

# Managing supply chain disruptions; Does culture matter?

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## Abstract

The literature has 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, managers who make such decisions are human beings and their decisions regarding risks are biased. Particularly, culture is shown to have significant effects on people's evaluation of and responses to risk. Despite the important role of culture in today's supply chain environment, the literature has been silent on this matter. To address the gap, our study adopts a behavioural perspective to examine cross-cultural differences in responses to a supply chain disruption risk.

**Keywords:** Behavioural Operations, Supply Chain Disruption Management, Culture

## Introduction

Supply chain disruptions are unexpected triggering events that could happen throughout a supply chain and if managed poorly disrupt and/or delay the operations of a firm (Svensson, 2000; Craighead *et al.*, 2007). As a consequence, a firm may be exposed to a range of operational and financial issues, such as stock-outs (Wagner and Bode, 2008), unsatisfied demand (Wang and Tomlin, 2009), lower returns on sale (Hendricks and Singhal, 2005) and decreased shareholder wealth (Hendricks and Singhal, 2003). The extant research has offered various strategies, such as diversification (Hendricks, Singhal

and Zhang, 2009), excess inventory (Tomlin, 2006), capacity restoration (Hu, Gurnani and Wang, 2013), and risk sharing (Wakolbinger and Cruz, 2011) to reduce the probability and/or the consequences of disruption. For instance, Knemeyer *et al.* (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 (Levy, 1994) that if used properly, could reduce a firm's exposure to disruption risks (Craighead *et al.*, 2007), improve supply chain resilience (Brandon-Jones *et al.*, 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 optimal decisions when facing disruptions (Ellis, Henry and Shockley, 2010; Ambulkar, Blackhurst and Cantor, 2016). Over last 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 *et al.* (2008) develop a multi-criteria-scoring procedure to assess and prioritise the sources of supplier risks in the automotive industry. 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, Kaufmann and Michel, 2007; Tokar, 2010). Objective implies that risk estimates are based on information that is generally accurate and can be reduced to quantifiable probabilities (Ellis, Henry and Shockley, 2010; Tazelaar and Snijders, 2013), and rational means that managers have access and are capable to process all relevant information to assess risk and make an optimal decision (Tversky and Kahneman, 1973; Simon, 1979). However, uncertainty in the supply chain environment and managers' cognitive biases cause decisions to deviate from these assumptions (Simon, 1979). Instead, a range of behavioural factors such as past experiences (Urda and Loch, 2013), inter-firm relationships (Bode *et al.*, 2011), and the characteristics of a market (Ellis, Henry and Shockley, 2010; Kull, Oke and Dooley, 2014) guide such decisions through a mediating role of subjective perceptions of risk (March and Shapira, 1987; Sitkin and Pablo, 1992).

Risk perception is defined as decision makers' subjective assessment of the risk inherent in a situation (Sitkin and 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 the structure of the information within these schemas (Klein, 2004) and therefore, affects the way people evaluate and make sense of risky situations (Gibson, Maznevski and Kirkman, 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 and Grimm, 2014). To date, the supply chain risk literature has been silent on this matter. We aim to

address the gap by examining the impact of culture on managers' risk perception and mitigation choices in the face of a supply disruption.

## **Culture**

Hofstede (1980, p. 21) 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). Extant research has shown the effect of culture on a range of individual and organisational outcomes, such as risk preferences (Weber and Hsee, 2000), trustworthiness (Özer *et al.*, 2014), negotiation style (Ribbink and Grimm, 2014), and conflict management (Gelfand *et al.*, 2001).

The majority of these studies have assumed that culture is homogenous and have subsequently, used nationality as a proxy for culture (Tsui, Nifadkar and Ou, 2007). In other words, they have overlooked a possible within country variation of subcultures (Erez and Gati, 2004; Taras, Rowney and 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 and 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 and 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 (Kirkman *et al.*, 2009). 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 (*cf.* Kirkman *et al.*, 2009).

## **Hypotheses**

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 *et al.* (1980) and GLOBE scholars (House, Javidan and Dorfman, 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 and Shoham, 2007; Yoo, Donthu and Lenartowicz, 2011), and hence have been used predominantly to study cross-cultural differences in various contexts (Taras, Rowney and Steel, 2009). Although various cultural values offered by Hofstede (1980) represent different aspects of a culture, not all values are salient in every context (Bockstedt, Druehl and Mishra, 2015). Thus, consistent with previous research (Statman, 2008; Rieger, Wang and Hens, 2015), we focus on the two values that have been shown to directly influence individuals' risk behaviour, i.e. individualism/collectivism and uncertainty avoidance.

### *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 and Kemmelmeier, 2002). Research has provided evidence on the negative impact of collectivism on financial risk perceptions (Weber and Hsee, 2000). To explain the phenomenon, Hsee and Weber (1999) propose "cushion hypothesis", that is the strong social ties in collectivist cultures provide a *cushion* for its members, protecting them against potential consequences of a risky event. In such cultures, social group members are likely to step up and offer help to any member of the culture who experiences financial losses of a risk (Rieger, Wang and Hens, 2015). On the contrary, the dominant independence values in individualist cultures require people to bear the consequences of their own decisions (Triandis, 1989). Therefore, it is likely that people from collectivist cultures perceive lower levels of disruption risk compared to their counterparts under similar circumstances (Statman, 2008).

**Hypothesis<sub>1a</sub>** *Higher collectivism is associated with lower levels of perceived disruption risk*

### *Uncertainty Avoidance*

Uncertainty avoidance refers to the extent to which a culture can tolerate uncertain and ambiguous situations (Steel and Taras, 2010). While cultures higher on this dimension feel more threatened by the ambiguity and unpredictability of uncertain situations (Bontempo, Bottom and Weber, 1997), people from lower uncertainty avoidant cultures are more comfortable in dealing with such circumstances (Rieger, Wang and Hens, 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, Bottom and Weber, 1997, p. 483), could result in systematic differences in perceptions of risk (e.g. Bontempo, Bottom and Weber, 1997; Choi and Geistfeld, 2004). In the context of supply chain disruption, we argue that individuals with higher uncertainty avoidant cultures tend to feel more nervous when facing the unpredictability of an impending event and hence, perceive higher levels of risk compared to their counterparts in a similar situation. Therefore, we hypothesise that:

**Hypothesis<sub>1b</sub>** *Higher uncertainty avoidance is associated with higher levels of perceived disruption risk*

### *Uncertainty as a moderator*

The notion of uncertainty is inherent in every decision-making situation (Vilko, Ritala and Edelman, 2014), and has been shown to influence the outcome of various social and organisational decisions (Carpenter and Fredrickson, 2001). In the context of our study, we define situational uncertainty as a consequence of external factors such as supply variability that could result in a lack, variability or ambiguity of information (Flynn,

Koufteros and Lu, 2016) needed to evaluate risk, make decisions, and confidently assign probabilities to their outcomes (Carpenter and Fredrickson, 2001). We argue that situational uncertainty moderates the relationship between managers' cultural values and their perception of supply disruption risk. Under high levels of situational 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, Maznevski and Kirkman, 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<sub>2</sub>** *Uncertainty positively moderates the relationship between cultural values and disruption risk perception:*

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

#### *Supply risk mitigation decision*

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 (Cantor, Blackhurst and Cortes, 2014; Ambulkar, Blackhurst and Cantor, 2016). 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. In the context of our study, we argue that higher levels of perceived disruption risk will lead managers to switch their supply to a less risky supplier even if it is more expensive to do so:

**Hypothesis 3** *Higher perceived risk is associated with higher likelihood to switch suppliers in the face of disruption*

## Methodology and results

### *Subjects and experimental design*

A total of 220 experienced professionals were recruited through a survey research firm, Qualtrics (*cf.* Kaufmann *et al.*, 2018). Participants were required to have work experience in related operations and supply chain management areas. The sample characteristics of our study were as follow: 47.27% female (i.e. 52.73% male); an average age of 41.7 years (SD = 11.73); an average work experience of 16.77 years (SD = 11.11).

We developed a scenario (drawn from news reported in the media) that assigned respondents to the role of a 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 plant. We drew from theoretical conceptualisation of uncertainty in risk assessment literature (Guyonnet *et al.*, 2003) to carefully craft two levels of 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 a strike duration (“*a potential strike will last for 4 weeks*”), while they were given a possible range of a strike duration in 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. After reading the scenario, participants responded to a series of question on dependent and control variables, manipulation and realism checks. The manipulation check was conducted through a seven-point measurement item to see whether participants in low and high uncertain conditions perceived different levels of uncertainty around the duration of the strike. The results showed a successful manipulation check, i.e. there was a significant difference between the responses to this item in the two scenarios ( $F = 14.89, p < 0.001$ ).

To operationalise the constructs of collectivism and uncertainty avoidance, we adopted existing multi-item individual level cultural value measurement 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 (where 1= “strongly disagree” and 7 = “strongly agree”). Furthermore, to measure our dependent variables – i.e. risk perception and supplier switching – we adapted existing scale items from earlier research. A 3-item measurement of overall risk perception was adapted from Jia *et al.* (2015). In addition, we adapted a single-item of supplier switching measure by Mir *et al.* (2017) (the measurement model is available upon request).

### *Analysis and results*

We used an ordinary least squared (OLS) regression model to test hypotheses 1a-b and 2a-b. The average VIF was 5.27 suggesting that multicollinearity is unlikely to pose a threat to the validity of our findings (Chandrasekaran and Mishra, 2012).

As shown in Table 1, none of the control variables significantly influence disruption risk perception. Our results only found a weak support for hypothesis 1a, i.e. collectivism was negatively related to disruption risk perception ( $\beta = -0.16, p < 0.1$ ). Moreover, the

main effect of uncertainty avoidance on risk perception was positive and significant ( $\beta = 0.41$ ,  $p < 0.001$ ), yielding support for our hypothesis 1b.

As hypothesised (H2a), we found a significant positive interaction between collectivism and uncertainty ( $\beta = -0.2$ ,  $p < 0.05$ ). To facilitate the interpretation of the interaction term, we divided our samples into two groups (low and high uncertainty) and conducted simple effect analyses. The results showed a contingent effect of collectivism on risk perception, i.e. we found a non-significant positive effect under lower uncertainty ( $\beta = 0.05$ , n.s.), while a significant negative effect in high uncertain situations ( $\beta = -0.33$ ,  $p < 0.02$  ( $\alpha/2$ )). This supports our hypothesis on the importance of incorporating situational uncertainty in explaining cross-cultural differences of disruption risk perception. Nonetheless, we could not find support for our hypotheses 2b ( $\beta = 0.09$ , n.s.).

*Table 1 Regression Results (dependent variable: disruption risk perception)*

<b>Variable</b>	<b>Estimate</b>	<b>SE</b>
Intercept	4.9 ***	0.28
Age	-0.02	0.18
Gender	-0.15	0.17
Work experience	0.12	0.19
Risk attitude	0.02	0.09
Collectivism	-0.16	0.1
Uncertainty avoidance	0.41 ***	0.09
Uncertainty	0.05	0.08
Collectivism × Uncertainty	-0.2 *	0.09
Uncertainty avoidance × Uncertainty	0.09	0.09
	$R^2$	0.07
	$F$	2.87 **

*Note.*  $n = 220$ . Standardised regression coefficients are shown.

We also tested hypotheses 3 using a separate regression model where switching intention was the dependent variable and disruption risk perception was the independent variable. Our analysis showed no significant relationship between control variables - i.e. age, gender, work experience, and risk attitude - and switching intention. The results supported H3 ( $\beta = 0.63^{***}$ ,  $R\text{-squared} = 0.2$ ), i.e. disruption risk perception leads to significantly higher switching intention.

Our study contributes to the extant research by providing insights into the underlying behavioural factors that determine managers' responses to a supply chain disruption (*cf.* Ellis, Henry and Shockley, 2010; Bode *et al.*, 2011). In particular, our empirical findings show that cross-cultural differences systematically affect managers' subjective perception of a disruption risk, which in turn guide their decision-making behaviour.

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