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A comparison of supply chain risk perceptions in Original Equipment Manufacturers and Tier One suppliers: A case-study in the aerospace industry.

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1.0 Introduction and Overview

Whilst supply chain risk has become a topic of great interest to supply chain researchers, few studies have used the supply chain as a 'unit-of-analysis' to track how perceptions of risk of the same component streams vary at different tiers along that chain. The understanding of differences in risk perception is crucial in devising effective approaches to militate against risk. This paper reports on an investigation that proposes that perceptions of risk will change along the supply chain.

The paper begins by giving a brief overview on the literature on supply chain risk and the lack of coverage of variations of risk perception across the supply chain. It presents the results of a case study investigation into the proposition in the aerospace sector into the differences in risk perceptions between and OEM and four of its Tier One suppliers. It shows how the proposition is partially supported and how disparities in perceptions could be partly attributed to complex supply chain interactions and partly attributed to informational inequalities at different tiers. It also discusses findings on risks in supply chains that lie outside the original goals of the investigation but highlight the difficulties of dealing with 'unknown unknowns' in a supply chain risk context.

2.0 Perceptions of Supply Chain Risk

Supply risk is defined by Zsidisin (2003), from a review of the literature, as the probability of an incident associated with inbound supply from individual supplier failures or the supply market occurring, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety. Chopra & Sodhi (2004) in their theoretical paper go on to argue that there are nine categories of risk: Disruptions, Delays, Systems, Forecast, Intellectual Property, Procurement, Receivables, Inventory, Capacity. This disruption

can be minor and short term or catastrophic and long term. . Table 1 shows a framework for categorizing supply risk factors.

Table 1: Supply Risk Characteristics from Zsidsin (2003a)

Juttner (2005) extends the construct of supply risk and argues that risk in the supply chain centres around the disruption of flows between organisations. These flows relate to information, materials, products, and money. They are not interdependent of each other but are clearly connected. A key feature of supply chain risk is that, by definition, it extends beyond the boundaries of the single firm and moreover, the boundary spanning flows can become a source of supply risks. Khan and Burnes (2007) go on to argue that in the area of SCM, risk is less understood than in other disciplines and less developed. Hendricks and Singhal (2003) argue that the failure to manage supply chain risks effectively can be costly. They found that on average major supply chain disruptions can reduce the stock market value of a company by 10 per cent . Given the critical need for holistic considerations of supply chains in other areas of their design and management (Fawcett et al , 2008), it is unsurprising that information sharing and communication and coordination among all elements of the supply chain is essential to reduce supply chain risk susceptibility..

Given that the nature of actors changes at different levels of the hierarchy in the supply chain (internal structure (Peter, 2004) likelihood to be an SMA (Bales et al 2004)) it is likely that the perceptions of risk of those actors will vary as well. It could therefore be argued that supply chain risk frameworks cannot be considered as unitary constructs that will work in the same way at any point in the supply chain. If perceptions in risk do change across the supply chain, then it is important that these are understood so that effective flows of information can be maintained

along the supply chain to mitigate against these risks. However, very little work has been undertaken to establish if such a variation of risk perception can be discerned. The research question that the investigation seeks to explore is therefore as follows:

How do supply chain practitioners perceptions of supply chain risk vary at different points along the supply chain?

3. The Investigation Methodology

3.1 The Rationale for a Case Study Approach

The lack of extant literature in this area meant that this investigation was highly exploratory in nature. In these circumstances, case study enquiry is a particularly pertinent research methodology. The case study enquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points. (Yin, 2003).

3.2 The Case Study Design

The context for the case study was the aerospace sector. The aerospace sector was selected as a useful environment to investigate supply chain risk as many of the perceived supply risk factors are very prevalent in the aerospace industry. These include scarcity of esoteric raw materials, low volumes, high complexity of components and a high number of ‘monopoly’ suppliers. The aerospace OEM that is the subject of this investigation is a wholly-owned subsidiary of a parent organisations that has a UK head-quarter but has substantial global subsidiaries including a large number of facilities and subsidiaries in the US. The OEM’s parent company was ranked in the global ‘top twenty’ by turnover of aerospace organisations.

The key components of the case study design are captured in Table 2.

Stage	Component	Explanation
1	A study’s questions	How do perceptions of risk of supply chain practitioners vary along the supply chain?
2	Its propositions	That the nature of the risk perceptions may vary between OEMs and Tier One suppliers.
3	Its unit of analysis	Dyadic relationships between an OEM and four of its Tier One suppliers

4	The logic linking the data to the propositions	Data was collected by semi-structured interviews. The interview transcripts of supply chain practitioners in the OEM and in the Tier1 suppliers were analysed to discern their perceptions of what comprised risk in a supply chain relationship.
5	The criteria for interpreting the findings	The perceptions of risk (exemplified in codified ‘themes’) were to be compared between the OEM and the Tier One suppliers were compared in order to establish similarities and differences.

Table 2: The Case-Study Design (c.f. Yin, 2003)

The investigation was confined to the dyadic relationship between the OEM and Tier One suppliers. The rationale for this was that, if differences of risk perception were spotted between ‘close’ members of a supply chain then risk perception are likely to vary substantively from the highest to the lowest echelons of the supply chain network.

The protocol followed by the case study is shown in Figure One. Data was collected from semi-structured interviews that were conducted using the seven stage process promulgated by Kvale (Kvale, 1996). Fifteen supply chain related practitioners were interviewed in the OEM and two practitioners were indicated in each of the Tier One suppliers.

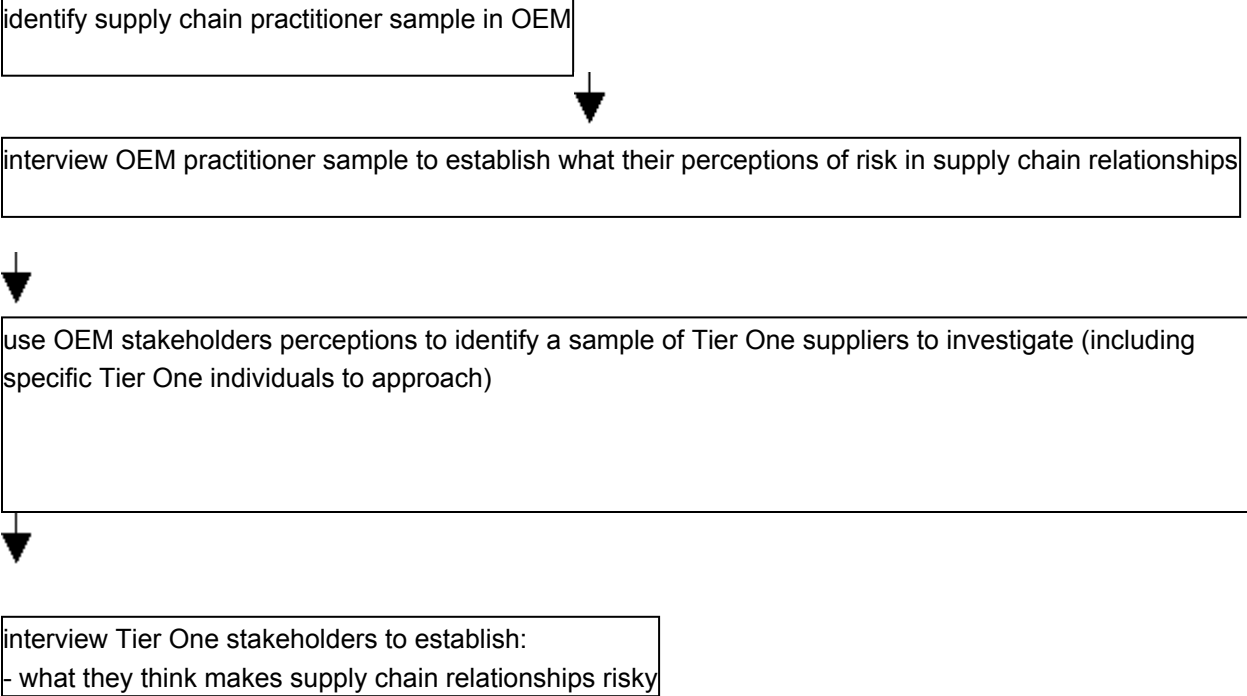


Figure 1: The Case Study Protocol

4.0) Results and Analysis

4.1 Perceptions of supply chain risk in the OEM

The OEM perceived its supply chain risk in two distinctly different ways. Firstly it identified ‘risk propensity factors.’ These factors captured the underlying propensity for risk that characterized a relationship. It differentiated these from ‘risk trigger factors’ . These factors indicated that supply chain disruption was becoming more likely i.e. supply chain risk was increasing.

The prime factor that was identified as a propensity for risk was the single sourcing of a component with one supplier. A secondary factor was the situation where the OEM’s business comprised only a small part of the Tier 1 suppliers business.

‘Trigger’ factors that indicated that risky relationships were becoming likely to cause disruption were identified as:

- Suppliers asking for changes to payment terms
“If a supplier is asking for earlier payment terms, or chasing payment earlier than normal, it’s a good indicator that there is a cash flow problem.”
- Late deliveries
“If deliveries tend to be late, that may be because they’re unable to pay their suppliers, so they haven’t got their raw materials.”
- Unexpected price increases
“The risks are indicated by unexpected raw material prices”
- Poor quality of parts
“It could be as simple as quality has begun to go wrong.”
- Increased lead times
“Lead times went out from nine months to twelve months showing there was a problem.”

Using the risk factors that they had identified in the interview process, the practitioners were then brought together and asked to identify a sample of Tier 1 suppliers who exemplified those characteristics for further investigation. (See Table 3)

Selected Tier One suppliers	single source supplier	low proportion of OEM business	Presence of recent ‘trigger’ factors
Company A	x		quality and delivery problems

Company B	x		delays due to raw material supplies
Company C		x	items purchased were becoming obsolescent
Company D	x	x	lead-times for delivery were increasing

Table 3: Tier 1 Supplier Sample Characteristics

4.2 Perceptions of Supply Chain Risk in Tier 1 Suppliers

The data collection for the investigation took a problematic turn when Company A and Company B failed to participate in the case study. Originally Company A agreed to participate but a senior supply chain manager refused when the researchers arrived on-site to conduct the interviews. Company B did not explicitly refuse to participate but prevaricated in response to email and telephone requests. In order to investigate the companies’ reluctance to participate, researchers looked for secondary data that may provide insights into why this reluctance may have been present. Through these investigations, researcher identified the following information of which the OEM was unaware:

- Company A was owned by a competitor of the OEM’s parent company’s other subsidiaries following a recent acquisition and had recently won a significant order for non-aerospace business
- Company B was being de-selected by other parts of OEM’s parent company as a preferred supplier

Company C and Company D identified a similar list of risk trigger factors to that identified by the OEM. However, Company C and Company D identified different risk propensity factors. Company C viewed their relationship with the OEM substantially differently and did not view the risk in the relationship as due to a material supply chain issue. Company C viewed the risk in the relationship due to the OEM’s inability to communicate its future usage of the components it provides to the OEM. Company C argued that if it was aware of the future usage patterns it could resolve issues of obsolescence immediately. Company D identified that the relationship with the OEM was more risky than the OEM was aware. Although Company D was a single source for the OEM, the OEM thought that with further accreditation it could obtain a similar component from Company D’s competitor, Company E. However Company D’s Tier 2 supplier for a critical sub-component was a company owned by Company E that also supplied Company E. The OEM was unaware that whether it sourced with Company D or Company E it would still result in using the same sub-component supplier.

5.0) Conclusions

The aim of this exploratory investigation was to understand if perceptions of supply chain risk varied at different points in the supply chain. With all of the provisos pertaining to the validity and reliability of a case study approach, the results of this investigation partially support the proposition that different actors on a supply chain hierarchy will consider risk differently. Both Company C and Company D identified different risk propensity factors for their relationship than the OEM identified. Both tier one suppliers viewed that the relationship that they had with the OEM had a different propensity to risk than the manner in which the OEM viewed the relationship.

However, the proposition is not supported in other ways. The OEM, Company C and Company D all identified similar 'risk trigger' factors. This implies that although they way view the relationship as having different risk propensities, they would use the same 'risk trigger' factors to understand if the relationship was becoming more likely to be disruptive i.e. more 'risky.'

The failure for Company A and B to participate highlighted an important issue in assessing supply chain risk that did not form an objective for the original scope of the investigation. The relationship that the OEM had with Company A and Company B had changed (and potentially become more 'risky') without its cognisance. This highlights the paradox of risk assessment where the risks that may be most potentially dangerous can lie in the region of 'unknown unknowns.'

This investigation has demonstrated that the area of risk perception along the supply chain is one that is worthy of further investigation both qualitatively and eventually quantitatively when the constructs have been clearly defined and operationalized. Indeed, the holistic understanding of supply chain that it is argued by so many as fundamental to optimal supply chain management may prove impossible without a greater understanding of how perceptions of risk vary in the supply chain.

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