about the disruption, they rely on a socio-psychological process to distil and interpret the information in their mental representation (Porac, Thomas, & Baden-Fuller, 1989; Weick, Sutcliffe, & Obstfeld, 2005). There is evidence that shows the underlying characteristics of a disruption triggering event have significant effects on the content and structure of this mental model (Lynch & Zauberman, 2007; Trope & Liberman, 2003, 2010). In other words, managers may focus on different aspects of the disruption losses and subsequently, prefer alternative resolutions (*cf.* Li *et al.*, 2011). This is of particular importance, since it may introduce systematic biases into managerial interpretation (DuHadway, Carnovale, & Kannan, 2018; Polyviou *et al.*, 2018) and hence, influence the effectiveness of a supplier's recovery actions on a buyer's behaviour (Reimann *et al.*, 2017; Wang *et al.*, 2014). Our research draws from social psychology literature to study the contingent impact of a supplier's recovery actions on a buyer's responses during a supply chain disruption. In doing so, we seek to contribute to the extant supply chain risk studies that have examined the effect of pre-established organisational and relational factors on buyers' decision-making process during a disruption (Ambulkar, Blackhurst, & Grawe, 2015; Bode, Huebner, & Wagner, 2014; Bode *et al.*, 2011; Cantor, Blackhurst, & Cortes, 2014).

First, we apply construal level theory (CLT) to study the effect of *psychological distance* from a disruption triggering event on managers' mental representation of the event (Trope & Liberman, 2003, 2010). Psychologically distant events are categorised by a) belonging to the past rather than the present; b) happening in remote locations rather than the here; and c) happening to an unfamiliar or dissimilar rather than familiar or similar supplier (Trope & Liberman, 2010). For instance, in assessing a supplier-induced disruption, managers may be 2 months versus 2 days away from a triggering event, and/or dissimilar versus similar to the focal supplier. According to the theory, in facing psychologically close events, people utilise incidental and peripheral information (*i.e.* low construal level) as the basis of their mental models (Liberman, Trope, & Wakslak, 2007), and are concerned with secondary as opposed to primary goals in making decisions. In the context of a disruption, this may mean that buying managers focus on intangible losses, and are concerned with a supplier's social repair of the disruption through activities, such as apologising and being courteous, in ameliorating the disruption (*cf.* Reimann, Kosmol and Kaufmann, 2017). On the other hand, in interpreting psychologically distant events, people use core and essential information (*i.e.* high construal

level), and focus on primary as opposed to secondary concerns in making decisions (Liberman & Trope, 2014). During a disruption recovery, this may translate into buying managers' attention to tangible losses caused by the event that in turn, increase the importance of suppliers' tangible actions, such as product replacement and financial compensation.

Second, we use construal level fit hypothesis (Higgins, Idson, Freitas, Spiegel, & Molden, 2003; Kim, Rao, Lee, Kim, & Lee, 2009; Zhao & Xie, 2011) to propose that the fit between a supplier's recovery action and mental representation of the disruption influences buyers' satisfaction with the supplier's resolution (*cf.* Kruglanski, 2006; Pizzi *et al.*, 2015). In general, the fit hypothesis suggests that an external stimulus (*e.g.* supplier's effort to fix a disruption) exerts the greatest influence on judgement (Thompson & Hamilton, 2006), and decision-making (Higgins *et al.*, 2003) when it fits individuals' mental representation (*i.e.* construal level). When people process information that fits with their construal level, they are more likely to "feel right" (Higgins *et al.*, 2003; Li *et al.*, 2011). This, in turn, increases the likelihood of positive evaluation of the target (Roy & Ng, 2012). In the context of our study, we draw from this argument to develop a set of propositions that investigate the relationship between a supplier's recovery actions (*i.e.* psychological and tangible) and a buyer's alternative engaging (*i.e.* bridging) and disengaging (*i.e.* buffering) responses during a supply chain disruption.

Our study makes contributions to the extant literature in three different ways. First, it provides understanding of the interplay of a supplier's recovery actions and buyer-side responses during a supply chain disruption (Reimann *et al.*, 2017). While past research has examined individual (Cantor *et al.*, 2014), organisational (Ambulkar *et al.*, 2015), and relational (Bode *et al.*, 2011) determinants of disruption responses, we use insights from social psychology to highlight the importance of a supplier's recovery actions in the wake of such events. Second, we extend the application of construal level theory in operations and supply chain management (OSCM) research (*cf.* Cantor and Macdonald, 2009) by conceptualising the supply chain disruption environment in terms of psychological distance from a triggering event. This has implications for understanding the underlying psychological factors that bias organisation agents' decision-making at different stages of supply chain disruption management (Blackhurst, Craighead, Elkins, & Handfield, 2005; Reimann *et al.*, 2017). Furthermore, we contribute to the application of construal level fit hypothesis in OSCM literature. Extant research has previously discussed the value of strategic fit (Griffith & Myers, 2005; Ketokivi & Schroeder, 2004), and organisational value congruence (Khazanchi, Lewis, & Boyer, 2007) in enhancing operational and supply chain performance. Our study is the first

to introduce the positive effect of fit between an external stimulus and mental representation on supply chain-related judgement and decision-making. Third, our propositions highlight the role of satisfaction as a determinant of buyers' alternative responses during a disruption. While previous research has investigated the impact of satisfaction on positive relational outcomes, such as commitment (Benton & Maloni, 2005; Griffith, Harvey, & Lusch, 2006), the effect of satisfaction following a supply chain disruption has been less studied (Wang et al., 2014).

The remainder of this paper proceeds as follow. First, we provide a review of research on supply chain disruption management, and construal level theory. Second, we develop propositions for the relationship between psychological distance of supply chain disruption and buyers' mental representation, as well as the link between a supplier's recovery actions and mental representation. Third, we discuss the concept of construal level fit and its implications for buyers' satisfaction. Then, we propose the relationship between buyers' satisfaction and the extent to which they choose alternative bridging and buffering actions during the disruption. Lastly, we discuss the theoretical and managerial contributions of the study.

4.2 Literature review

4.2.1 Supply chain disruption management

Supply chain disruptions are unplanned triggering events that happen in a supply chain and delay/disrupt the physical flow of goods and materials (Bode & Wagner, 2015; Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007). These events can have a pronounced effect through a supply chain (Ivanov, Sokolov, & Dolgui, 2014) to cause higher operational costs (Hendricks & Singhal, 2005), decreased shareholder wealth (Hendricks & Singhal, 2003), and lost customers (Macdonald & Corsi, 2013; Xu, Yin, & Dong, 2016). To protect firms from the consequences of such events, supply chain practitioners and scholars have offered various strategies that are mainly related to planning and proactive management of risks (*e.g.* Norrman and Jansson, 2004; Tang, 2006; Blackhurst, Scheibe and Johnson, 2008; Knemeyer, Zinn and Eroglu, 2009; Simchi-Levi, Schmidt and Yehua, 2014). For example, Neiger, Rotaru, & Churilov (2009) offer a process-based risk identification approach that identifies potential sources of vulnerability throughout a supply chain, and Trkman & McCormack (2009) develop a new approach that assesses and prioritises risk sources based on suppliers' performance and supply chain characteristics. Abundant evidence has supported the positive effect of these strategies in enhancing planning capabilities (Knemeyer et al., 2009; Tang & Nurmaya Musa,

2011), and protecting supply chains against disruption vulnerabilities (Craighead et al., 2007; Ivanov et al., 2014).

However, despite organisation's best efforts, supply chain disruptions still happen (Macdonald & Corsi, 2013). The increasing globalisation and interdependence in today's business environment has improved the efficiencies of supply chain operations, but has also created a complex and uncertain structure in which the occurrence of some events is inevitable (Bode & Wagner, 2015; Brandon-Jones, Squire, Autry, & Petersen, 2014). To retain the operations and mitigate the adverse effects of a disruption when it happens, organisations take two generic actions: buffering and bridging (Bode et al., 2011). While buffering refers to passive responses through various forms of slack to "absorb the shocks" of an event, bridging represents a range of boundary-spanning activities, such as collaborative risk sharing and resource pooling, to manage the consequences of a disruption (Reimann et al., 2017, p. 39). Research has shown that decisions made during a supply chain disruption recovery could have a significant effect on minimising the overall costs and ripple effects of the event (Ivanov et al., 2017, 2014), and maintaining the firm's position in the market (Sheffi and Rice, 2005; Bode et al., 2011). Nonetheless, there is plenty of evidence highlighting that organisational responses during disruption recovery are systematically different (Bode et al., 2014; DuHadway, Carnovale, & Hazen, 2017; Reimann et al., 2017).

Given its practical importance, studies have investigated the impact of a range of internal and external factors on the use of alternative actions. For instance, Bode et al. (2011) show that the interaction between various inter- and intra-organisational elements, such as disruption orientation and dependency, could drive buffering and bridging decisions. Mir, Aloysius, & Eckerd (2017) investigate the effect of managerial perceptions of disruption severity and attribution on supplier switching intention following the event. Similarly, Ellis et al. (2011) explain the interaction between supply chain environmental, contextual, and individual factors in influencing managerial decision-making during a disruption situation. Although these studies have provided great insights into individual (Ambulkar, Blackhurst, & Cantor, 2016; Cantor et al., 2014; Polyviou et al., 2018), organisational (Ambulkar et al., 2015; Bode et al., 2014), and relational (Bode et al., 2011) determinants of a buying firm's responses, less has been discussed on the role of suppliers' recovery action in the wake of such events (Reimann et al., 2017). This is of significant importance, because managing supply chain disruption involves a dyadic transaction (Bode et al., 2011) and hence, actions employed by one party during a resolution could have a meaningful effect on the other party's reaction to the incident

(Polyviou et al., 2018; Reimann et al., 2017; Urda & Loch, 2013; Wang et al., 2014). For instance, a recent study by Wang et al. (2014) shows that the supplier's use of justice approaches during disruption recovery could mitigate trust damages caused by the event and foster relationship satisfaction and continuity following the disruption. To investigate the impact of a supplier's recovery actions on a buyer's responses during a supply chain disruption, we draw from construal level theory and construal fit hypothesis from social psychology.

4.2.2 Construal level theory

Construal Level Theory (CLT) is concerned with the psychological processes by which people utilise information to make decisions (Fiedler, 2007; Trope & Liberman, 2010). CLT centres on the idea that individuals create mental representations based on contradictory aspects of the same information depending on whether information pertains to *psychologically* near or distant targets (Liberman et al., 2007). Psychological distant targets are those that are not part of one's direct experience: things may belong to the past or to the future, to spatially remote locations, to socially distant people, and to hypothetical situations. These alternatives define respectively, four dimensions of psychological distance: temporal distance, spatial distance, social distance, and hypotheticality (Soderberg, Callahan, Kochersberger, Amit, & Ledgerwood, 2015; Trope & Liberman, 2010); while target could refer to a person, situation, object, event, or even a course of action.

According to CLT, the greater one's psychological distance from a target, the more likely that target is to be represented (*i.e.* construed) at higher level – *i.e.* in terms of few global features that convey its essence (Trope & Liberman, 2003). High-level construal reflects the primary features of a target; they are abstract, and decontextualized representations that extract the gist of available information (Liberman et al., 2007). For instance, in representing spatially distant objects, people ignore the need to encode all fine-grain metric values by relying instead on high-level categorical information. On the other hand, the closer an individual is to a target, the more likely that target is to be represented by its contextual and peripheral features – *i.e.* low-level construal (Trope & Liberman, 2003). Low level construal represents concrete and incidental features of a target. A person who has recently experienced a major crisis, for example, may think of the event in terms of its detailed incidental information about the location, the people who were involved, as well as their interactions throughout the event. While, after a few years, she tends to think more in terms of the cause and consequences of the

incident. Low-level construal thus, provides richer and more detailed information than high-level construal, but is less structured (Trope & Liberman, 2010).

CLT therefore, has two key elements: construal level of targets and psychological distance that leads to a particular mental representation (*i.e.* construal level) (Soderberg et al., 2015). By linking psychological distance and construal level, CLT claims that psychological distances are one of the significant determinants of whether global and central features, or contextual and peripheral characteristics of an event are used as a basis of people’s evaluation, prediction, and decision-making process (Fujita, Trope, Liberman, & Levin-Sagi, 2006; Liberman et al., 2007; Wakslak, Trope, Liberman, & Alony, 2006). Within the context of a supply chain disruption, we draw from CLT to develop a set of propositions that link contextual characteristics of a disruption environment to an individual’s mental representation of the event, and show the mediating effect of this mental model on the relationship between a supplier’s recovery actions and a buyer’s responses. In line with CLT studies, we adopt two units of analysis – individual, and environment. We conceptualise an “individual” as a manager within a buying firm who evaluates a situation and makes risk-related decisions on behalf of the firm, and suggest that disruption “environment” refers to a supply chain entity that has already experienced a disruption incident. Figure 4:1 shows a schematic representation of our research propositions, which will be discussed in the following section.

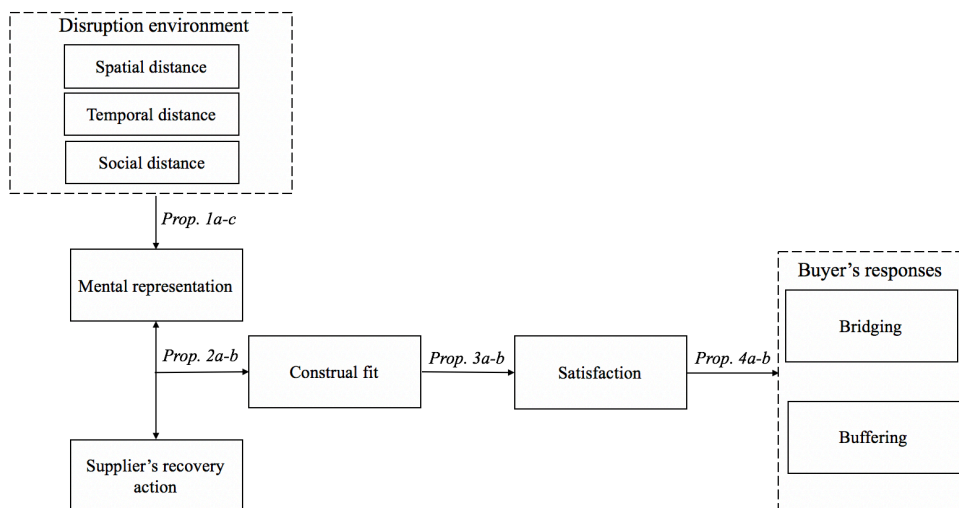


Figure 4:1 Schematic Representation of Research Propositions

4.3 Propositions

4.3.1 Psychological distance of disruption management

Drawing from CLT, disruption environment is characterised in terms of three dimensions of psychological distance: spatial distance, temporal distance, and social distance. We choose not to incorporate hypotheticality, *i.e.* whether an event is real or imaginary/potential, as we focus on the impact of psychological distance following the *occurrence* of a disruption. We define spatial distance as the geographic distance between the buying firm and its supplier (*cf.* Henderson et al., 2006, 2011). Extant supply chain risk research has previously investigated the impact of geographic distance on the probability of supply disruption risk using a structural and behavioural perspectives (Choi & Krause, 2006; Craighead et al., 2007). These studies have found that higher physical distance between exchange partners implies more variable lead times and a less resilient supply chain which, in turn, increases the possibility of supply disruption events (Bode & Wagner, 2015; Brandon-Jones, Squire, & Van Rossenberg, 2015). Moreover, spatial distance poses a higher probability of confronting the unknown due to, for example, institutional differences, communication issues, or visibility (Ellis et al., 2011; Handley & Benton, 2013; Wilson, Crisp, & Mortensen, 2013). Building on the main premise of CLT, we argue that as buyers become more distant from the supplying firm (*i.e.* disruption location), they tend to think in more abstract terms (Henderson et al., 2006, 2011) and hence, rely on higher level mental representation to evaluate and make decisions about the event.

Temporal distance is defined as the timeframe between the point that a disruption occurs to the point that buying firms respond to the event. Past supply chain risk research has mainly discussed time in terms of its value in minimising the consequences of a disruption during the discovery and recovery stages (Blackhurst et al., 2005; Craighead et al., 2007; Ponomarov & Holcomb, 2009; Simchi-Levi et al., 2014; Wagner & Bode, 2006). For instance, Sodhi and Tang (2009) highlight the value of timely recovery responses to a natural disruption by modelling the impact of the event as a function of time. They show that while the number of people affected by the event grows exponentially during the initial phases of recovery, it becomes plateaus as one gets further away from the point of disruption. From a behavioural perspective, temporal distance is often associated with the availability of incidental information about the location and time of the event (Blackhurst et al., 2005; Tang, 2006). In the context of our study, we draw from construal level theory to argue that individuals create different mental representations of a supply disruption as a function of time. In other words, as the

buying firm gets away from the actual point of a disruption, they represent the event in terms of less peripheral and incidental, and more essential and core information (Nussbaum, Trope, & Liberman, 2003; Trope & Liberman, 2003). For instance, in the early stages of a disruption, buyers focus on the behaviour of the supplier in terms of accepting the responsibility and/or providing explanations. However, after a while, they become more concerned with the overall financial damages caused by the event. Temporal distance in this sense, implies construing a disruption in terms of more high-level representation of the event, e.g. the tangible losses of the disruption.

Lastly, social distance is defined as the perceived degree of buyer-supplier similarity, familiarity, and/or social closeness (Gray, Roth, & Leiblein, 2011; Liberman et al., 2007; Zhao & Xie, 2011). As the complexity of supply chain increases, firms deal with a range of suppliers whose characteristics, culture, and practices are more heterogeneous in nature (Bode & Wagner, 2015; Durand, Turkina, & Robson, 2016; Sousa & Lages, 2011). Differences among supply chain partners may arise from variations in hard aspects, such as technologically advanced or backward firms, offshore or local operations, as well as soft aspects such as culture and language differences (Gray & Massimino, 2014; Gray et al., 2011; Skilton & Robinson, 2009). In dealing with socially distant suppliers, a focal firm may have less familiarity with the way supplier's operations work which will in turn, create greater uncertainty (Brandon-Jones et al., 2015). From a CLT point of view, the lack of knowledge about context and behaviour of a dissimilar exchange partner will produce a sense of distance from the disruption leading to higher mental representations. Therefore, in line with the prediction of construal level theory, we propose that:

Proposition 1. Psychological distances from a supply chain disruption are associated with individuals' mental representation of the event, such that:

- a. Spatial distance is positively associated with higher construal level*
- b. Temporal distance is positively associated with higher construal level*
- c. Social distance positively associated with higher construal level*

4.3.2 Supply chain recovery actions

Supplier recovery actions refer to those activities employed by a supplier during a disruption to “ameliorate” the consequences of the event (Reimann et al., 2017, p. 42). Drawing from advances in the service recovery literature, scholars have identified two categories of recovery

actions: tangible and psychological (Reimann et al., 2017). Tangible actions are intended to return supply chain operations to normal operating performance in a timely manner, and/or compensate for real and perceived losses (Gelbrich and Roschk, 2011; Miller et al., 2000). In particular, suppliers may provide replacement, compensation, or refund to quickly mitigate operational and financial (*i.e.* tangible) damages caused by a disruption (Liao, 2007; Primo et al., 2007; Reimann et al., 2017). For example, following a mechanical fault at NHS Supply Chain National Distribution Centre (NDC), the firm offered to facilitate a direct delivery on an emergency basis at no cost to customers to minimise damages caused by the event (NHS Supply Chain, 2017). On the other hand, psychological actions focus on social aspects by showing concerns for buyers' needs and providing *situation-specific* treatments (Miller et al., 2000; Reimann et al., 2017). Particularly, supplying firms may attempt to alleviate a disruption situation by accepting responsibility of the event, providing explanations, apologising, and being courteous (Craighead et al., 2004; Miller et al., 2000; Reimann et al., 2017). For instance, following the 2016 battery incident of Samsung Galaxy 7 mobile phones, the company made public apologies to customers and provided an explanation of why the issue had been caused. Within the supply chain disruption context, scholars have recently highlighted the significance of a supplier's recovery actions on shaping buyers' behaviour following a disruption (Primo et al., 2007; Reimann et al., 2017; Wang et al., 2014). However, we still know very little on the effectiveness of a particular supplier's action on buyers' responses.

- Linking supplier's recovery actions and mental representation

The occurrence of a supply chain disruption could lead to both tangible and intangible losses (Hendricks and Singhal, 2005, 2003; Ivanov et al., 2014; Wang et al., 2014). While the former refers to operational and financial consequences, such as delays and costs of non-delivery (Hendricks and Singhal, 2005), the latter reflects social damages, such as loss of confidence in supply chain knowledge and ability (Kaufmann et al., 2018a; Wang et al., 2014). For example, following a supplier disruption caused by the 2011 Japanese earthquake, Toyota experienced several months of delay in delivery and a global production loss of 5% in 2011 (*i.e.* tangible losses) (Brüning, Hartono, and Bendul, 2015). In addition, the company experienced intangible losses, in terms of losing confidence in its supply chain visibility (*i.e.* they realised that the company lacks sufficient visibility to monitor the performance of third- and fourth-tier suppliers) (van der Vagt et al., 2015). In the context of a supply chain disruption, both tangible

and intangible damages could increase transactions costs (Kauffman et al., 2018), by driving the redesign of slack resources and control systems (Christopher and Lee, 2004).

To minimise the occurrence of such costs, suppliers tend to take psychological and tangible actions to address intangible and tangible losses (Reimann et al., 2017). Within the service failure literature, scholars have highlighted the value of psychological actions due to the intangible nature of service operations (Craighead et al., 2004; Ding and Keh, 2017). In other words, since the main transaction in this context happens in a service provider-customer interface, people tend to base their recovery judgement mainly on the behaviour of the provider (Smith and Karwan, 2010). On the contrary, psychological actions may be seen as of *secondary* concern in a business-to-business context (Kaufmann et al., 2018). Since supply chain disruptions influence the flow of physical goods and material (Ivanov et al., 2017; Sheffi and Rice Jr., 2005), the primary focus of recovery is concerned with tangible repairs (Norrman and Jansson, 2004). That is, suppliers need to address transaction obligations that contribute to retaining the operations and minimise financial losses (Kaufmann et al., 2018; Reimann et al., 2017; Sheffi and Rice Jr., 2005).

Despite the primacy of psychological actions in service recovery contexts, scholars have highlighted the role of individual factors, service failure type and loyalty on customers' expectations and the relative importance of response strategies (*e.g.* Miller, Craighead and Karwan, 2000; Hess Jr., Ganesan and Klein, 2003; Patterson, Cowley and Prasongsukarn, 2006; Aggarwal and Larrick, 2012). For instance, Craighead et al. (2004) find that loyal customers tend to prefer psychological and tangible actions (*e.g.* apology and compensation) in the case of a severe failure, while their expectation of psychological recovery disappears for less severe events. The findings from these studies have highlighted that recovery efforts are most effective if they match customers' expectations and preferences during the event (Craighead et al., 2004; Griffin et al., 1996; Nguyen et al., 2012). Within the supply chain disruption context, scholars have recently highlighted the positive impact a supplier's recovery actions on buyers' attitudes and behaviour following a disruption (Primo et al., 2007; Reimann et al., 2017; Wang et al., 2014), but have not yet distinguished between the effectiveness of different types of actions. For instance, Wang et al. (2014) find empirical evidence on the effect of suppliers' recovery actions on mitigating trust damages and dissatisfaction caused by a disruption. In a similar vein, Reimann et al. (2017) use qualitative interview data to create various archetypes of buyer-side and supplier-side actions that lead to collaboration/conflict in the aftermath of a supplier-induced disruption. Despite the significant insights provided by

these studies, we still know very little on the effectiveness of a particular supplier's action on buyers' responses.

We draw from construal level theory to argue that the importance of a supplier's tangible versus psychological actions depends on the psychological distance of a disruption and managerial mental representation (*cf.* Lee and Aaker, 2004). In other words, when a disruption is psychologically distant, managers create a mental representation that focuses on core consequences, *i.e.* tangible losses (*cf.* Liberman, Trope and Wakslak, 2007; Zhao and Xie, 2011). Within such contexts, an individual manager takes an abstract view of a disruption and focuses on the impact of the event on key performance measures (*i.e.* sales, financial performance). Therefore, a supplier's recovery actions that address tangible elements, such as product replacement and financial compensation, match with the mental representation of a buying manager (*cf.* Li et al., 2011). For instance, when a geographically distant supplier experiences a fire incident at its plants, a buying manager focuses on production delays and financial consequences of unsatisfied demands. Hence, tangible recovery actions that could reduce delays and financial losses are preferred. On the other hand, during psychologically close events, managerial mental representation focuses on peripheral consequences, that is intangible losses (*e.g.* losses of confidence in knowledge and ability of the supply chain). Accordingly, psychological actions that offer social repairs, through accepting responsibility of the disruption, apologising and providing explanations (Kaufmann et al., 2018; Reimann et al., 2017), fit the buying manager's mental representation (Figure 4:2). For example, when a disruption happens to a socially familiar supplier, a buying manager is more concerned with the loss of confidence and goodwill and hence, expect psychological actions to repair such damages. Therefore, we propose that:

Proposition 2. A supplier's recovery actions match with different mental representations of a disruption, such that:

- a. Tangible actions match with mental representation of a psychologically distant disruption*
- b. Psychological actions match with mental representation of a psychologically close disruption*

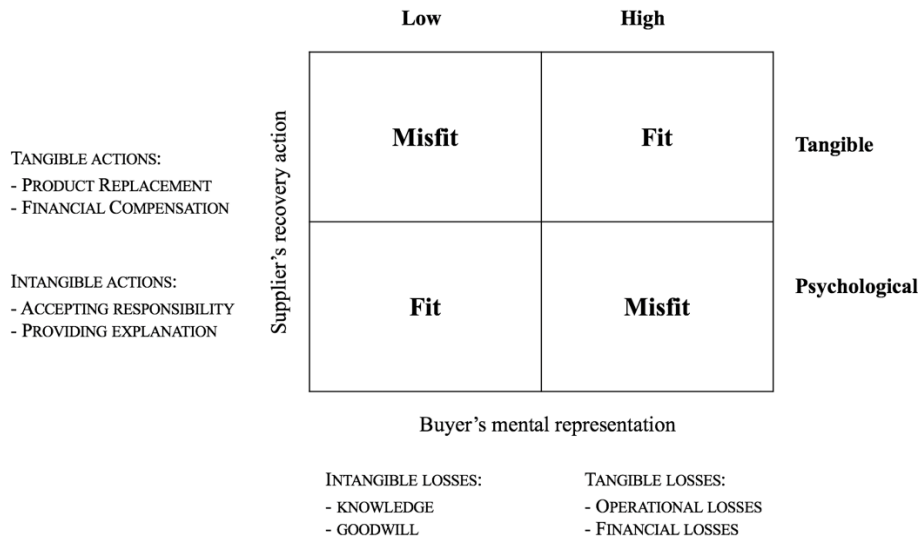


Figure 4:2 Fit-Misfit Between Recovery Actions and Mental Representation”

4.3.3 Construal level fit

We draw from construal level fit hypothesis (Higgins et al., 2003; Zhao, Hoeffler, & Zauberaman, 2007; Zhao & Xie, 2011) to propose that the match or mismatch between decision makers’ construal level and the supplier’s recovery actions influences buyers’ satisfaction with the resolution process and consecutive disruption responses (Kruglanski, 2006; Pizzi et al., 2015). Construal level fit is a construct derived from CLT, and has been associated with important organisational outcomes, such as social bonding and job satisfaction (Berson & Halevy, 2014), commitment (Berson, Halevy, Shamir, & Erez, 2015), perception of fairness (Li et al., 2011), and persuasiveness (Kim et al., 2009; Lee & Aaker, 2004). In general, construal fit suggests that an external stimulus exerts the greatest influence on thinking (Zhao et al., 2007; Zhao & Xie, 2011), judgement (Thompson & Hamilton, 2006), and decision-making (Higgins et al., 2003) when it fits individuals’ mental representation (*i.e.* construal level).

When people process information that fits with their construal level, they are more likely to “feel right” (Higgins et al., 2003; Li et al., 2011). This, in turn, increases the likelihood of a positive evaluation of the target, as people tend to misattribute this feeling to the focal judgemental task (Roy & Ng, 2012). For instance, Kim et al. (2009) find that in framing political campaign messages, a candidate’s explanation that fits people’s construal level leads to a sense of “feeling right” that in turn, increases the persuasion of the advertised message. In other words, when an election is temporally distant, explanations that focus on core

characteristics of a candidate (*i.e.* why they do things) are evaluated more favourably. Whereas, people tend to prefer candidates whose message is more situation-specific (*i.e.* how they do things), when the election is temporally close. Similarly, Zhao et al. (2011) show that when evaluating a product for a temporally close future (*i.e.* low-level construal), recommendations that focus on the low-level process of using the product, lead to a higher product evaluation. On the other hand, when evaluating a product for a temporally distant future, recommendations focusing on the high-level benefits of the product result in higher product evaluation because of the fit.

- Consequences of construal level fit on satisfaction

Drawing from the above arguments, we propose that during a supply chain disruption, buyers tend to feel more satisfied if the supplier's actions match their mental representation of the disruption. The fit between the recovery actions and mental representation creates a sense of rightness about what the supplier is doing (Camacho, Higgins, & Luger, 2003) that is associated with a positive feeling of satisfaction (Kruglanski, 2006). Previously, scholars have mainly conceptualised satisfaction as a function of cognitive factors, such as disconfirmation of expectations (Benton & Maloni, 2005; Parasuraman, Zeithaml, & Berry, 1985) and justice evaluations (Goodwin & Ross, 1992; Wang et al., 2014). These studies have argued that in shaping satisfaction judgements, people use a comparative reference point to assess whether the recovery efforts have met their prior expectations and/or justice principles (Benton & Maloni, 2005; Parasuraman et al., 1985; Szymanski & Henard, 2001; Wang et al., 2014).

However, we draw from construal level fit hypothesis to propose the effect of a match between a supplier's recovery efforts and mental representation on individuals' satisfaction. In other words, a fit between a supplier's action and buyer's construal level leads to a sense of "feeling right" that in turn, induces higher satisfaction with the supplier's resolution, compared to when the actions are incongruent with construal level. For instance, buyers tend to create a low-level construal (focusing on intangible losses), when a disruption caused by a spatially close supplier. In such cases, the supplier's psychological actions fit with buyers' mental representation and hence, are more likely to enhance satisfaction. On the other hand, buyers focus more on tangible losses when a supplier is spatially distant. Accordingly, supplier's tangible actions, that address such losses, are more likely to induce higher levels of satisfaction. Therefore, we propose that:

Proposition 3. The fit between construal level and a supplier's recovery action is positively associated with a buyer's satisfaction with the disruption resolution process, such that:

- a. In low-level construal, relative to a supplier's tangible actions, psychological actions increase a buyer's satisfaction with the disruption resolution process*
- b. In high-level construal, relative to a supplier's psychological actions, tangible actions increase a buyer's satisfaction with the disruption resolution process*

4.3.4 Satisfaction and buyer responses

While research has extensively discussed the impact of satisfaction on positive relational outcomes, such as trust and commitment (e.g. Anderson and Sullivan, 1993; Ganesan, 1994; Benton and Maloni, 2005; Griffith, Harvey and Lusch, 2006), the role of satisfaction in response to supplier disruption has received less attention (Wang et al., 2014). Satisfaction in this context is defined as buyers' affective psychological state as a result of subjective evaluations of the supplier's actions during a recovery process (cf. Oliver, 1980; Hess Jr., Ganesan and Klein, 2003). Extant service failure literature has referred to satisfaction as an underlying psychological factor that explains the relationship between service provider recovery efforts and customers' responses to a service failure (Patterson et al., 2006; Schoefer & Ennew, 2005; Van Vaerenbergh & Orsingher, 2016; Wu et al., 2013). In other words, the impact of recovery activities on behavioural responses is mediated by customers' satisfaction judgement (Liao, 2007; Wirtz & Mattila, 2004). Recently, scholars have also highlighted the role of satisfaction in mediating the relationship between supplier's justice approaches and buyers' switching intention following a supplier-induced disruption (Wang et al., 2014). We build on the findings from these studies to propose that the extent to which buyers pursue bridging versus buffering is at least partly, dependent on subjective evaluations of satisfaction with a disruption resolution process.

Previous research has found evidence on the positive effect of satisfaction on cooperation, and its negative impact on relational conflict (Anderson & Sullivan, 1993; Benton & Maloni, 2005; Skinner, Gassenheimer, & Kelley, 1992; Vos, Schiele, & Hüttinger, 2016). Satisfaction has also been viewed as a necessary psychological factor that sustains the trust and commitment needed for long-term partnerships (Benton & Maloni, 2005). In the context of our study, we argue that as satisfaction with the supplier's action increases, buyers are more likely to take

bridging actions. In other words, to ensure maintaining their relationship in the future (Ping, 1997; Purdy & Nye, 2000), buyers tend to work constructively and collaboratively with the supplier firm to cope with the consequences of a disruption (*cf.* Geyskens and Steenkamp, 2000; Griffith et al., 2006). Therefore, we propose that higher satisfaction with the supplier's actions during the recovery process is positively related to bridging strategies, such as resource pooling and information sharing.

Proposition 4a. A buyer's satisfaction with the supplier's action during the recovery process is positively associated with bridging responses

On the other hand, research in marketing channel relationships has shown the negative impact of satisfaction on destructive and passive responses to channel relationship problems (Geyskens & Steenkamp, 2000). In the context of supplier-induced disruptions, we propose that lower satisfaction with the supplier's action is likely to lead to more passive responses. In other words, buyers tend to protect themselves against the reoccurrence of a similar event by reducing contact with the supplier through multiple sourcing and adding slack resources in their supply base (Bode et al., 2011), or withdrawing from the relationship altogether (Geyskens & Steenkamp, 2000). In particular, when the supplier is perceived to underperform, buyers may feel that they have less to lose if their responses lead to relationship dissolution. Therefore, we propose that satisfaction with the supplier's actions during the recovery process is negatively associated with buffering responses, such as multiple sourcing and adding slack resources.

Proposition 4b. A buyer's satisfaction with the supplier's action during the recovery process is negatively associated with buffering responses

4.4 Discussion

Extant supply chain risk literature has offered valuable insights into the role of pre-established organisational, relational, and individual factors that shape alternative responses to a supply chain disruption (*e.g.* Ambulkar et al., 2015; Bode et al., 2014, 2011; Cantor et al., 2014; Reimann et al., 2017). However, we know very little about the impact of a supplier's recovery actions on a buying manager's behaviour in the wake of an event (Reimann et al., 2017). This is surprising, given that supply chain disruptions are inter-organisational in nature and hence, the actions of one party following the event could have significant effect on the other party's

responses to the incident (Urda & Loch, 2013; Wang et al., 2014). Therefore, our aim in this study was to draw from advances in social psychology to develop a set of testable propositions that explain the interplay of a supplier's recovery actions and a buyer's responses during a supply chain disruption. In doing so, we make several contributions to the extant literature.

4.4.1 Theoretical contributions

First, we contribute to the understanding of the antecedents of heterogeneity in organisational-level supply chain disruption responses (Bode et al., 2014, 2011). Past studies have highlighted the importance of individual, and contextual factors in explaining variations in responses to a supply chain disruption (Ambulkar et al., 2015; Bode et al., 2014, 2011; Cantor et al., 2014). Our research builds on the findings from these studies to propose that this heterogeneity could, at least partly, be explained by managerial interpretation of a supplier's recovery actions in the wake of a disruption (*cf.* Wang, Craighead and Li, 2014; Reimann, Kosmol and Kaufmann, 2017; Polyviou et al., 2018). When a disruption occurs, organisational decisions, that underlie all responses and recovery actions, are determined by an individual manager's interpretation and evaluation of the situation (Ellis et al., 2011; Reimann et al., 2017). Due to the high uncertainty of a disruption situation and their bounded rationality, managers create a mental representation of the environment to facilitate their decision-making (Weick et al., 2005). We draw from construal level theory (Liberian et al., 2007; Trope & Liberman, 2003, 2010) to argue that psychological distance from a disruption triggering has a meaningful effect on the content and structure of this mental model (Propositions 1a-c). In particular, we show that managers tend to use primary and essential as opposed to secondary and peripheral aspects of information as the basis of their mental representation when they are spatially (Proposition 1a), temporally (Proposition 1b), and socially (Proposition 1c) distant from a disruption triggering event. This is of importance, as it could reflect the sources of managerial biases in disruption-related decision-making (DuHadway et al., 2018; Fiedler, 2007) and subsequently, the underlying factors that lead to variations in organisation-level responses during a recovery process (Macdonald & Corsi, 2013; Polyviou et al., 2018).

Our study is not the first that applies construal level theory in explaining the psychological underpinning of supply chain management decision-making. For instance, Cantor and Macdonald (2009) use the theory to examine the effect of abstract versus concrete problem-solving approaches on individual performance in the presence and absence of supply chain system-wide information in a beer distribution game. Nonetheless, our research utilises the

theory to conceptualise the supply chain disruption environment in terms of psychological distance from an event that could, in turn, have wider implication for individual decision-making in various contexts and stages of supply chain disruption management (*cf.* Cantor, Blackhurst and Cortes, 2014). Future empirical studies can opt to examine these propositions in controlled experimental conditions, and/or focus on the effect of psychological distance in risk perception (Wakslak, 2012), causal attribution (Nussbaum et al., 2003), and decision-making at the discovery and redesign stages of supply chain disruption management.

Second, we contribute to the understanding of the effectiveness of a supplier's tangible and psychological recovery actions depending on psychological distance and the buying manager's mental representation of the disruption. Previous research has mainly investigated the holistic effect of a supplier's actions on a buyer's perception of justice, satisfaction, and emotional responses (Primo et al., 2007; Reimann et al., 2017; Wang et al., 2014). Our study draws from the premise of construal level theory to argue that the effectiveness of a particular action is dependent upon managerial mental representation of a disruption that is associated with the context of the event. In particular, we show that a supplier's tangible actions, such as product replacement and financial compensation, match a manager's mental representation of psychologically distant events (Proposition 2a). Whereas, a supplier's psychological actions, such as providing explanation and apologising, are associated with a manager's mental representation of psychologically close events (Proposition 2b). Subsequently, drawing from construal level fit hypothesis (Higgins et al., 2003; Zhao et al., 2007; Zhao & Xie, 2011), our study demonstrates that providing recovery actions that fit with managerial mental representation could enhance a buyer's satisfaction with the supplier's resolution (Proposition 3). In other words, tangible actions are relatively more effective for psychologically distant events, whereas psychological actions are more suited for psychologically close disruptions. Therefore, our research provides insights into the impact of disruption context on the effectiveness of a supplier's recovery actions (Wang et al., 2014).

Furthermore, this study contributes to the application of construal level fit hypothesis in OSCM literature. OSCM scholars have previously discussed the value of buyer-supplier goal congruence in successful new-product development (Yan & Dooley, 2013), and the importance of fit between managers' and operators' values in enhancing plant performance (Khazanchi et al., 2007). However, to the best of our knowledge, our research is the first to propose the positive effect of match between an external stimulus and mental representation on individuals' judgement and supply chain-related decision-making. The insights from this study and the fit

hypothesis can be used by future scholars to examine the effect of construal level fit on a range of other operations and supply chain management issues, such as supplier selection (Kaufmann, Kreft, Ehr Gott, & Reimann, 2012), negotiation (Thomas, Thomas, Manrodt, & Rudner, 2013), conflict resolution (Lumineau, Eckerd, & Handley, 2015), and mitigating trust damage (Wang et al., 2014). For instance, studies can examine the effectiveness of a supplier's negotiation strategy on buyers' behaviour during different stages of a negotiation process (*cf.* Appelt et al., 2009).

Third, our propositions (4a-b) offer insights into the importance of satisfaction as a determinant of a buying firm's responses during disruption recovery (*cf.* Bode et al., 2011). Extant research has investigated the effect of satisfaction on a range of positive relational outcomes, such as commitment and trust (*e.g.* Anderson and Sullivan, 1993; Ganesan, 1994; Benton and Maloni, 2005; Griffith, Harvey and Lusch, 2006). However, the role of satisfaction on responses following a supply chain disruption is understudied (Wang et al., 2014). Our study draws from the findings of conflict literature (*e.g.* Geyskens and Steenkamp, 2000) to show that satisfaction could have a significant effect on the buyer's alternative choice of bridging and buffering actions. In particular, we argue that higher satisfaction with the supplier during a recovery process may motivate buyers to take bridging actions through for instance, resource pooling, in order to manage the disruption (Proposition 4a). On the other hand, under relatively lower levels of satisfaction, they are more likely to employ buffering strategies, such as adding slack resources, to mitigate the disruption consequences without worrying that these actions may influence the future of the focal relationship (Proposition 4b).

4.4.2 Managerial implications

Our study also has important managerial implications. From a buyer's point of view, our propositions shed light on the underlying psychological factors that may bias decision-making during disruption recovery. Relying on feelings as a source of information is an efficient strategy to deal with the uncertainty and ambiguity of the disruption environment (Carter, Kaufmann, & Michel, 2007). However, this could potentially blanket (Schwarz, 2006) the effect of other structural and relational factors that sustain a firm's success and competitive capabilities in the future (Bode et al., 2011; Zsidisin & Ellram, 2003). There is evidence that drawing individuals' attention to the source of "feeling right" could reduce or diminish its effect and hence lead to more rational judgements (Cesario, Grant, & Higgins, 2004). Therefore, the insights from our study could be used by organisations to educate managers

about the sources of their positive/negative judgement, and encourage managers to adopt a more analytical and reflective thinking that takes a supplier's prior performance ("shadow of the past") and future benefits ("shadow of the future") into account when making recovery decisions.

On the other hand, from a supplier's point of view, our propositions can highlight the relative importance of alternative recovery actions depending on a disruption context. Service recovery research has previously highlighted the significance of matching recovery response to customers' expectations and preferences (Craighead et al., 2004; Griffin et al., 1996; Nguyen et al., 2012). Our study proposes that suppliers can tailor their recovery actions temporally, and/or according to their spatial and social distance from the buying firm. While psychological actions may be more effective in fostering collaborative risk management in psychologically close contexts, tangible actions may become more effective for managing psychologically distant events. For instance, when suppliers are dissimilar to the buyer, providing compensation and/or product replacement are more effective, while apologising and explanations work better when they are similar to the buyer.

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Chapter 5 Study 3: Redesign

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Supply Chain Redesign Following a Disruption: The Influence of Blame and Trust⁹

ABSTRACT

Following a disruption, organisations may choose to redesign aspects of their supply base to reduce the probability of reoccurrence, future impacts and/or improve recovery capabilities. However, we know very little about why and when firms choose to respond to some disruptions and not to others. Through two empirical studies, we investigate to what extent the attribution of blame for a disruption influences a manager's decision to redesign their supply chain. First, data collected from a behavioural experiment with 137 global MBA students examines the antecedents of blame. Our findings suggest that controllability significantly influences the extent to which suppliers are blamed for a disruption, while severity has no significant effect. Second, data collected from a survey of 115 UK managers examines the impact of blame on supply base redesign. Our findings suggest that blame significantly impacts redesign, but only when a buyer's prior trust in the supplier is low.

Keywords:

Supply chain disruptions, behavioural operations, attribution theory

5.1 Introduction

The study of supply chain disruptions has become a major focus for operations management scholars over the past 15 years (Neiger, Rotaru, & Churilov, 2009). Studies have investigated the sources of disruption (Bode & Wagner, 2015; Chopra & Sodhi, 2004; Ellis, Henry, & Shockley, 2010), proactive strategies to improve resilience (Brandon-Jones, Squire, Autry, & Petersen, 2014; Kim, Chen, & Linderman, 2015; Knemeyer, Zinn, & Eroglu, 2009), and the performance impact of disruptions (Hendricks & Singhal, 2003; Hendricks, Singhal, & Zhang, 2009; Jacobs & Singhal, 2017). Much less attention has been paid to when and why firms choose to respond to some disruptions (Bode, Wagner, Petersen, & Ellram, 2011). This is a significant gap, given that organisational responses to supply chain disruptions are a major determinant of their resilience to subsequent threats. For example, when Hurricane Katrina hit

⁹ An earlier version of this chapter was presented during EurOMA annual meeting in 2017 and Academy of Management (AoM) annual meeting in 2018. The current version is under review in Journal Operations Management.

the US in 2005, Cisco's supply chain could not cope with the surge in demand and led directly to reductions in visibility and performance (Miklovic & Witty, 2010). This disruption triggered Cisco to redesign aspects of its supply base, including inventory levels, the location and availability of alternative suppliers, and levels of visibility. The value of these changes was realised when the Japanese earthquake and Tsunami hit Japan in 2011. Despite having more than 300 suppliers producing over 7,000 parts in the affected region, Cisco suffered almost no operational delays or revenue losses (Sáenz & Revilla, 2014).

This study builds from attribution theory to examine blame as a means to understand a firm's decision to redesign its supply chain following a disruption. Attribution theory predicts that responsibility and blame are key elements of post-event sense-making (Bundy & Pfarrer, 2015; Shaver, 1985), through which managers attempt to understand why an event occurred and who is responsible (Hamilton, 1987). The attribution of an event to someone, or something, may be determined by several dimensions, including locus, controllability, and severity (Weiner, 1979, 1985). Our study has a fixed locus by examining only supplier-induced disruptions (*cf.* Wang et al., 2014), and therefore suggests that buyers attribute greater blame to the supplier if the disruption is severe and controllable. In doing so, we seek to complement extant studies that have investigated the buyer's decision making process in advance of disruptions (Ellis et al., 2010), by providing a behavioural view of decision making in the advent of a disruption.

The attribution of blame has consequential effects for behaviours, responses or choices (Weiner, 1995). Our study focuses specifically on the decision to redesign an existing supply base in response to the attribution of blame for a supply chain disruption. Redesign activities are part of the remedial steps required to address a recent failure (Holguín-Veras, Jaller, Van Wassenhove, Pérez, & Wachtendorf, 2012; Speier, Whipple, Closs, & Voss, 2011), and our research predicts that blame will lead to more change in the supply base as the buyer attempts to improve future resilience. Of course, taking the decision to redesign a supply chain does not occur within a vacuum (DuHadway, Carnovale, & Hazen, 2017). An organisation's response to any single event needs to be carefully weighed against the prior history and relationship with that supplier. In particular, highly trusting relationships imply levels of commitment and loyalty that can create stickiness within the exchange, and therefore reduce the propensity for change (McEvily, Zaheer, & Perrone, 2003; Villena, Revilla, & Choi, 2011). Therefore, while a manager might blame a supplier for a disruption, the goodwill within the dyad will insulate the relationship (Kumar, 1996), thereby negatively moderating the relationship between blame and redesign.

Our study applies a multi-method design, combining a scenario-based experiment and a cross-sectional survey. Given the possible risk of endogeneity between controllability and blame (Coombs & Holladay, 2002), experimental manipulation of controllability is preferable (Ketokivi & McIntosh, 2017). However, we also wished to observe the effect of blame ‘in the wild’ to more fully capture the organisational realities of making such a decision (*cf.* Levitt & List, 2007), and therefore employed a cross-sectional survey within UK manufacturing firms to examine the relationships between attribution of blame, trust and supply chain redesign (*cf.* Brandon-Jones et al., 2014). We find that while controllability influences the attribution of blame, the severity of a disruption does not have a significant effect. Moreover, we find that the attribution of blame only has a significant impact on supply base redesign when the buyer’s trust in the supplier was low.

The study makes two theoretical contributions to the supply chain risk literature. First, we complement existing supply chain risk research by examining organisational responses to risk events. The extant literature is primarily concerned with understanding the steps to be taken prior to a disruption (Chopra & Sodhi, 2004; Kleindorfer & Saad, 2005; Knemeyer et al., 2009), that is risk planning. However, we know little about decisions taken after disruptions (Bode et al., 2011), or how organisations recover from an event and redesign their supply chain (Ghadge, Dani, & Kalawsky, 2012; Sodhi, Son, & Tang, 2012). Second, we offer a behavioural view of the effect of disruptions on supply base redesign. While previous research has explored the effect of structural factors, such as organisational responsiveness (Macdonald & Corsi, 2013; Ponomarov & Holcomb, 2009) and supply chain flexibility (Simchi-Levi, Schmidt, & Yehua, 2014; Wagner & Bode, 2006) on the ability of a firm to resist or respond to disruptions, our understanding of the antecedents to post-disruption decisions is limited. Our study therefore answers calls for greater research into the links between behaviours, mitigation strategies, and the risk of future disruptions.

The rest of the paper proceeds as follows. Section 5.2 reviews the literature on supply chain disruption management and attribution theory. Section 5.3 develops hypotheses on the causes and effects of attribution after a disruption. Section 5.4 discusses the methods employed in our two studies, while Section 5.5 provides the results of the analyses. Finally, Section 5.6 and 5.7 discuss the theoretical and practical implications of our studies, the limitations and opportunities for future research.

5.2 Literature review

5.2.1 Supply chain disruption management

Supply chain disruptions are unexpected triggering events occurring in a supply chain that could seriously threaten the normal operations of the focal firm (Bode & Wagner, 2015; Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007). The increasing trends towards lean operations, outsourcing, and close collaboration with exchange partners have improved the efficiencies of firms' activities, but have also created supply chain structures that are more vulnerable to events occurring either upstream or downstream of the chain (Brandon-Jones et al., 2014; Ponomarov & Holcomb, 2009). A recent survey by the Business Continuity Institute (BCI) shows that the majority of firms in the study experienced at least one disruption event in the last year, of which 44% were triggered at Tier 1 suppliers (Alcantara, Riglietti, & Aguada, 2017). These events, especially when triggered on the supply side, could have a ripple effect throughout a supply chain, leading to losses in profitability, operating income, return on sales, customer satisfaction, and brand image (Hendricks & Singhal, 2003, 2005; Ivanov, Sokolov, & Dolgui, 2014).

Due to the unpredictable nature of these events, extant research has focused on the proactive identification and management of risks in the design and planning stages of supply chain management (Ivanov et al., 2014). Supply chain scholars have provided valuable insights into the sources of disruption vulnerabilities related to the supply network structure (Bode & Wagner, 2015; Craighead et al., 2007; Kim et al., 2015), market environment of a firm (Rao & Goldsby, 2009; Trkman & McCormack, 2009), and product specific factors (Shah, Ball, & Netessine, 2017; Wagner & Bode, 2006). They have used a range of formal and informal approaches to estimate risks associated with these events (Blackhurst, Scheibe, & Johnson, 2008; Hallikas, Karvonen, Pulkkinen, Virolainen, & Tuominen, 2004; Wu, Blackhurst, & O'grady, 2007), and offered robust risk management strategies, accordingly (for review, see Snyder et al., 2016; Tang, 2006). This involves strategic planning and alignment of facility locations (Aghezzaf, 2005; Snyder, Daskin, & Teo, 2007), transportation mix (Tang, 2006), number of suppliers (Hendricks et al., 2009; Li, Sethi, & Zhang, 2016; Sting & Huchzermeier, 2014), contractual terms (Nishat Faisal, Banwet, & Shankar, 2006), inventory levels (Chopra & Sodhi, 2004), and slack capacities (Yang, Aydın, Babich, & Beil, 2009) to improve supply chain *readiness*, and *resilience* in vulnerable areas (Carvalho, Barroso, Machado, Azevedo, & Cruz-Machado, 2012; Das & Lashkari, 2017).

However, despite risk planning, the occurrence of certain disruptive events in a global and interdependent supply chain environment is inevitable (Macdonald & Corsi, 2013). To create recovery capabilities and improve supply chain resilience, firms may decide to make changes to various aspects of their supply chain (Olcott & Oliver, 2014), including the number of suppliers or inventory levels, that can reduce the disruption impact and contribute to a firm's growth and superior performance in the aftermath of an incident (Blackhurst, Dunn, & Craighead, 2011; Hohenstein, Feisel, Hartmann, & Giunipero, 2015). The performance improvement associated with such reactive decisions has motivated scholars to examine the underlying antecedents to change. Initial evidence indicates that organisations with a supply chain disruption orientation are more likely to redesign their risk management infrastructure following a disruption (Ambulkar, Blackhurst, & Grawe, 2015). Moreover, relational factors, such as supplier dependency and inter-firm trust, guide an organisation's choice between alternative buffering and bridging strategies post-disruption (Bode et al., 2011). However, despite the value of these studies, it is still not clear what drives managerial redesign decisions after a disruption.

Managers employ risk management strategies based on their evaluation of supply chain vulnerabilities (Ellis et al., 2010; Ellis, Shockley, & Henry, 2011). The occurrence of certain incidents may change their perceptions about the resilience of their supply chain and motivate post-disruption infrastructural redesign (Ambulkar et al., 2015; Kahn, Barton, & Fellows, 2013). When facing a disruptive incident, managers rely on their sense-making process to analyse plausible causal explanations, and in turn apply remedial actions (Lampel, Shamsie, & Shapira, 2009; Seeger, Ulmer, Novak, & Sellnow, 2005; Weiner, 1985). For instance, in the aftermath of the Galaxy Note 7 explosion incident that led to the global recall of millions of devices, Samsung attempted to shed light on the issue by attributing the causes to the mobile phone battery flaws (Martin & McKinnon, 2017). This attribution in turn, motivated the company to introduce a new audit procedure to prevent the occurrence of similar events in the future (McCurry, 2017; Tilley, 2017). In our study, we seek to understand the underlying disruption-related factors that affect this sense-making process (Choi & Mattila, 2008; Hartmann & Moeller, 2014), and in turn motivate redesign decisions post-disruption (Gioia & Chittipeddi, 1991; Olcott & Oliver, 2014).

5.2.2 Attribution theory

Attribution theory (AT) draws on a set of theories founded on the work of Heider (1958) in social psychology, and extended to the organisational literature (Harvey, Madison, Martinko, Crook, & Crook, 2014; Martinko, Harvey, & Dasborough, 2011; Martinko, Harvey, & Douglas, 2007). The main aim of the theory is to understand how people attribute causes to events in order to better make sense of the social world (Fiske & Taylor, 1991). Such attributions made by individuals, groups, or organisations help them in dealing with, and reacting to events happening in their environment (Weiner, 1972). Although extant work has largely focused on individuals' attribution in a personal context, the theory has increasingly been recognised as being useful to investigate decision-making within organisations (*e.g.* Harvey et al., 2014).

In the achievement domain of attribution theory, Weiner (1985) discusses the way a person, group or organisation examines the causes of success or failure (*i.e.* achievement outcomes), and its consequences for future achievement behaviour. He proposes that people are more likely to seek causal explanations in response to triggering events which are negative, surprising, and unexpected. This makes the theory specifically relevant to the context of supply chain disruption since disruptions are also understood to be unexpected and negative (Bode & Wagner, 2015; Craighead et al., 2007; Svensson, 2000). According to the theory, there are a number of dimensions which contribute to how people attribute cause and responsibility. Originally, Heider (1958) distinguishes between internal and external causal attributions, and proposes that a balance between personal and environmental factors affecting the 'person' determines the attribution process. This has been extended by Weiner (1979; 1985) who argues that causal attribution dimensions go beyond internal versus external locus of causality, and include: locus, controllability, and stability. In addition, scholars (*e.g.* Laufer, Gillespie, McBride, & Gonzalez, 2005; Tennen & Affleck, 1990; Walster, 1966) have introduced severity as a new dimension that also contributes to people's attributional process.

While locus refers to whether the cause is attributable to internal or external factors, controllability refers to volitional control over an event (Tomlinson & Mayer, 2009). It suggests that the attribution of responsibility will be stronger if the firm is seen to have had control over the cause of an event (Lange & Washburn, 2012). Stability relates to the extent to which the cause of an event remains the same or changes over time (Weiner, 1983). It suggests what may be expected in the future if circumstances are comparable (Tomlinson & Mayer,

2009). Lastly, severity reflects the extent of damage caused by an event (Hartmann & Moeller, 2014; Walster, 1966). Attribution theory suggests that as the cause of an event becomes more internal, controllable, stable, and severe, people tend to attribute higher responsibility (Hartmann & Moeller, 2014; Tennen & Affleck, 1990; Weiner, 1983).

Attribution of blame is a common reaction when people try to identify who or what was responsible for things going wrong (Driedger, Mazur, & Mistry, 2014). In such cases, blame often follows responsibility attribution unless there is a successful intervention, *e.g.* excuse or justification (Shaver, 1985). It is important to note that intervention does not deny ‘responsibility’ but provides a reason why it should not lead to the negative attribution of blame. Blame attributions in turn, affect people’s feelings, reactions, their expectations and future behaviours (Weiner, 1972). The literature has applied the theory to examine a range of organisational outcomes, such as managers’ responses to performance downturns (Ford, 1985), psychological contract breach (Mir, Aloysius, & Eckerd, 2017), organisational learning from failures (Desai, 2015), customers’ responses to a firm’s unsustainable behaviour (Hartmann & Moeller, 2014), and satisfaction in service recovery (Tsiros & Ross, 2004).

5.3 Hypotheses

5.3.1 Antecedents of blame attribution

The choice of attribution dimensions depends on the context of the research (Tsiros & Ross, 2004). For instance, whilst Eggers & Song (2015) focus on the locus dimension to examine differences in founders’ venture behaviour following a failure, Eckerd et al. (2016) demonstrate the effect of the locus and severity of psychological contract breach attribution on the buyers repurchase intention. Our study focuses on the severity and controllability dimensions for both theoretical and methodological reasons. Theoretically, we are interested in supplier induced disruptions as these are the most common disruptive events (Alcantara et al., 2017). Within this context, locus is fixed (at the supplier) and stability is not relevant due to the one-off nature of the disruption. Previous research has also suggested that severity and controllability are particularly relevant within the context of supply chain disruptions (Heckmann, Comes, & Nickel, 2015; David Simchi-Levi, Kaminsky, & Simchi-Levi, 2008). Methodologically, recent research has also questioned the use of locus and controllability within a single study. Empirical evidence suggests that the two variables lack discriminant validity to be used concurrently (Harvey et al., 2014), further justifying our approach of fixing the effects of locus.

- Controllability

Controllability refers to volitional control over an event (Tomlinson and Mayer, 2009). The extent to which a firm is seen to be in control of an event is determined by two factors: 1) whether a firm could prevent the outcome, and 2) whether a firm could have foresight of the event (Lange & Washburn, 2012; Shaver, 1985). It has been suggested that the attribution of responsibility will be stronger if the firm is seen to have had control over the cause of an event (Lange & Washburn, 2012). For example, if a supplier experiences a production failure due to obsolescent machineries, the supplier is perceived to have control over the occurrence of the event and is therefore to blame. However, if a supplier experiences a natural disaster, it is perceived to be outside of their control and therefore not their fault (Giannakis & Papadopoulos, 2016). Therefore, we hypothesise:

Hypothesis 1a. Buyers attribute more blame to the supplier, when the supplier has higher control of the disruptive event.

- Severity

Severity is the extent of impact caused by an event, ranging from minor to major (Hartmann & Moeller, 2014). For instance, incidents such as labour strikes and quality breakdowns may delay supply chain operations for a short period of time, whereas severe earthquakes may have longer-term consequences (Chopra & Sodhi, 2004). Severe outcomes have been argued to threaten people's feeling of control (Malle, Guglielmo, & Monroe, 2014). To restore this feeling, people tend to view such events as predictable, and thus more likely to assign blame to someone responsible for the incident (Laufer et al., 2005; Tennen & Affleck, 1990). According to Fiske & Taylor (1991, p. 85), "as the consequences of an action become more severe, they become more unpleasant, and the notion that they might be accidental becomes less tolerable: The fear that the same thing might involve the self becomes a realistic possibility. Seeing the actions as avoidable and blaming a person for their occurrence makes the actions more predictable and hence avoidable by the self". In the context of our study, we hypothesise that buyers are more likely to blame the supplier for a disruption, when the consequences of the event are more severe:

Hypothesis 1b. Buyers attribute more blame to the supplier, when the disruptive event is more severe.

5.3.2 Consequences of blame attribution

Supply base refers to “a proportion of the supply network that is actively managed by the focal company through contracts and purchasing of parts, materials and services” (Choi & Krause, 2006, p. 638). The literature has offered various approaches to manage supply base risks and increase levels of resilience, such as the management of inventory levels, sourcing strategy, and the level of information sharing among supply chain partners (Ang, Iancu, & Swinney, 2017; Carvalho et al., 2012; Hendricks et al., 2009; Knemeyer et al., 2009; Tang, 2006; Tomlin, 2006). In the aftermath of a disruption, the supply base may be redesigned to create a more resilient supply chain (Blackhurst, Craighead, Elkins, & Handfield, 2005; Mitroff, 1994; Speier et al., 2011). We define redesign as the extent to which an organisation’s supply base is changed in response to a supply-induced disruption. Redesign activities are viewed as part of the remedial steps to address a recent failure (Holguín-Veras et al., 2012; Speier et al., 2011) and include changes to number of suppliers (Hendricks et al., 2009; Li et al., 2016; Sting & Huchzermeier, 2014), facility locations (Aghezzaf, 2005; Snyder et al., 2007), inventory levels (Chopra & Sodhi, 2004), transportation mix (Tang, 2006), levels of visibility (Brandon-Jones et al., 2014), and contractual terms (Nishat Faisal et al., 2006).

During a disruption and its aftermath, organisational actors may experience extreme emotions leading them to change the systems which may be perceived to cause the event (Seeger et al., 2005). We draw from attribution theory to argue that attribution of blame influences the extent of changes made following an incident. Blaming helps individuals and organisations to examine their situation and determine their actions (Rosenthal & Schlesinger, 2002). Once blame is assigned, people then try to put appropriate mitigation strategies in place to avoid the reoccurrence of the event (Driedger et al., 2014). For instance, Eggers and Song (2015) demonstrate that serial entrepreneurs who blame the external environment for their previous venture failure tend to change industries for their subsequent venture. In the present study, we argue that higher attribution of blame leads buyers to redesign their supply base to remedy causes of the incident. Therefore, we hypothesise:

Hypothesis 2a. Higher blame attribution towards the supplier leads to higher levels of supply base redesign.

5.3.3 Trust as a moderator

Of course, decisions to redesign a supply base following a disruption cannot be made in isolation. Although blame attribution may motivate remedial actions (Driedger et al., 2014; Hibbard, Kumar, & Stern, 2001), its ultimate impact on post-event decision-making is moderated by the context in which the disruption has occurred (*cf.* Schorsch, Wallenburg, & Wieland, 2017). Supply chain disruptions are inter-organisational phenomenon that occur within an exchange relationship context (Bode et al., 2011). Hence relationship-specific factors, such as trust, play an important role in the resolution process (Grewal, Johnson, & Sarker, 2007), and management of risk after the event (Bode et al., 2011). Trust is described as a relational asset that is developed, evaluated and propagated through relationships between social actors and their interactions (Dyer & Singh, 1998). Through repeated interactions, firms develop a form of mutual confidence (Barney & Hansen, 1994; Granovetter, 1985; Madhok, 1995) or type of expectation of their exchange partners that help them to make sense of their relationships in situations of risk and vulnerability (Dirks & Ferrin, 2001). Relying on the actions of other parties in a supply chain introduces vulnerabilities into the operations of the firm (Bill McEvily, Zaheer, & Kamal, 2017). By reducing the uncertainty and ambiguity associated with the supplier's action, trust brings a sense of confidence in suppliers' responses under unexpected circumstances (Andaleeb, 1995).

Research has extensively discussed the optimal design of buyer-supplier contracts to improve resilience (*e.g.* Ang et al., 2017; Chen & Yano, 2010). However, contracting a supplier's actions in many cases, such as their responses to unexpected incidents, is not possible (Beer, Ahn, & Leider, 2017). In such circumstances, firms rely on their perception of a supplier's *benevolence* and *credibility* to fulfill its commitments and not to exploit vulnerabilities (Doney & Cannon, 1997). While benevolence reflects the extent to which an exchange partner is willing to consider mutual benefits, credibility refers to the partner's expertise in delivering against performance expectations effectively and reliably (Doney & Cannon, 1997). Thus, a focal firm that has great trust in its supplier is less likely to buffer the relationship (Anderson & Narus, 1990; Mayer, Davis, & Schoorman, 1995; Morgan & Hunt, 1994) through contracting, alternative supply, or inventory decisions. In addition, trust in an exchange partner creates a confidence in their abilities to resolve arising conflicts (Kale, Singh, & Perlmutter, 2000; Simonin, 1997), decreases uncertainty of future actions, and improves the predictability of relationship outcomes.

In the aftermath of a supplier disruption, blame attribution draws buyers' attention to the vulnerabilities associated with the occurrence of an event. Subsequently, risk management practices and/or supply base may be redesigned to avoid the reoccurrence of similar events in the future (Blackhurst et al., 2011). We assert that the degree of prior inter-firm trust moderates the relationship between blame and supply base redesign by shaping people's expectations of the supplier's actions in the future. This is in line with past research (Dirks & Ferrin, 2001), suggesting that people's reaction to the same event differs depending upon the level of trust they have in their exchange partner. According to this view, buyers who have high levels of trust in their supplier may see events in a less negative light (*e.g.* viewing it as a temporary lapse). They accept supply chain vulnerability based upon an expectation (Rousseau, Sitkin, Burt, & Camerer, 1998) that the supplier is *willing* and *capable* to deploy its resources in order to successfully manage the consequences of similar events in the future (*cf.* Rhee & Valdez, 2009). On the other hand, under conditions of low trust, a supplier disruption confirms the buyer's prior reservations about the supplier (Bode et al., 2011; Deutsch, 1973). Hence, buyers tend to evaluate the event in ways consistent with low prior trust and to interpret it in an even more negative light (*e.g.* as unwillingness or inability of the supplier to avoid the disruption) (Robinson, 1996). This makes buyers anxious about their supplier's behaviour in similar circumstances in the future (Dirks & Ferrin, 2001), and motivates them to remedy vulnerabilities associated with a disruption by changing the supply base design. Therefore, we hypothesise that:

Hypothesis 2b. A buyer's trust in their supplier negatively moderates the relationship between blame attribution and supply base redesign.

5.4 Method

5.4.1 Overview

We tested our hypotheses in two studies combining an experiment with a cross-sectional survey (*cf.* Chua, 2012; Duclos et al., 2013; Hewlin et al., 2017; Sutanto et al., 2013; Tazelaar and Snijders, 2013). In the first study, we used a vignette-based behavioural experiment to test hypotheses 1a and 1b. This provides a number of methodological advantages for our study. First, manipulating controllability and severity restrained endogeneity (*i.e.* simultaneity) issues caused by this possible correlation between controllability and blame attribution (Coombs & Holladay, 2002). Endogeneity bias caused by measurement error, simultaneity, or omitted

variables threatens the theoretical validity and practical relevance of empirical research (Antonakis, Bendahan, Jacquart, & Lalive, 2010; Ketokivi & McIntosh, 2017; Wooldridge, 2016). In our study, we used an experimental remedy to ensure that the high correlation between controllability and blame attribution does not influence the validity of our results (Ketokivi & McIntosh, 2017). Furthermore, the use of experiment allowed us to control for spurious causes and minimise selection bias (Clougherty, Duso, & Muck, 2016; Siemsen, 2011).

However, we also acknowledge that an experiment may not capture the reality of redesign decisions in an organisational setting (*cf.* Hewlin et al., 2017; Tazelaar & Snijders, 2013). Levitt and List (2007) outline several limitations for experimental approach that seem relevant in our study. First, while supply base redesign decisions could have long-term impact on organisational performance, the stakes for making such decisions in an experimental setting are quite small. Second, experiments are often unable to control over the full context within which managers make decisions (Madsen & Stenheim, 2015; Verschoor, D'Exelle, & Perez-Viana, 2016). For instance, a set of contextual factors, such as supplier's past performance and relational situations may influence the impact of blame attribution on a firm's redesign decisions (Bode et al., 2011). To provide a real-life picture of such decisions in a supply chain setting, we used a cross-sectional survey design in study 2 to test hypotheses 2a and 2b. This approach has been previously used by scholars to study a range of relevant topics, such as firms' mitigation strategies (Ellis et al., 2010), and buffering and bridging decisions in response to a disruption (Bode et al., 2011).

5.4.2 Study 1: Experiment

Development of the vignettes: We developed a vignette – drawn from a real event reported in the media – that assigned respondents to the role of a purchasing manager in a fictitious manufacturer. The scenario described a supply chain disruption in the upstream supply chain which involved a specific supplier. In the scenario, the firm has been informed about an upcoming labour strike at its supplier's plant. The vignette was carefully designed to allow the manipulation of two key event characteristics, namely severity (low or high) and controllability (low or high), thereby resulting in a total of four treatments (*i.e.* 2×2 between subject factorial design).

Table 5:1 Description of the Vignette

You are a purchasing manager for a mid-sized tier-one automotive manufacturer based in Midwestern United States. Your company provides automotive interior products, such as seat assemblies, centre consoles and overhead systems with 800 employees spread across four plants. Adhesives and curing agents are an important raw material for the centre consoles that you manufacture; therefore, they need to be purchased regularly. A single supplier provides both these raw materials to your organisation.

Low Controllability

Recently, the supplier has informed you that they are involved in a labour dispute. Managers at the supplier firm have stated that production will stop next week for five working days and further stoppages are expected for the next 1 – 3 months. The strike is being organised by a national union and will affect a number of suppliers, including your adhesive and curing agent supplier. Since a large proportion of your suppliers' employees are members of this union, they have very little choice but to participate in the strike. It is being made by the union. At present, it appears that this is called as a result of a deadlock in wage negotiations and will affect other tier one suppliers across the United States. However, an internal risk assessment confirms that none of your other suppliers are currently affected by the national action.

High Controllability

Recently, the supplier has informed you that they are involved in a labour dispute. Managers at the supplier firm have stated that production will stop next week for five working days and further stoppages are expected for the next 1 – 3 months. Led by the plants' unions, a decision to strike has been made over disparities in pay and working conditions between the four supplier plants. Your sources indicate that management are currently refusing to negotiate despite several attempts. It is being made by the union. At present, it appears that this is called as a result of a deadlock in wage negotiations and is an isolated incident at the supplier organisation.

Low Severity

You are confident that the upcoming strike action will have little to no effect on your plant or your ability to deliver to your customers. You maintain fairly high levels (approximately 21 days inventory) of adhesives and curing agents and have recently pre-qualified an alternative supplier for both raw materials.

High Severity

The strike action is likely to have severe consequences for your production and ability to fulfil customer orders. You hold very little inventory of either material and it would take you at least three months to locate and qualify an alternative supplier. It is likely you will have production issues after approximately 3 consecutive days of supplier stoppages.

Because we utilise a between subjects design, it is important to provide respondents with contextual information that is held constant across the various treatments (Aguinis & Bradley, 2014). The scenario was composed of an introduction to the firm and supply chain, and a conclusion that were held identical across four treatments. Severity was manipulated by the level of inventory held at the focal firm for the disrupted material (very little versus fairly high levels of inventory) and the existence of an alternative source of supply (*cf.* Roehm & Brady, 2007). Event controllability was viewed as the extent to which the supplier was able to control the occurrence of the event (*cf.* Zemba, Young, & Morris, 2006). To assess the clarity and realism of our vignette, we ran a pilot test with scholars and practitioners (Rungtusanatham, Wallin, & Eckerd, 2011). In addition, participants evaluated the validity of our manipulations. Based on their suggestions, several minor changes were made in the scenario. Table 5:1 illustrates a summary of the vignette (Aguinis & Bradley, 2014).

After reading the scenario, participants responded to a series of questions on the dependent variable, manipulation checks for the severity and controllability factors, and the realism of the scenario.

Participants: We conducted our experiment using 165 global MBA students from a leading UK business school. Research has used student subjects to examine the impact of behavioural factors on various operations and supply chain management contexts (e.g. Kaufmann et al., 2018; Lee et al., 2018; Ribbink and Grimm, 2014; Tangpong et al., 2010). Using MBA subjects allowed us to create a controlled environment that randomised the effect of prior work experience on the findings (*cf.* Tangpong et al., 2010) and hence, enhanced internal validity of our results (Stevens, 2011). However, we acknowledge that this might raise concerns around external validity of our findings as students may not have sufficient experience in dealing with such situations. We respond to this concern through two arguments; theoretically, attribution theory deals with the universal psychological mechanism of causal explanation (Fiske & Taylor, 1991; Martinko et al., 2007), regardless of who makes the attribution. Methodologically, we controlled for the effect of respondents’ work experience on blame attribution in our analyses.

Participation in the experiment was voluntary and participants did not receive financial compensation or extra course credit for the study. From this pool, 137 participants completed our scenario. Table 5:2 presents demographic characteristics of our sample.

Table 5:2 Demographic Data of Experiment Participants

	Percentage
Gender	
Female	28%
Male	72%
Work Experience	
1 – 10 years	51%
11 – 20 years	43%
> 20 years	4%
Industry	
Manufacturing	31%
Service	67%

Note: $n = 137$

Dependant variable: To operationalise the construct of blame attribution, we adapted measures from earlier research on product-harm crisis (Lei, Dawar, & Gürhan-Canli, 2012) and corporate

social responsibility (Klein & Dawar, 2004). Participants were asked to evaluate the extent to which “*the supplier is to blame for the potential disruption*”, “*the supplier is at fault for the potential disruption*”, and “*the supplier is responsible for the potential disruption*” on a 7-point rating scale (1 := “strongly disagree”; 7 := “strongly agree”).

Control variables: Past research shows that individual characteristics influence people’s attribution behaviour (Martinko et al., 2007). In our study, we controlled for the effect of respondents’ gender (Grubb & Harrower, 2009; Lord & Smith, 1983), and experience (Knowlton & Mitchell, 1980; Mitchell & Kalb, 1982) on attribution of blame. We measured work experience based on three categories: 1-10 years, 11-20 years, and over 20 years of experience. Moreover, to control for a potential effect of context familiarity on responses (Carvalho & Muralidharan, 2015; Dawar & Lei, 2009; Newcombe, Eynde, Hafner, & Jolly, 2008), we used participants’ industry – manufacturing or service – as a methodological control variable.

Manipulation check: After each participant read and responded to a vignette, we conducted checks for both of the manipulations of our experimental cues and the extent to which participants considered our scenario to be realistic (1 := “not at all realistic”; 7 := “very realistic”). Results show an average of 5.46 on the 7-point realism scale (*c.f.* Hora & Klassen, 2013; Mir et al., 2016). For the controllability manipulation, participants were asked “*The cause of the strike was something the supplier could control*” (1 := “strongly disagree”; 7 := “strongly agree”). An analysis of variance (ANOVA) revealed that participants in the high controllability vignettes scored significantly ($p < 0.001$) higher on this item ($M = 4.73$) than those in the low controllability condition ($M = 3.80$). The severity manipulation check (“*The strike is likely to have severe consequences for our organization*”) shows similar results ($M_{high} = 5.48$ vs. $M_{low} = 4.17$, $p < 0.001$).

Analysis: Table 5:3 summarises the descriptive statistics for blame attribution for the various treatment groups. We conducted a multiple regression analysis to examine the relationship between disruption characteristics – *i.e.* severity, controllability – and blame attribution. The Shapiro-Wilk normality and Breusch-Pagan tests were performed to ensure that non-normality and heteroscedasticity do not violate the underlying assumptions of regression analysis (Breusch & Pagan, 1979; Royston, 1982). In addition, we evaluated Cook’s distance (D) measure to examine potential existence of outliers (Hair, Anderson, Tatham, & Black, 1998, p. 225). There were 5 (of the 137) of the cases that had the Cook’s distance value of more than $4/n$ (where n refers to the sample size) and hence, were deemed influential. We further

investigated these cases in our data and found no concerns regarding the style and pattern of responses. Therefore, we decided to retain these cases to ensure generalisability of our findings to the entire population. We also ran the analysis with the reduced sample and found consistent results with those obtained with the full sample.

Hypothesis 1a predicted that buyers attribute more blame to the supplier, when the supplier has a higher control on the cause of the disruption. As predicted, we found a significant positive relationship between disruption controllability and attribution of blame ($B = 0.75, p < 0.01$). In contrast, we did not find strong empirical support for our second prediction (Hypothesis 1b): although attribution of blame is positively related to disruption severity, the relationship is not significant ($B = 0.29, p = \text{n.s.}$). In sum, the results suggest that controllability is very likely to be a precursor to blame.

Table 5:3 Means (Standard Deviations) of Blame Attribution by Treatment

Treatment	Blame attribution	
	<i>M</i>	<i>SD</i>
<i>Low Severity, Low Controllability</i>	3.49	1.32
<i>High Severity, Low Controllability</i>	3.75	1.46
<i>Low Severity, High Controllability</i>	4.25	1.19
<i>High Severity, High Controllability</i>	4.58	1.23

Table 5:4 Regression Results for the Influence of Disruption characteristics on Blame Attribution

Variable	Estimate	<i>SE</i>
Gender (Female := 1)	0.105	0.254
Industry (Manufacturing := 1)	-0.420	0.241
Work experience	0.062	0.195
Controllability	0.751 **	0.227
Severity	0.283	0.224
Constant	3.533 ***	0.305
R^2	0.121	
<i>Adjusted R</i> ²	0.087	
<i>F</i>	3.598 ***	
	(<i>df</i> = 5, 131)	

Note: $n = 137$. Dependent variable is “blame attribution”.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed).

5.4.3 Study 2: Survey

Sampling and data collection: We tested hypotheses 2a and 2b in the context of the manufacturing sector in the UK and our unit of analysis is a supply disruption event experienced by a buying firm (*cf.* Bode et al., 2011). This is consistent with Study 1 that examined the effect of disruption characteristics on people's attribution of blame. Primary data were collected by means of a self-administered mail-based survey. We selected 1,257 potential respondents from a list maintained by Chartered Institute of Purchasing and Supply (CIPS) in the UK. They were selected by their job function (supply manager or equivalent), and industry codes representing manufacturing, construction, or mining (*cf.* Brandon-jones et al., 2014). We selected supply managers as key respondents since we considered them to be acquainted with their firms' supply chain and our related subject of research, *i.e.* supply disruption, inter-firm trust, and supply base redesign.

We adapted Dillman's total design method (2000) to increase our response rate. First, we telephoned all 1,257 managers to brief them on the purpose of the study and invite them for participation. Second, we sent a copy of the cover letter and survey to all firms who agreed to participate. Finally, we followed up with an adapted cover letter, as well as the original survey, on three further occasions over the subsequent months. To increase the probability of that respondents completing the survey, we also offered managers with the opportunity to receive an executive summary and managerial implications of the findings. All respondents were assured of the confidentiality of their responses and the academic purpose of the survey. Overall, we received 115 completed survey, a response rate of 9.15%. Table 5:5 provides a profile of our respondent firms.

In the survey, we first asked respondents to choose a disruption that occurred in their upstream supply chain during the last three years, and a supplier involved in the disruption¹⁰. They then responded to survey questions regarding trust prior to the disruption, the extent to which they blame the supplier for the incident, and their redesign activities post disruption. Participants also responded to a set of questions about their sourcing strategy, supplier dependency, supplier risk profile (*i.e.* riskiness of the supplier), their industry, company size, the size of their business unit, and the location, timing, and financial consequences of the event to their firm.

¹⁰ If the disruption involved more than one supplier, we asked them to refer to the most strategic one.

Table 5:5 Descriptive Statistics for Survey Sample Frame

	Count	Percentage
Profit level		
Negative (net loss)	6	5.22
Break even	5	4.35
Up to 5% profit	26	22.61
Over 5% to 10% profit	28	24.35
Over 10% to 15% profit	16	13.91
Over 15% to 20% profit	10	8.7
Over 20% to 25% profit	5	4.35
Over 25% profit	7	6.09
NA's	12	10.43
Total	115	100
Number of employees		
0 – 50	13	11.3
51 – 100	20	17.39
101 – 200	22	19.13
201 – 500	24	20.87
501 – 1000	10	8.7
> 1001	24	20.87
NA's	2	1.74
Total	115	100

Measures: We developed our questionnaire using existing measures whenever possible. Supply base redesign was the only new measure which we developed based on past supply chain risk management research. We then asked a number of academics to provide feedback on the survey to ensure that our items are comprehensible, unambiguous and relevant. The results of this process confirmed that all measurement items were sound and clear. All our items, except those for disruption impact, were scored on 7-point rating scales.

Blame attribution. We adapted established measures of blame to the context of supply chain disruption (*cf.* Lei et al., 2012). Our 3-item measure captures the extent to which respondents feel that the supplier was at fault, was responsible, and that the disruption originated in their firm.

Trust. We adopted a seven-item measure developed by Doney & Cannon (1997). Respondents were asked to indicate the extent to which “*this supplier was genuinely concerned that your business succeeded*”, “*this supplier consider your welfare as well as its own, when making important decisions*”, “*your business unit trust that this supplier kept your best interests in mind*”, “*this supplier was trustworthy*”, “*this supplier kept the promises it made to your business unit*”, “*this supplier was honest with your business unit*”, and “*your business unit believed the information that this supplier provided*” prior to the disruption.

Supply base redesign. Supply base redesign is a new *composite* variable (Aguirre-urreta, Rönkkö, & Marakas, 2016; Bollen & Bauldry, 2011) developed for this study and measures the extent of change in six dimensions of a business unit's supply base. As redesign can be pursued in a variety of *possibly uncorrelated* ways, we contend that a formative approach is appropriate in this case. The items comprising redesign reflect various design aspects of a supply network (Melnik, Narasimhan, & DeCampos, 2014; Melo, Nickel, & Saldanha-da-Gama, 2009) that are “actively managed by the focal company” (Choi & Krause, 2006, p. 638). In particular, we focused on those aspects related to supply chain resilience (Carvalho et al., 2012; Tang, 2006). For instance, previous studies have suggested that firms can improve supply base resilience through changing the number of suppliers (Hendricks et al., 2009; Sting & Huchzermeier, 2014), inventory levels (Chopra & Sodhi, 2004), or transportation mix (Tang, 2006). Our composite-formative variable integrates insights from these studies and comprises of independent supply base design strategies related to resilience. Following Buchko (1994), we measured the extent of change on a 7-point scale ranging from 1 := “no change” to 7 := “significant change”. We selected composite items that are specifically relevant to a supply base in the event of a disruption. We followed a deductive approach in generating the items/indicators and to entirely capture the multifaceted nature redesign (Hinkin, 1995), whereby we undertook a thorough review of the extant literature, followed by interviews with experts in the field of supply chain risk management to capture the extent of change on various aspects of supply base structure. The six composite indicators are the *number of suppliers*, *inventory decisions*, *contractual terms with suppliers*, *location decisions*, *transportation mix*, and *levels of visibility*. We formed an unweighted index of these indicators to construct the supply base redesign measure. These items were not used as measures nor causes for redesign, and hence were assumed to be free from measurement errors (Aguirre-urreta et al., 2016; Bollen & Diamantopoulos, 2017). Therefore, the use of a common validation process was not relevant for this variable (Hardin & Marcoulides, 2011). However, prior to constructing the index, ordinary least squares regressions (OLS) were run to check for redundant items and multicollinearity. We did not find redundancy to pose a problem as all variance inflation factors were low (maximum VIF is 2.06 which means that that standard error for the corresponding independent variable is 2.06 times as large as it would be if there was no multicollinearity) and the bivariate correlations between the indicators were within an acceptable range ($r < 0.60$).

Control variables. In the advent of a disruption, the buying firm will not only analyse the blame attributable to the supplier but also examine other factors relevant to the probability

and/or impact of future events. We therefore control for the firm's dependency on the supplier, the supplier's risk profile and the impact of the disruption, each of which could have a confounding effect on the relationship between blame and supply base redesign (Atinc, Simmering, & Kroll, 2012; Becker, 2005). Supplier dependency is often the result of procurement decision-making that seeks to balance costs (economies of scale) and supply market availability (Kraljic, 1983), and will therefore influence both the blame attributable to the supplier and the option set available to the buyer post disruption. We adopted a 3-item scale that examines the extent to which "we are dependent on this supplier", "it would be difficult to replace this supplier", and "it would be costly to replace this supplier" (Wang, Li, Ross, & Craighead, 2013). We predict a negative relationship between the control variable and the extent of redesign given that dependency reduces the extent to which the buying firm can make changes to its supply base. Second, we control for the supplier's risk profile. Attribution of blame and propensity to change are linked to the stability of a cause (Weiner, 1983), and while our study focuses on a single disruptive event, the supplier's historical risk profile will influence affect, and therefore both attributions of blame and supply base redesign. We developed a measure of supplier risk profile that captures the frequency and severity of past incidents (over the past 3 years) at the supplier firm. Given that historical data should form the basis of probability estimates and subsequent risk management strategies (Knemeyer et al., 2009), we predict that a supplier's risk profile is positively associated with redesign. Finally, we control for the impact of the disruption itself. Although we do not find a significant relationship between severity and blame in study 1, it is still important to control for the confounding effects given that severity has the potential to influence both the independent and dependent variables. We measured disruption impact using four items on a 9-point scale (1 := "significantly lower", 5 = "no change", 9 := "significantly higher"). The items assess the impact of the disruption on the: 1) *purchasing costs (direct and indirect materials)*, 2) *manufacturing costs (labour, inventory)*, 3) *logistics costs (transportation, warehousing, delivery)*, 4) *administration and managerial costs*, compared to normal operating cost. Following Bode et al. (2011), we predict a positive relationship between disruption impact and redesign.

Construct validity: Three constructs – blame, trust and dependency – were measured by means of a reflective measurement model. To assess the psychometric properties of these constructs, we performed a single multifactorial covariance-based confirmatory factor analysis (CFA) (number of free parameters: 21). Given some indications regarding the presence of multivariate non-normality (Mardia's multivariate skewness = 525.43; Mardia's multivariate kurtosis =

7.77; both $p < 0.05$), we applied maximum likelihood estimation with robust standard errors using the MLR estimator implemented in *Lavaan* (Version 0.6-2)¹¹. Given the small model and sample size, the CFA results showed acceptable measurement fit indices for both constructs (Hair et al., 1998, Chapter 11): $\chi^2/df = 2.36$ [$\chi^2_{(62)} = 146.31, p < 0.001$] highlighted a reasonable fit between the predicted and observed covariance matrices (Kline, 2005, p. 137); CFI = 0.88 and TLI = 0.85 provided evidence that our measurement model has reasonably better fit compared to the baseline model (Kline, 2005, p. 140); and RMSEA = 0.10 [90% CI = (0.08, 0.13)] indicated an acceptable approximate fit given our sample size (Kline, 2005, p. 139). In addition, based on our CFA analysis, the reflective items captured the respective underlying latent variables well, implying a satisfactory level of convergent validity and internal consistency. Table 5:6 shows the results. Without exception, each item loaded on its hypothesized factor with a large and significant loading (all significant at $p < 0.001$). Average variances extracted (AVE) of both constructs exceeded the commonly recommended cut-off value of 0.50, meaning that measurement items are good representatives of their respective constructs (Hair et al., 1998, p. 612). We also evaluated discriminant validity of our three variables using confident intervals (CI) assessment, and the comparisons between the squared intercorrelation coefficient (of blame and trust) and AVE estimates (Fornell & Larcker, 1981). The absolute value of CI for constructs intercorrelation were between zero and one, and the squared correlation coefficient of for each pair of variables were less than the AVE for the respective constructs. This supported discriminant validity of both reflective measures.

Table 5:6 Confirmatory Factor Analysis

Measures and associated indicators	ω_H^c	AVE	λ^a	SE	z -value	R^2
Trust	0.87	0.53				
<i>In dealing with this supplier prior to the disruption, to what extent...</i>						
was this supplier genuinely concerned that your business succeeded?			0.52	— ^b	— ^b	0.28
was this supplier trustworthy?			0.72	0.19	5.9	0.51
did this supplier consider your welfare as well as its own, when making important decisions?			0.66	0.25	5.12	0.44
did your business unit trust that this supplier kept your best interests in mind?			0.70	0.24	5.04	0.49
did this supplier keep the promises it made to your business unit?			0.85	0.37	4.42	0.72
was this supplier honest with your business unit?			0.85	0.36	4.12	0.72
did your business unit believe the information that this supplier provided?			0.78	0.34	3.89	0.60
Blame	0.94	0.84				
<i>To what extent do you agree or disagree with the following statements about the source of the disruption?</i>						

¹¹ In the following, χ^2 refers to a scaled χ^2 -static which incorporates a scaling correction based on the degree of multivariate non-normality.

The disruption originated within the supplier firm	0.86	– ^b	– ^b	0.74
The disruption was the fault of the supplier	0.98	0.1	11.88	0.96
The supplier was responsible for the disruption	0.91	0.09	11.15	0.82
Dependency	0.94		0.83	
<i>In dealing with this supplier prior to the disruption, to what extent...</i>				
Was your business unit dependent on this supplier	0.63	– ^b	– ^b	0.40
would it have been costly to replace this supplier?	0.90	0.25	6.86	0.81
would this supplier have been difficult to replace?	0.78	0.26	5.33	0.62

^a All factor loadings are significant at the $p < 0.001$ level (two-tailed).

^b Factor loading was fixed at 1.0 for identification purposes.

^c Hierarchical coefficient omega (McDonald, 1999; Zinbarg, Revelle, Yovel, & Li, 2005), a measure of reliability, which assumes a congeneric model (factor loadings are allowed to vary).

Common method bias: Common method bias threatens the validity of our results since we collected all data from a single informant using perceptual items and at one point in time (Podsakoff, MacKenzie, & Podsakoff, 2012). Accordingly, we used several procedural remedies to minimise this bias. First, we offered anonymity and confidentiality to reduce the probability that respondents provide socially desirable answers (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Second, in our cover letter, we highlighted the importance of their responses to our research and promised them feedback on our key findings (Podsakoff et al., 2012). In addition, consistent with past research (e.g. Liu, Wei, Ke, Wei, & Hua, 2016; Zhao, Huo, Selen, & Yeung, 2011), we placed the construct items in different sections of the survey design to decrease the chance of ERS¹² or MRS¹³ response style. Blame, trust, and supply base redesign were each measured using 3-7 items and the items used to measure components were focused on different aspects of the constructs and therefore were not similar in content (Podsakoff et al., 2012).

Furthermore, we employed a correlation-based marker variable technique to evaluate potential common method bias in our survey (Podsakoff et al., 2012). The technique was originally proposed by Lindell and Whitney (2001), and has been later applied by many cross-sectional studies (Williams, Hartman, & Cavazotte, 2010). First, we selected a single-item scale for the competitor risk monitoring as a marker variable. Competitor risk monitoring refers to the extent to which a firm monitors its competitors' reaction to supply disruptions, and is theoretically unrelated to other variables in the regression analysis. We measured competitor risk monitoring using 7-point Likert-type rating scale (1 := “strongly disagree”; 7 := “strongly agree”). Empirically, the lowest correlation between the marker and other latent variables with

¹² Extreme response style.

¹³ Midpoint response style.

this variable was $|r| = 0.01$ (with blame). We then adjusted the zero-order correlation between any pair of explanatory variables (including control variables) by subtracting this estimate ($r = 0.01$) and dividing by the quantity of 1 minus the estimate. As shown in Table 5:7, examining the resulting adjusted correlations and their significance levels indicated that the substantive relationships among the variables still hold, and thus common method bias is unlikely to seriously influence our results.

Table 5:7 Means, Standard Deviations, and Correlations

Variable	<i>M</i>	<i>SD</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Supply chain redesign	19.57	8.96	–	–0.13	0.03	0.14	0.28**	0.24**	0.11
(2) Trust	4.73	1.22	–0.12	–	–0.27**	0.11	–0.32***	–0.14	–0.13
(3) Blame	4.83	2.22	0.04	–0.26**	–	0.06	0.14	–0.05	–0.02
(4) Dependency	5.22	1.54	0.15	0.12	0.07	–	0.09	0.25**	–0.09
(5) Supply risk	2.64	1.53	0.29**	–0.31***	0.15	0.1	–	0.05	0.01
(6) Disruption impact	25.26	3.77	0.25**	–0.13	–0.04	0.26**	0.06	–	0.03
(7) Marker variable	3.73	1.77	0.12	–0.12	–0.01	–0.08	0.02	0.04	–

Note: Unadjusted correlations appear below the diagonal; correlations adjusted for the common method appear above the diagonal.

Findings: We used hierarchical moderated regression analyses to test hypotheses 2a and 2b. Since we employed a non-experimental design in Study 2, the threat of endogeneity might bias our results. Past research shows that endogeneity created by omitted variables is a significant threat to management studies (Antonakis et al., 2010). In our regression model, there is likely to be omitted variables that influence attribution of blame and redesign concurrently, and hence affect the hypothesised relationship between blame and redesign. Given the potential endogeneity, the OLS estimate for the raw value of blame may not be consistent (Antonakis et al., 2010; Ketokivi & McIntosh, 2017). In response, the literature has suggested the use of instrumental variable (IV) and two-stage least square regressions (2SLS) to correct for such endogeneity bias (Antonakis et al., 2010; Hamilton & Nickerson, 2003). We adapted this technique in our analyses.

To identify a potential instrumental variable (IV), two criteria should be satisfied: 1) the instrument should be correlated with the endogenous variable of interest (i.e. inclusion relevance); and 2) the instrument should be uncorrelated with the residual term for the prediction of the outcome (i.e. exclusion criterion) (Wooldridge, 2016, pp. 462–464, 475–477). The latter means that IV could only influence the outcome variable through its effect on the endogenous predictor. In the context of our study, we chose disruption controllability (i.e. the

extent to which the cause of the disruption was controllable by the supplier) as IV in the first stage regression, since it met the aforementioned criteria. First, as suggested by attribution theory (Lange & Washburn, 2012), the correlation between blame attribution and controllability was significant ($r = 0.73$, $p < 0.001$). Second, although there is not a statistical test for exclusion criterion (*i.e.* the statistical independence of IV and the error term of the regression for predicting the outcome variable), attribution theory demonstrates that the relationship between controllability and redesign is fully mediated through the mechanism of attribution of blame (*e.g.* Hartmann and Moeller, 2014; Klein and Dawar, 2004). In other words, disruption controllability is associated with attribution of blame (Hartmann & Moeller, 2014; Lange & Washburn, 2012) that in turn, motivates redesign decisions (Driedger et al., 2014; Rosenthal & Schlesinger, 2002).

We regressed blame on controllability and other explanatory variables in Stage 1. The regression results showed that blame is positively related to controllability ($\beta = 1.6$, $p < 0.001$). This confirmed the significant impact of controllability on blame attribution and show the relevance of the selected instrumental variable. Subsequently, we used the fitted values of Stage 1 as an instrumental variable for blame in the second-stage of regression. In addition, we used the fitted values to create the interaction term and entered them into the second-stage of regression model (Wooldridge, 2016, p. 476).

Table 5:8 presents the instrumented regression results: Model 1 includes only our control variables, *i.e.* dependency, disruption impact and supplier risk profile. Model 2 adds blame attribution and trust. Lastly, Model 3 includes the interaction term. We checked the variance inflation factors (VIF) for potential multicollinearity issues. The largest coefficient was one associated with trust (VIF = 1.33), representing the variance of estimated regression coefficient associated with trust is 1.33 times greater than it would be if trust was not correlated with other explanatory variables in the regression model. In the context of our study¹⁴, where the direct effect of trust is not the focal relationship of interest, multicollinearity was unlikely to pose a threat to the validity of our findings (Guide & Ketokivi, 2015; O'Brien, 2007; Wooldridge, 2016, p. 86).

¹⁴ O'Brien (2007) uses a general formula of the variance of regression coefficient for the *i*th independent variable to illustrate that contextual factors, such as the sample size and R_y^2 , could also inflate/deflate the variance of the *i*th regression coefficient. Given our sample size ($n = 115$) and $R_y^2 = 0.2$, the variance of trust regression estimate is unlikely to affect the validity of our results.

For each model the assumptions underlying regression estimation were tested and verified. In particular, the results from Shapiro-Wilk normality test confirmed the normality of the residuals ($W_{\text{model 3}} = 0.98, p < 0.10$) (Royston, 1982). In addition, the Breusch-Pagan test statistic ($BP_{\text{model 3}} = 12.62, p < 0.10$) showed that heteroscedasticity is unlikely to pose a threat to the validity of our findings (Breusch & Pagan, 1979). Moreover, Cook's distances (D) were measured to detect potential outliers in our models. There were 5 influential observations that had D values of more than D/n (where $n = 115$). Further examination of these cases showed no serious concerns regarding the style and pattern of responses. Therefore, we decided to retain these cases into our sample.

As Table 5:8 shows, the control variables account for 12% of the variance in supply base redesign. While dependency had non-significant effect on supply base redesign ($\beta = 0.56, n.s$), disruption impact had a significant positive effect on the redesign ($\beta = 1.95, p = 0.02$). The results also showed that higher levels of supplier risk lead to greater supply base redesign ($\beta = 2.42, p = 0.003$). This was expected and consistent with the literature that the higher level of risk and disruption impact leads to more changes (Bode et al., 2011; Cantor, Blackhurst, & Cortes, 2014). As shown in Table 5:8, Model 2, blame attribution had a positive non-significant direct effect on supply base redesign ($\beta = 1.53, p = 0.08$). Hence, the results did not support hypothesis 2a. In addition, the main effect of trust on redesign was non-significant ($\beta = 0.35, p = 0.70$).

Table 5:8 Standardised Regression Results

Variable	Model 1		Model 2		Model 3	
	Estimate	SE	Estimate	SE	Estimate	SE
Dependency	0.563	(0.819)	0.354	(0.842)	0.100	(0.838)
Supplier risk profile	2.424**	(0.793)	2.231**	(0.837)	2.232**	(0.824)
Disruption impact	1.951*	(0.816)	2.153	(0.833)	2.453**	(0.832)
Blame			1.534	(0.858)	2.024*	(0.876)
Trust			0.345	(0.901)	0.490	(0.890)
Blame \times Trust					-1.826*	(0.867)
Constant	19.574***	(0.785)	19.574***	(0.780)	18.945***	(0.824)
R^2	0.142		0.167		0.200	
Adjusted R^2	0.119		0.129		0.156	
F	6.137***		4.375***		6.137***	
	($df = 3, 111$)		($df = 5, 109$)		($df = 6, 108$)	

Note: $n = 115$. Dependent variable is "supply chain redesign". All independent variables have been standardised.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (two-tailed).

The moderating effect of trust: Table 5:8 shows that the addition of the interaction term in Model 3 increased the adjusted R^2 value significantly ($\Delta R^2 = 0.03, p < 0.05$), supporting the significant moderating effect of prior trust on the relationship between blame and supply base redesign. Hypothesis 2b predicted that prior trust would reduce the effect of blame on supply base redesign following a disruption. The results of Model 3 confirmed this hypothesis showing that the coefficient for this interaction is negative and significant ($\beta = -1.83, p = 0.04$).

Moreover, to further facilitate the interpretation of our results, we decomposed the significant interaction terms, using simple slope technique (Aiken & West, 1991). We plot the effect of instrumented blame on supply base redesign for low and high levels of trust, equivalent to one standard deviation (SD) below and above the average value (M) (Figure 5:1). In support of H_{2b} , we found that blame was more positively related to redesign when trust was low ($\beta = 3.85, p < 0.01$) than when trust was high ($\beta = 0.20, p = 0.85$).

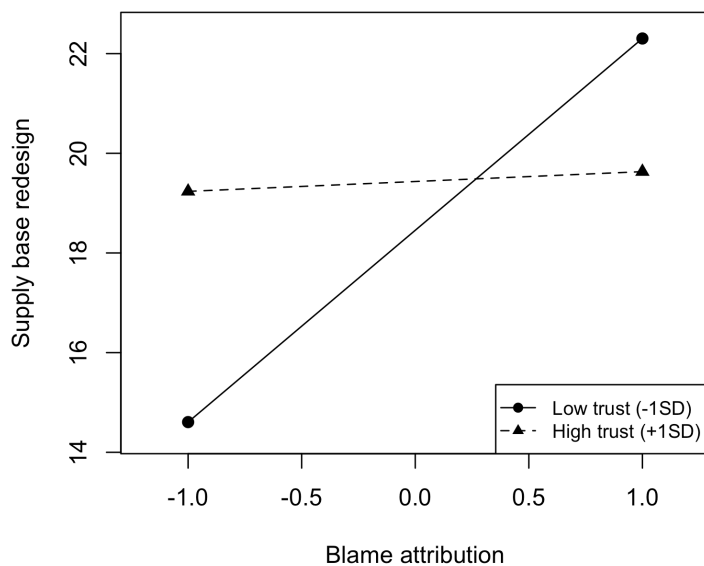


Figure 5:1 Simple Slope Analysis (Blame × Trust)

Robustness check: Subsequently, we conducted a Durbin-Wu-Hausman post-estimation test of endogeneity (Antonakis et al., 2010; Hausman, 1978). These results (Hausman = 0.82, n.s) indicated that the null hypothesis that all explanatory variables are uncorrelated with all disturbance terms cannot be rejected. Accordingly, we concluded that our regression results and conclusions were unlikely to be overly affected by endogeneity bias.

5.5 Discussion

The field of supply chain risk management has developed over the past fifteen years to have an important influence on both academia and practice. Research has primarily sought a better understanding of three topics: the identification, measurement and assessment of sources of risk (Blackhurst et al., 2008; Rao & Goldsby, 2009); the design of supply chains for resilience and robustness (Brandon-Jones et al., 2014; Craighead et al., 2007); and the performance outcomes associated with disruption (Hendricks & Singhal, 2003, 2005). These studies have been very influential, and supply chain academics have been actively involved in the risk management practices of multinational companies (*e.g.* Blackhurst, Craighead, Elkins, & Handfield, 2005), and have been invited to join significant industry groups, including the World Economic Forum and the Supply Chain Risk Leadership Council (www.weforum.org; www.scrhc.com).

Despite impressive growth, the literature has largely ignored the longer-term effects of a disruption on an organisation's recovery and decision-making (Sodhi et al., 2012), and particularly on their choice to redesign their supply base (Bode et al., 2011). This is surprising given that organisational responses to a disruption are a major determinant of recovery (Ambulkar et al., 2015) and an organisation's resilience to future threats (Sáenz & Revilla, 2014). The goal of our study was therefore to understand why and when an organisation chooses to redesign its supply base following a disruption. In doing so, our findings contribute to theory on supply chain risk management in several ways.

5.5.1 Theoretical contributions

First, we contribute to understanding of post-event supply chain disruption management. We build on previous work on the organisational (Ambulkar et al., 2015) and relational (Bode et al., 2011) antecedents of redesign by examining the relationship between disruptive event characteristics, managerial sense-making, and post-disruption changes. We adopt attribution theory to understand how people make sense of a disruption event, attribute blame, and shape their responses in the aftermath of an incident (Harvey et al., 2014; Weiner, 1972). With respect to blame attribution, we find a significant relationship between controllability and buyers' attribution of blame (H_{1a}). Our findings are consistent with past studies showing higher controllability leads to higher attribution of blame (*e.g.* Bundy and Pfarrer, 2015; Coombs and Holladay, 2002; Giannakis and Papadopoulos, 2016; Hohenstein et al., 2015; Lange and

Washburn, 2012). This shows that buyers acknowledge that more controllable events could be foreseen or prevented (for example, through negotiating with union members), and thus blame the supplier for such events. However, we find no significant relationship between the severity of an event and the buyer's attribution of blame (H_{1b}). This non-significant finding might be explained with reference to a subset of the attribution theory literature that examines defensive responses to attribution. Specifically, defensive attribution suggests that the perceived degree of similarity between the buyer and their counterpart within the supplier firm might reduce the effect of severity on attribution. Where the buyer can conceive of themselves facing a similarly severe event in the future, they might reduce the degree to which they blame the supplier in the hope that they would escape blame in the future. Given that our scenario depicts a labour dispute, we suggest that buyers might be able to conceive of a similar event affecting their firm in the future. This empathy will reduce their proclivity to blame the supplier, thereby negating the relationship between severity and blame.

With respect to the extent of change following a disruption, the results of our study demonstrate that attribution of blame alone does not encourage redesign (H_{2a}); instead when it interacts with prior inter-firm trust, it could lead to infrastructural changes in supply base practices (H_{2b}). This contributes to the supply chain risk literature by highlighting the importance of both behavioural and relational factors (*cf.* Sweeney, 2013; Tokar, 2010). While, the literature has so far focused on objective measures (e.g. supplier risk, disruption impact), it has largely overlooked the impact of managerial and relationship-specific antecedents on post-event responses. Therefore, our findings contribute to a growing body of behavioural supply chain management that investigates the psychological underpinning of managerial decision-making (Carter, Kaufmann, & Michel, 2007; Ellis et al., 2010, 2011; Hora & Klassen, 2013).

Furthermore, we contribute to the application of attribution theory in a supply chain context by studying the impact of disruption characteristics on buyers' attribution of blame, and then examining its effect on post-disruption redesign decisions. In doing so, we respond to the recent call to explain how attributions that shape buyer-supplier relationships drive their subsequent actions (Hall & Johnson-Hall, 2017). Our study is not the first to examine the impact of attribution in responding to supply chain issues. For example, Mir et al. (2017) explain buyers' switching behaviour through attributing the cause of a supplier's psychological contract breach, and Ro et al. (2016) show that attributions guiding buyer and supplier evaluations of impending supply disruptions. However, we adapt the theory to our context (Martinko et al., 2007) by integrating a supply chain-specific factor (namely, inter-firm trust) into the model. Future

studies could broaden the application of the theory in this context by examining the impact of other relationship-specific factors, such as relational norms, or governance structure on buyers' fairness perception or recovery efforts post-incident. In addition, research could study the effect of other dimensions of attribution (*e.g.* locus) on redesign decisions. While, we control for the effect of locus by focusing solely on supplier locus disruptions, it would be interesting to see if the findings are applicable to other types of disruptions, *i.e.* focal firm locus or industry locus.

5.5.2 Managerial implications

From a managerial point of view, our findings provide insight into the determinants of post-disruption changes. The results from our experiment show the effect of controllability on buyers' attribution of blame which in turn, leads to redesign decisions. They demonstrate that buyers are more likely to implement changes to their supply base, such as the number of suppliers, or level of supply visibility for events that the supplier could have foreseen or prevented. These changes however, are costly and could affect the stability of the buyer-supplier relationship. Suppliers could consider controllability in addition to probability and impact to proactively determine their risk mitigation strategies. In other words, they should identify and mitigate the risks that could be prevented in order to avoid the potentially costly redesign decisions made by the buyer.

Furthermore, our survey findings reveal the importance of the interaction of blame attribution and prior trust in leading redesign decisions. While attribution of blame to the supplier draws buyers' attention to the vulnerability of their risk management infrastructure and motivates them to redesign, a high level of prior trust could reduce this effect. Firms rely on the goodwill and credibility of the supplier in decreasing the likelihood of a similar incident and disregard the vulnerabilities that lead to the disruption. In such situations, managers might benefit from strategies, such as joint contingency plans or information exchanges that could improve resilience at both firms. On the other hand, low levels of prior trust reinforce the impact of blame attribution on buyers' redesign decisions. Under these conditions, blame attribution draws attention to the vulnerabilities of the existing supply base and confirms managerial distrust (Bode et al., 2011). Buyers subsequently seek to insulate themselves by changing their risk management infrastructure, such as the number of suppliers, inventory levels, and transportation mix. While such spontaneous actions could improve supply chain resilience for future incidents, they might not be optimal (Blackhurst et al., 2005). In weighting these decisions, we suggest that firms take into account supplier performance over an extended

period of time (and not only based on a single incident), and review both the short- and long-term losses due to a disruption, as well as the costs of any redesign. It is also important that firms consider investing in cooperative relationships with the supplier, since certain incidents may be avoided by the access to timely information or joint mitigation approaches.

5.6 Limitations and opportunities for future research

Our study has several limitations that provide opportunities for future research. First, due to our focus on the antecedents of redesign decisions, our interest lies in the extent of change in the supply base and not in the type of redesign strategies that firms choose. Hence, we used a multi-item formative measurement to capture the overall magnitude of change in buyers' supply base practices, *e.g.* changing inventory levels or levels of visibility. The rationale for our choice was that redesign items may not be necessarily correlated (Coltman, Devinney, Midgley, & Venaik, 2008; Diamantopoulos & Siguaw, 2006). In other words, depending on a specific context, firms may choose to conduct changes in certain practices (*e.g.* changing the level of inventory or number of suppliers), while leaving others as they are (Tomlin, 2006). Although this approach provides insight into the importance of behavioural factors in the organisational motivation to redesign, future studies could utilise a different measurement model to investigate the type of redesign strategies that a firm employs. This is of importance from both theoretical and practical perspectives, especially since particular strategies employed by a firm could have consequences on the future of the buyer-supplier relationship (Reimann, Kosmol, & Kaufmann, 2017).

Second, our aim in this study was to assess the importance of causal attribution (*i.e.* blame) on shaping supply base redesign decisions. We drew from attribution theory to manipulate two key characteristics of a disruption event – *i.e.* severity and controllability – and examine their impact on buyers' attribution of blame. While this contributes to our understanding of the link between a disruption event, blame attribution, and redesign decisions, it does not reflect on cultural and individual characteristics that may influence people's attribution of blame (Anagondahalli & Turner, 2012; Martinko et al., 2007). For instance, scholars have shown that people from collectivist cultures tend to attribute causes to contextual (or environmental) factors, while their counterparts from individualist cultures are more likely to show the opposite pattern in their attribution (Menon, Morris, Chiu, & Hong, 1999; Zemba et al., 2006). Similarly, several studies have demonstrated the effect of age, experience, and organisational role on individuals' attribution style or the presence of a self-serving attributional bias (Mezulis,

Abramson, Hyde, & Hankin, 2004). The recent surge of behavioural research has highlighted the importance of individual and cultural difference in operations and supply chain-related decisions (*cf.* Cui, Chen, Chen, Gavirneni, & Wang, 2013; Ribbink & Grimm, 2014; Weinhardt, Hendijani, Harman, & Steel, 2015). Building on the findings of our study, future research could focus on the effect of culture on attribution of blame, and how it links to the application of alternative response actions.

Finally, to assess managerial sense-making of a disruption event, our experiment captured buyers' attribution of blame at a single point in time (*i.e.* immediately following an event). This is logical, considering the unexpected and negative consequences of supply chain disruptions often require immediate managerial attention, and the need for causal attribution (Martinko et al., 2007; Weiner, 1985). However, we acknowledge that redesign decisions may not always occur immediately following an event, and may be postponed to post-recovery stages. It has been suggested that people's pattern of causal inference is a function of time (Nussbaum, Trope, & Liberman, 2003). This means that in a temporally distant situation, buyers tend to rely more on a supplier's dispositional properties as opposed to situational factors. For instance, Nussbaum et al. (2003) find that people made more global versus local causal attributions for temporally distant outcomes. Future studies that use attribution theory may opt to investigate the moderating impact of temporal distances from an event on buyers' attribution of blame.

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Chapter 6 Discussion and conclusion

This chapter provides an overview of the theoretical contributions and practical implications of this thesis, the limitations of the studies, and opportunities for future research. Section 6.1 discusses the main theoretical implications, in relation to supply chain disruption response (6.1.1) and individual-level behaviour (6.1.2), as well as contributions to the theories used as the basis of this thesis (6.1.3) and contribution of the thesis to the field of supply chain risk management (6.1.4). Section 6.2 provides the practical implications of the thesis from the buying (6.2.1), and supplying firm's (6.2.2) point of view. Lastly, Section 6.3 discusses the limitations of the research and opportunities for future studies.

6.1 Theoretical contributions

The theoretical contributions of this thesis are discussed in terms of two main gaps found in the supply chain risk literature, that is the limited theoretical understanding of 1) the antecedents of supply chain disruption responses, and 2) individual-level behaviour at this stage. Specifically, the first section (6.1.1) focuses on the underlying individual and contextual factors that influence organisational actions, as shown in each study. Subsequently, the second section (6.1.2) concentrates on the importance of individual-level behaviour by discussing socio-psychological processes that lead to suboptimal decisions at each stage of supply chain disruption management. The third section (6.1.3) discusses how the findings of this thesis could contribute to the theories used as the basis of the research. Lastly, section 6.1.4 provides a discussion on the contribution of the thesis to the field of supply chain risk management.

6.1.1 Supply chain disruption responses

The main aim of this section is to discuss the theoretical contributions related to the antecedents of organisational actions during disruption response stages. Therefore, the researcher focuses on internal and external factors that influence actions.

Over the last two decades, the studies of supply chain risk management have advanced the understanding of various sources and performance implications of risk (Hendricks & Singhal,

2005; Jacobs & Singhal, 2017; Rangel et al., 2015; Singhal et al., 2011), and developed risk management models and frameworks to build supply chain robustness and resilience (Das & Lashkari, 2017; Ho et al., 2015; Y. Kim et al., 2015; Knemeyer et al., 2009; Tang, 2006). This has contributed significantly to the prevention, reduction, and mitigation of the likelihood and consequences of many sources of risk, as evident in the results of a recent practitioner's survey (Alcantara, Riglietti, & Aguada, 2017). However, in a global and interdependent supply chain environment, disruptions still happen and organisations face the challenge of managing the consequences of these events (Macdonald & Corsi, 2013). Evidence has shown that organisational actions at three different stages of supply chain disruption, *i.e.* discovery, recovery and redesign, are a major determinant of a firm's performance, and supply chain resilience following the event (Blackhurst et al., 2005; Bode et al., 2011; Ivanov et al., 2017; Sáenz & Revilla, 2014). However, we still know very little about the underlying factors that shape such responses (Bode & Macdonald, 2016; Bode et al., 2011; Reimann et al., 2017; Sodhi et al., 2012). To address the gap, each study within this thesis takes a behavioural lens to investigate individual and contextual factors that systematically influence responses at a particular stage of supply chain disruption management.

Study 1 examines the effect of *culture* on supplier switching intention in the *discovery stage* of a supply disruption. Research has previously highlighted the importance of organisational culture on firms' vulnerabilities and responses to disruption (Revilla & Sáenz, 2014; Zsidisin & Wagner, 2010). However, our understanding of the systematic impact of culture on managers' responses to a supply chain disruption is limited. This is important in the supply chain environment where an increasing number of companies are integrated with partners who are located around the world and who hold a variety of cultural values (Ribbink & Grimm, 2014). Within this environment, the outcome of many locally-made decisions about a disruption could have a rippling effect on the operations of other exchange partners throughout a supply chain (Revilla & Sáenz, 2014). Therefore, Study 1 takes a behavioural view to study the effect of culture, as reflected in individual value orientations, on managerial responses to a supply disruption. In line with the findings in analogous fields (Bontempo et al., 1997; Rieger et al., 2015), Study 1 shows that uncertainty avoidance is positively associated with an individual's perception of disruption risk which in turn, leads to higher switching intention. Moreover, the findings from this study provide empirical evidence for the "cushion hypothesis" (Weber & Hsee, 1998; Weber & Johnson, 2009) but only in higher uncertain circumstances. In other words, people high in collectivism value tend to perceive lower levels of disruption risk

compared to individualists when the level of uncertainty in the environment is high. Subsequently, collectivists are more likely to switch suppliers in order to reduce the perceived risk, and increase supply chain resilience (Ellis et al., 2010; Kull et al., 2014; Sitkin & Pablo, 1992; Zsidisin & Wagner, 2010). Overall, by drawing from advances in behavioural research and cross-cultural studies, Study 1 provides theoretical insights into the systematic impact of culture on organisational actions at the discovery stage of a supply disruption.

Study 2 develops a set of propositions to show the effect of *a supplier's actions* on buyer responses at the *recovery stage* of a supply chain disruption. During a disruption, managers face a key challenge of whether to collaborate (*i.e.* bridge) or protect against (*i.e.* buffer) the supplier who has caused the event (Polyviou et al., 2018). Extant research has examined a range of pre-established organisational and relational factors that motivate alternative strategies during recovery (*e.g.* Ambulkar et al., 2015; Bode et al., 2014, 2011). For instance, Bode et al. (2011) find empirical evidence showing the interaction between trust and dependency determines the extent to which a buying firm uses bridging and buffering responses. Despite significant insights provided by these scholars, they have largely overlooked the importance of a supplier's actions in altering buyers' responses in the wake of a supply chain disruption (Wang et al., 2014). Unmet expectations due to a supplier-induced disruption could induce negative emotions and dissatisfaction (Polyviou et al., 2018; Primo et al., 2007; Wang et al., 2014). Therefore, to ameliorate the situation and enhance satisfaction, suppliers take a range of psychological and tangible actions, in the form of apologising or providing compensation (Reimann et al., 2017). According to Study 2 propositions, psychological actions are more effective at enhancing managers' satisfaction for disruptions that happened at a close spatial, temporal, and social distance. While, suppliers' tangible actions, such as product replacement and compensation, improve managerial satisfaction with the responses to disruptions that are psychologically (spatially, temporally, and socially) distant. Subsequently, Study 2 proposes that higher satisfaction with the supplier's recovery action increases the likelihood of bridging responses, such as resource pooling and risk sharing. On the other hand, buyers who are less satisfied with the supplier's action tend to take buffering actions, such as supplier switching and adding slack resources. In general, Study 2 draws from construal level theory to demonstrate the interplay between supplier- and buyer-side actions during the recovery stage of a supply chain disruption, and shed light on the underlying mechanism of decision-making at this stage (*cf.* Ellis et al., 2011)

Finally, Study 3 draws from attribution theory to examine the effect of *attribution of blame* on managerial responses at the *redesign stage* of a supply chain disruption. The supply chain risk studies have mainly discussed the proactive design of resources and capabilities to build robustness and resilience (Hohenstein et al., 2015; Ponomarov & Holcomb, 2009; Tang, 2006). For instance, scholars have highlighted the importance of designing flexibility and visibility in a supply base to reduce the likelihood and/or impact of potential sources of risk (Brandon-Jones et al., 2014; Craighead et al., 2007; Tang & Tomlin, 2008). Despite such efforts, disruptions still happen (Macdonald & Corsi, 2013). To address the latent issue and improve supply chain resilience, firms need to redesign their supply base and/or risk management practices (Blackhurst et al., 2005; Blackhurst et al., 2011). Extant literature has paid little attention to the underlying factors that motivate such redesign decisions (Ambulkar et al., 2015). This is important, because there is evidence showing managerial responses at the redesign stage of a supply chain disruption are a key determinant of the firm's resilience in the face of similar events in the future (Revilla & Sáenz, 2014; Van Der Vegt, Essens, Wahlström, & George, 2015). Therefore, Study 3 draws from attribution theory to investigate the role of blame in post-disruption redesign responses (*cf.* Driedger et al., 2014). According to the theory, following negative and unexpected events, blame is used as a key psychological factor to help managers understand causal explanations and design appropriate actions (Martinko et al., 2007; Weiner, 1985). Moreover, the theory provides a lens whereby the characteristics of a disruption, *i.e.* severity and controllability, determine the extent of blame (Harvey, Madison, Martinko, Crook, & Crook, 2014; Weiner, 1979). The findings from Study 3 show that disruption controllability is positively associated with attribution of blame, while severity does not have a significant effect on the extent to which managers blame the supplier. Subsequently, the interaction between attribution of blame and prior trust in the supplier determines the extent of post-disruption redesign. In other words, buyers tend to redesign their supply base only if they distrust the supplier. In such cases, the occurrence of a disruption confirms the firm's prior reservations about the supplier (Bode et al., 2011) and hence, lead to extreme responses. Overall, the findings from this study provide insights into the role of prior trust and a supplier's blameworthiness on motivating post-disruption redesign decisions.

Study 3 findings are also consistent with recent research that has shown controllability as a major antecedent of managerial responses to supply chain disruptions (DuHadway et al., 2017; Polyviou et al., 2018). According to these studies, following an event, controllability is used as a key dimension for assessing whether the supply chain needs a redesign. Drawing from

attribution theory, Study 3 provides empirical evidence on the impact of controllability on redesign through attribution of blame. Hence, it reemphasises the importance of integrating disruption controllability into formal supply chain risk management processes (DuHadway et al., 2017; Polyviou et al., 2018).

6.1.2 Individual-level behaviour

The contributions in this section focus on an individual manager's behaviour when making decisions about a supply chain disruption. The researcher draws from the findings and theoretical insights of each study to highlight the subjective nature of managerial decision-making during the three stages of a supply chain disruption.

Extant supply chain risk research has mainly investigated risk management from the point of view of an organisation or supply chain system (*e.g.* Kim et al., 2015; Manuj and Mentzer, 2008) and overlooked the role of individual managers (Ambulkar et al., 2016; Cantor et al., 2014; Tokar, 2010). The majority of these studies have suggested optimal mitigation strategies based on the properties of the organisation, governance relationships, and supply chain structure (Ambulkar et al., 2015; Bode & Wagner, 2015; Gümüş et al., 2012; Y. Kim et al., 2015). In other words, individual managers have not been the main phenomenon under study or if considered, have been assumed as rational decision-makers (Tokar, 2010). That is, they are able to search the environment and identify risks; have consistent preferences; and are capable of evaluating all possible alternatives and making optimal decisions (Boudreau et al., 2003; Gino & Pisano, 2008). However, the advance of research in behavioural operations (BeOM) has shown that these assumptions are often violated, particularly when a situation is uncertain (Bendoly et al., 2006; Kahneman & Tversky, 1974; Simon, 1957). In other words, managers have individually-motivated goals that may not be in line with the profit-maximising objectives of a firm (Loch & Wu, 2007). Moreover, because of the limitations in people's information processing capabilities, managers cannot attend to every information needed for making optimal choices (*i.e.* they are boundedly rational) (Bendoly et al., 2006; Carter et al., 2007; Tokar, 2010). Instead, they rely on a subjective satisficing as opposed to an objective rational process to make decisions (Ellis et al., 2010, 2011).

This has important implications for organisational responses to supply chain disruptions. Within such an environment, it is often the individual manager's responsibility to detect risks, evaluate a situation, make decisions, and direct organisational actions (Ambulkar et al., 2016; Cantor et al., 2014; Polyviou et al., 2018). Uncertainty associated with supply chain

disruptions, coupled with the individual's bounded rationality, means that managerial decisions may be biased by their subjective evaluation of a situation and hence, may be suboptimal (DuHadway et al., 2018; Ellis et al., 2010, 2011). Failure to account for behavioural factors that drive subjective evaluations may lead to the design of risk management models and mitigation strategies that are not effective in practice (Ancarani & Di Mauro, 2012; Tokar, 2010). Therefore, the three studies within this thesis draw from behavioural operations research to examine the role of socio-psychological factors that systematically influence managerial perception and decisions about a supply chain disruption (*cf.* Cantor et al., 2014; DuHadway et al., 2018; Polyviou et al., 2018; Reimann et al., 2017; Wang et al., 2014).

Study 1 highlights the importance of *the subjective perception of risk* in driving supplier switching intention at the discovery stage of a supply chain disruption (*cf.* Ellis et al., 2010). Traditionally, the literature has assumed that managerial decisions in the face of an impending disruption are driven by an objective evaluation of risk and profit-maximising goals (Gurnani, Ramachandran, Ray, & Xia, 2014; Tazelaar & Snijders, 2013). In the presence of historical data on the source and frequency of risks, this may be straightforward, and can be done using quantitative techniques and statistical analysis. However, due to the uncertain nature of the supply chain disruption environment, quantifying an objective level of risk may not always be possible (Ellis et al., 2011; Hult, Craighead, & Ketchen, 2010). Managers may face substantive uncertainty (Dosi & Egidi, 1991) because there is a lack of information about (a) the nature of an event, (b) the cause-effect relationships of an event (*i.e.* the lack of information about the location, severity, and timing of an event), or (c) the value of available mitigation strategies (*cf.* Milliken, 1987). In addition, even when all necessary information is available, bounded rationality may limit their ability to process all of this information and pursue decision objectives (Dosi & Egidi, 1991). To deal with such uncertainties, they instead rely on a range of socio-psychological processes to form a subjective perception of a disruption situation, which will be subsequently used as the basis of their decision-making (DuHadway et al., 2018; Ellis et al., 2010; Sitkin & Pablo, 1992).

The findings from Study 1 show that managers rely on their cultural values to shape the subjective perceptions of a disruption risk. In other words, uncertainty avoidance is positively associated with disruption risk perception (Bontempo et al., 1997; Rieger et al., 2015) and subsequently, supplier switching intention. In addition, people high on collectivism value perceive lower levels of risk compared to their counterparts in uncertain situations (Weber & Hsee, 1998) and hence, are less likely to switch suppliers in the face of disruption (Ellis et al.,

2010; Kull et al., 2014). Therefore, Study 1 findings highlight the effect of the interaction between cultural values and situational uncertainty in shaping subjective perceptions of and responses to supply disruption risk. In other words, managerial responses tend to be more heterogeneous and influenced by subjective biases under uncertain circumstances (Carter et al., 2007; Kahneman & Tversky, 1982). This reemphasises the importance of integrating behavioural factors in risk management models and frameworks that may be utilised during the discovery stage of a disruption (*cf.* Cantor et al., 2014; Ellis et al., 2011; Reimann et al., 2017).

Study 2 shows that when a supply chain disruption happens, managers rely on their *mental representation* to evaluate the consequences and make appropriate decisions (Combe & Carrington, 2015; Ellis et al., 2011). Extant literature has previously proposed several models and strategies in regards to a firm's operational resources and capabilities (Hishamuddin, Sarker, & Essam, 2013; Ivanov et al., 2017, 2014). For instance, using an analytical technique, Tomlin (2006) finds an optimal level of supplier volume flexibility to reduce time of recovery. In a similar vein, Hishamuddin et al. (2013) develop a recovery model for a two-echelon supply chain that identifies optimal ordering and production levels during disruption recovery in order to reduce the total costs of the operations. However, less attention has been paid to the individual managers' behaviour during equivocal disruption situations (Ellis et al., 2011). Study 2 within this thesis takes a behavioural view to suggest that organisational responses are systematically influenced by managerial satisfaction with the supplier during disruption recovery. In particular, it draws from construal level theory and construal level fit hypothesis to propose that the fit between an individual's mental representation and supplier's recovery actions influences the level of satisfaction at this stage (Trope & Liberman, 2010).

During a disruption, managers face uncertainty and ambiguity around the consequences and potential resolutions (Combe & Carrington, 2015). To facilitate decision-making, they distil this information through a socio-psychological process and store it in their mental representation (Porac, Thomas, & Baden-Fuller, 1989). According to construal level theory, the psychological distance of the disruption triggering event determines the content of this mental model (Trope & Liberman, 2010). That is, people tend to focus on intangible losses (*i.e.* social losses) of psychologically close events and hence prefer suppliers' psychological actions, such as providing explanation and apologising. Whereas, managers are more concerned with tangible losses (*i.e.* financial damages) for psychologically distant events and thus, prefer suppliers' tangible actions, such as product replacement and compensation.

Drawing from the fit hypothesis, Study 2 proposes that the fit between managerial mental representation and suppliers' recovery actions enhances satisfaction and subsequently, leads to bridging actions. Whereas, the mismatch between the mental model and recovery actions reduces satisfaction and results in buffering responses. This is of significant importance, especially given that supply chain disruptions are often psychologically distant from the manager who makes decisions (Cantor et al., 2014; Wakslak, 2012; Zsidisin, Wagner, Melnyk, Ragatz, & Burns, 2008). Hence, the effect of such distances on managerial mental representation could introduce systematic biases into the evaluation of the disruption, and influence the effectiveness of recovery responses (Polyviou et al., 2018).

Lastly, Study 3 examines the role of the managerial *sense-making process* in directing organisational post-disruption responses (Eckerd et al., 2016; Mir et al., 2017; Polyviou et al., 2018). Sense-making refers to a socio-psychological process that occurs when individuals face "discrepant cues" in their environment, and involves the retrospective development of a plausible explanation for the event (Maitlis & Sonenshein, 2010; Olcott & Oliver, 2014). It is particularly useful in resolving uncertainty within a disruptive environment, and shaping responses during and after an unexpected event (Ellis et al., 2011; Olcott & Oliver, 2014). Within the supply chain risk literature, scholars have mainly discussed decision-making related to the identification, assessment and mitigation of risk sources (e.g. Blackhurst et al., 2011, 2005; Hallikas et al., 2004; Ho et al., 2015; Neiger et al., 2009). However, less attention has been paid to the underlying factors that shape post-disruption decisions (Bode et al., 2011; Polyviou et al., 2018). To investigate the underlying mechanism of post-disruption decision-making, Study 3 draws from attribution theory (Shaver, 1985; Weiner, 1985). According to the theory, following a disruption, managers rely on a sense-making process to understand why the event happened and who was to blame (Hamilton, 1987). This attribution, in turn, helps managers to decide how to react to the event (*cf.* Driedger et al., 2014; Rosenthal and Schlesinger, 2002). Study 3 provides empirical evidence that shows higher attribution of blame leads to more supply base redesign. In other words, managers tend to attribute blame to the supplier for not mitigating or preventing a controllable event (e.g. not arranging a meeting with the employees and prevent a labour strike) and subsequently, redesign to address the issue and prevent the reoccurrence of a similar event in the future.

The findings also highlight the importance of a buyer's perception of a supplier's benevolence and capabilities (*i.e.* trust) in moderating the relationship between blame and redesign. In other words, when buyers have low prior trust in the supplier, the occurrence of a

disruption confirms their prior perceptions of the supplier (Bode et al., 2011). Hence, they view the disruption in a more negative light (*e.g.* supplier's incapability or unwillingness to prevent the event) and therefore redesign to remedy supply vulnerabilities (Robinson, 1996). On the other hand, a high prior trust in the supplier diminishes the effect of blame on redesign, as buyers tend to evaluate the event in a less negative light (*e.g.* seeing it as a temporary lapse). Hence, they accept supply vulnerabilities based on the belief that the supplier is willing and capable to prevent the reoccurrence of the disruption. While such actions may contribute to supply chain resilience, they might not always be optimal, especially given the high costs involved in implementing redesign decisions (Blackhurst et al., 2005). To improve the effectiveness and predictability of post-disruption responses, identifying and incorporating the individual-level behaviour seems important.

6.1.3 Contribution to the behavioural theories

The contributions in this section focus on how the findings of this thesis advance the application of the theories that are used as the basis of this research: specifically, how Study 1 and Study 3 contribute to cross-cultural research and attribution theory.

This thesis makes contributions to the application of cross-cultural theories by investigating culture as reflected in individual value orientations (*cf.* Kirkman et al., 2017). In particular, Study 1 draws from cross-cultural research to hypothesise the effect of uncertainty avoidance and individualism-collectivism on disruption risk perception. Extant cross-cultural research has previously studied the impact of these cultural dimensions on people's evaluation of risk in various contexts (*e.g.* Bontempo et al., 1997; Rieger et al., 2015; Weber and Hsee, 1998; Xue et al., 2014), however these studies have mainly focused on the role of culture as reflected on Hofstede's country-level value scores (Kirkman et al., 2017; Taras et al., 2010, 2009). While this has provided significant insights into the underlying cultural mechanism that drive variations in attitudes and behaviour, it has largely overlooked a possible within-country heterogeneity of culture (Yoo et al., 2011). Given today's mobility of people and ever-increasing use of communication channels, individuals' cultural values are exposed and influenced by several sub-cultures (Taras et al., 2010). Therefore, using country-level scores to study the effect of culture on an individual's behaviour may increasingly become less relevant (Yoo et al., 2011). Study 1 responds to recent calls in cross-cultural research by adopting a micro-view of culture, as reflected in an individual's cultural value orientations (Gelfand et al., 2017; Kirkman et al., 2017). The findings from this study support previous

works at country-level by indicating that uncertainty avoidance is positively (Bontempo et al., 1998; Rieger et al., 2014) and collectivism is negatively (Hsee and Weber, 1998; Weber et al., 2010) related to disruption risk perception.

Moreover, Study 1 contributes to the extant cross-cultural studies by examining the moderating effect of situational uncertainty on the relationship between cultural values and disruption risk perception. While previous research has mainly studied the impact of culture on attitudes and behaviours to investigate *whether culture matters*, few scholars have focused on examining “when and how culture matters” the most (Gibson et al., 2009; Kirkman et al., 2017, p. 15; Nouri et al., 2013). Study 1 contributes to the previous cross-cultural studies by integrating a situational factor that may moderate the relationship between culture and disruption risk perception. In particular, Study 1 examines the effect of uncertainty avoidance and individualism-collectivism on disruption risk perception under two distinct levels of situational uncertainty. The results show that while the impact of uncertainty avoidance on risk perception was not significantly different in the two conditions, the effect of individualism-collectivism on risk perception is dependent on the level of uncertainty. In other words, collectivism is associated with lower perceptions of disruption risk only in high uncertain situations. These findings highlight the important role of culture in people’s perception of risk and behaviour, when objective information about risk is not available or unclear (*cf.* Gibson et al., 2009; Nouri et al., 2013).

Study 3 contributes to the application of attribution theory by adapting the theory to the context of the supply chain environment (Martinko et al., 2007). Extant operations and supply chain management (OSCM) research has previously applied the theory to examine the effect of attribution on various supply chain phenomenon (*e.g.* Hall and Johnson-Hall, 2017; Mir et al., 2017; Ro et al., 2016). For instance, Mir et al. (2017) study the effect of attribution of the cause of a supplier’s psychological contract breach on switching intention following the event, and Hartmann and Moeller (2014) examine the impact of responsibility attribution for an unsustainable firm’s behaviour on customers’ boycotting reactions. Study 3 departs from previous research by incorporating a moderating impact of a supply chain-specific factor (*i.e.* trust) on the relationship between attribution and behaviour. Specifically, the findings from this study show that attribution of blame only leads to redesign if the level of prior trust in the supplier is low. In such cases, attribution of blame draws people’s attention to the vulnerabilities of their supply chain and confirms their earlier view of the supplier (Bode et al., 2011). Therefore, they tend to act upon blame and redesign to address the latent problem.

However, in high trust environments, managers see the disruption as a temporary lapse in supplier's performance and hence, overlook their blameworthiness. Therefore, these findings highlight that blame only matters when trust in the supplier is low.

6.1.4 Contribution to the field of supply chain risk management

The field of supply chain risk management has contributed significantly to the design and understanding of risk identification, evaluation, and mitigation approaches (Sodhi et al., 2012; Fan and Stevesson, 2018; Ho et al., 2015). Supply chain academics and practitioners have designed various quantitative and qualitative techniques to assess and prioritise the sources of supply chain risks based on risk and cost minimisation objectives (*e.g.* Tang, 2006; Snyder et al., 2016). Moreover, various planning and design strategies, such as risk-sharing contracts and supply base flexibility, have been proposed and put in place to minimise the probability and/or impact of disruption events (Tang and Tomlin, 2008; Dong and Tomlin, 2012; He et al., 2013). As it stands, the field provides a wealth of knowledge with regard to the technical issues; that is, what operational resources and capabilities are required to reduce supply chain vulnerability, improve resilience, and ensure profitability (Fan and Stevenson, 2018). However, it has largely overlooked the key issue in the implementation of such strategies in practice, that is, *human behaviour* (Juttner et al., 2005). In implementing risk management strategies, managers have been assumed to act in a predictable and rational manner. That is, they 1) have access to all information about the cause, consequences and possible mitigation approaches; 2) are able to evaluate an objective level of risk; 3) are not influenced by their environment (relationships, situations, interactions); 4) have consistent preferences; and 4) follow normative rules of cost and risk minimisation (Ancarani and Di Mauro, 2012).

The findings and theoretical insights from this thesis challenge the validity of such assumptions. In particular, the thesis shows that in managing supply chain disruption, managers are systematically influenced by psychologically held cultural values and the context in which they make decisions. The findings from Study 1 highlight that uncertainty avoidance and individualism-collectivism values impact the extent to which individual managers (*i.e.* recovery lead) decide to switch the supplier in the face of an impending disruption. In a similar vein, the theoretical insights from Study 2 show that psychological distance (*i.e.* temporal, spatial, social) of a disruption triggering event systematically affects the information used as the basis of individual managers' judgment and decision-making about the event. While people tend to focus on tangible (*i.e.* financial, operational) losses of the event for psychologically

distant disruptions, they are concerned with intangible (*i.e.* social) damages of the event, if it is temporally, spatially, and socially close to them. This could in turn, influence the extent to which managers pursue buffering versus bridging during disruption recovery stage. These findings highlight that in managing supply chain disruptions, managers are systematically affected by individual and contextual factors. Therefore, failure to account for *human behaviour* and the bottom-up processes in the design of supply chain risk management may lead to inaccurate models that do not reflect such factors and hence, may not be effective in practice. Scholars need to develop supply chain risk management models and frameworks that take limitations of human behaviour into account and subsequently, design/integrate interventions that help correct or counteract the systematic variations in decision-making (Gino and Pisano, 2008).

Within the field, there is a gap between what the risk management approaches has offered and what has been applied in practice (Juttner et al., 2005; Sodhi et al., 2012). Although there could be numerous reasons for this gap, the findings of the thesis may point to the lack of insights into human behaviour as an underlying reason for the inconsistencies between supply chain risk management theories and practices. In other words, the thesis argues that “human and behavioural components (the soft-wiring)” (Sweeney, 2013, p. 73) play at least an equally critical role as the hard aspects, such as operational resources and capabilities, in managing supply chain risk (Schorsch, 2017). Understanding that people do not act always rationally, that they care about their relationships and are influenced by their cultural background (Loch and Wu, 2005) relates to the importance of human behaviours in supply chain risk management. When it comes to implementation, the success of risk management tools and techniques, depends on understanding of the bottom-up processes by which people make decisions and activate organisational mitigation actions (*cf.* Schorsch, 2017; Tokar, 2010).

Furthermore, from a top-down perspective, the findings and theoretical insights of the three studies highlight the importance of decision context in influencing managerial perceptions and behaviours. In other words, although psychological factors are the root causes of individuals’ judgement and decision-making, situational and contextual factors may moderate their ultimate impact on decision outcomes (Schorsch, 2017). The findings from Study 1 show that varying the level of uncertainty in disruption environment moderates the impact of cultural values on disruption risk perception and switching intention in the face of a disruption. Similarly, the theoretical insights from Study 2 highlight that a match between individual managers’ mental representation and supplier’s recovery actions in the wake of a supply disruption could enhance

managerial satisfaction with the resolution process and encourage bridging as opposed to buffering responses. Moreover, Study 3 findings provide empirical evidence on the role of prior inter-firm trust in moderating the relationship between blame attribution and post-disruption redesign decisions. In other words, the findings show that a high level of prior trust between a buying and supplier firm could hinder the impact of attribution of blame on redesign decisions. Therefore, from a practical point of view, the thesis contributes to a better understanding of potential management interventions to create a decision environment that leads to “desired” behaviour. In other words, the operational context and supply chain relationships can be formed in such a way that minimise systematic variations, or at least eliminate their negative consequences on risk management processes (Gino and Piscano, 2008). The next section will provide practical implications of the thesis in more detail.

6.2 Managerial implications

From a practical point of view, this thesis has several implications. It provides insights into the underlying factors that systematically influence managerial decisions at three stages of supply chain disruption response. In the event of a supply chain disruption, organisations often allocate decision-making and the task of coordinating response activities to an individual manager (Deloitte, 2015; Polyviou et al., 2018). Although this may accelerate the process of shaping and implementing mitigation responses (Bode & Macdonald, 2016), it could also introduce systematic biases into the decision-making process and hence impact the effectiveness of organisational actions. To improve performance, organisations need to understand the underlying sources of these biases and implement strategies to minimise and control for their effect on decision-making (Carter et al., 2007; Tokar, Aloysius, & Waller, 2012). The theoretical insights and findings from this thesis could be used by both buying and supplying firms to create intra- and inter- organisational decision environments that will drive “desired” behaviour. The following sections will discuss the managerial implications from the buyer’s and supplier’s perspectives, in order.

6.2.1 Buyer’s point of view

From a buying firm point of view, organisations can use the insights from this thesis to design intervention strategies that “de-bias” or homogenise managerial behaviour (Tokar, 2010; Tokar et al., 2012). In particular, firms could rely on human resource management practices to develop training programmes that reduce individuals’ susceptibility to unconscious biases

(Kaufmann, Carter, & Buhrmann, 2012; Kaufmann, Michel, & Carter, 2009). Past studies have suggested that informing people about the sources and effect of decision biases, and providing appropriate trainings to control these could reduce the likelihood of biased behaviour (Morewedge et al., 2015; Tokar, 2010). Hence, the insights and findings from this thesis may inform the design of training programmes that educate managers about the underlying factors that systematically influence disruption responses. For example, Study 1 finds empirical evidence for the “cushion hypothesis”. That is, collectivist people tend to perceive lower levels of disruption risk, because they view their social group members as buffers that protect them against the financial losses of a potential disruption (Weber & Hsee, 1998; Weber & Johnson, 2009). Similarly, Study 2 propositions offer insights on the underlying mechanism of satisfaction and “feeling right” during a supply chain disruption (Higgins, Idson, Freitas, Spiegel, & Molden, 2003; Lin & Zhou, 2011). Training programmes could be designed to educate managers about such sub-conscious thinking (e.g. Morewedge et al., 2015). Moreover, they could offer intervention strategies, such as perspective shifting and reflective thinking, to minimise the source and effect of such sub-conscious biases (Kaufmann et al., 2012). For instance, the findings from Study 3 show that the attribution of blame to distrusted suppliers leads to redesign decisions. Under these conditions, blame draws attention to vulnerabilities of the existing supply base and confirms managerial distrust (Bode et al., 2011). To protect themselves against the occurrence of similar events in the future, managers tend to make spontaneous change through, for instance, modifying the number of suppliers, inventory levels, and transportation mix. While these could improve supply chain resilience, it may also increase transaction costs (Blackhurst et al., 2005). In making such decisions, organisations could encourage managers to adopt more reflective thinking to account for the performance of the supplier over an extended period of time, and evaluate the short- and long-term costs of a redesign.

6.2.2 Supplier’s point of view

From a supplier’s point of view, organisations can opt to use the findings from this thesis to create a decision environment to improve buyers’ satisfaction, encourage collaboration and reduce transaction costs. In particular, Study 3 findings highlight the effect of controllability on buyers’ attribution of blame that could, in turn, motivate supply base redesign. In other words, buyers tend to modify their supply base for disruptions that could be predicted and prevented by suppliers. Given the high transaction costs involved in such changes, suppliers

may add controllability to the traditional probability and impact measures of supply chain risks. In other words, to reduce the likelihood of costly redesign decisions made by buyers, suppliers need to identify and manage the risk of controllable events in their operations. Furthermore, the theoretical insights from Study 2 could be used by suppliers to provide effective recovery actions depending on psychological distance from the disruption. In other words, Study 2 propositions argue that psychological (tangible) recovery actions could enhance buyers' satisfaction and hence, collaborative actions for disruptions that are spatially, temporally, and socially close (distant). For example, while apologising and providing explanations are effective recovery actions during the early stages of a disruption, product replacement and financial compensations are most effective during the later stages.

6.3 Limitations and opportunities for future research

Each study within this thesis made several informed choices that were motivated by the context of supply chain disruption management and the theoretical lens of the study. For instance, the choice of culture as the main antecedent of managerial responses in Study 1 was motivated by two factors. First, culture has become an important topic of interest for supply chain scholars, as firms have started to integrate with exchange partners that spread around the world and hold different cultural values (Ribbink & Grimm, 2014). Second, culture has been shown to be a significant determinant of subjective perceptions of risk that by itself, is a key driver of decision-making in the face of disruption risk (DuHadway et al., 2018; Ellis et al., 2010; Gibson et al., 2009; Sitkin & Pablo, 1992). Therefore, the findings of this study can shed light on the systematic cultural variations in managerial perceptions of and responses to a disruption in a supply chain environment (Revilla & Sáenz, 2014; Zsidisin & Wagner, 2010). However, the researcher acknowledges the role of other individual and contextual factors, such as problem familiarity and organisational control systems in shaping subjective risk perception (Sitkin & Pablo, 1992). For instance, Wiseman et al. (1998) highlight the role of compensation mix, direct supervision, and performance history on an individual's risk behaviour. This is important, because the effect of such factors may strengthen or diminish the relationship between cultural values and disruption risk perception (*cf.* Gibson et al., 2009). Therefore, future research may build on the findings from this thesis to examine the interaction between cultural values and other contextual and individual factors in shaping managerial perception of disruption risk.

Moreover, Study 3 examines the effect of blame attribution on post-disruption redesign decisions. The choice of blame as the key behavioural factor was motivated by the response stage of a supply chain disruption. Past research has shown that people need to find causal explanation and assign blame following negative and unexpected events (Coombs, 2007; Seeger et al., 2005), such as supply chain disruption. Blame attribution is also a main characteristic of attribution theory that has been applied extensively to study behaviour following various incidents (Harvey et al., 2014). Drawing from attribution theory, Study 3 investigates the effect of disruption characteristics, *i.e.* severity and controllability, on managerial attribution of blame and redesign decisions following a supply disruption. While this provides insights into the link between the characteristics of a triggering event and disruption responses, it does not account for possible cultural differences in attribution of blame (Anagondahalli & Turner, 2012; Martinko et al., 2007). For instance, past studies have shown that compared with individualists, collectivist cultures are likely to attribute causes to contextual (or environmental) factors (Menon, Morris, Chiu, & Hong, 1999; Zemba, Young, & Morris, 2006). Given the findings of Study 1 that show the importance of cultural values on responses to supply chain disruption, future scholars could focus on the interaction between culture and attribution of blame in shaping redesign decisions.

Moreover, past research has shown that attribution of blame to the supplier following a disruption leads to dissatisfaction (Primo et al., 2007). Drawing from the theoretical insights from Study 2, future research can opt to investigate the impact of a supplier's recovery actions on the relationship between blame and redesign responses. In other words, the supplier may decrease dissatisfaction caused by blame through providing recovery actions that match a buyer's mental representation (*cf.* Lin and Zhou, 2011). Moreover, a supplier's psychological and tangible actions may replenish a buyer's low "reservoir" of trust in the supplier (*cf.* Kumar, 1996; Wang et al., 2014) and reduce the impact of blame on redesign decisions. Therefore, building on the insights from this thesis, future research could investigate the interaction between blame, trust, and a supplier's recovery actions in the aftermath of a supply chain disruption.

From a methodological point of view, this thesis is not without limitations. Study 1 and 3 used vignette-based experiments to examine the effect of behavioural factors on disruption responses in a controlled experimental environment (Eckerdt, 2016; Katok, 2011). Both studies made several assumptions about the nature of supply chain structure, organisation, and relationship factors that may influence disruption responses. In the context of this thesis, this

was plausible and justified by the given behavioural theories. Moreover, it provided a controlled set-up to focus on the effect of a variable of interest (*cf.* Bendoly et al., 2009; Tokar, 2010), and establish internal validity by ruling out other potential explanations of the behaviour (Mir et al., 2017). However, it is acknowledged that contextual factors, such as transaction costs, buyer-supplier trust, commitment, relationship norms, and organisational rules and reward systems, could potentially influence managerial decisions and determine organisational actions (Bode et al., 2014, 2011; Ellis et al., 2011; Reimann et al., 2017). For instance, Bode et al. (2011) highlight the role of trust and supplier dependency in organisational responses, while Ellis et al. (2011) discuss the importance of organisational control systems in influencing managerial evaluation of a disruption. This is important, because such decisions are embedded in a particular context and hence, organisational and relational factors may moderate the impact of individual-level behaviour on decision-making (*cf.* Schorsch et al., 2017). To generalise the findings from this thesis, future studies are encouraged to examine the relationships in other experimental settings. Scholars may also build on these findings and investigate the effect of different management practices or relationship governances utilising other methodologies, such as field experiment. In recent years, the use of field experiments has gained increasing attentions from management scholars (Bradler, Dur, Neckermann, & Non, 2016; Voors, Turley, Bulte, Kontoleon, & List, 2017), as it provides quasi-experimental settings to manipulate and randomise a variable of interest (*e.g.* organisational control system: no decision accountability versus accountability and incentives) in a real-life organisational environment.

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