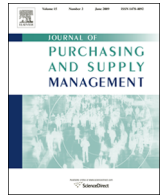




Contents lists available at ScienceDirect

# Journal of Purchasing & Supply Management

journal homepage: [www.elsevier.com/locate/pursup](http://www.elsevier.com/locate/pursup)

## Uncertainty, supply risk management and their impact on performance



Petra Hoffmann\*, Holger Schiele, Koos Krabbendam

Department of Business Administration, School of Management and Governance, University of Twente, P.O. Box 217, 7500 AE Enschede, The Netherlands

### ARTICLE INFO

Available online 28 June 2013

#### Keywords:

Supply risk management  
Transaction cost theory  
Behavioral uncertainty  
Environmental uncertainty  
Maturity

### ABSTRACT

The purpose of this research is to identify the antecedents of supply risk management performance. Speed consortium benchmarking is used to explore the concepts of supply risk monitoring and mitigation. In addition, a survey yielding 207 responses is used to test our hypothesized antecedents of supply risk management performance. Findings indicate that the transaction cost constructs environmental- and behavioral uncertainty have a negative effect on supply risk management performance. In addition, supply risk mitigation and supply risk management process maturity positively influence supply risk management performance, the latter having the strongest influence. Furthermore, supply risk monitoring, supply risk mitigation and supply risk management process maturity all moderate the effect of environmental uncertainty, whereas only risk monitoring has an influence on the relationship between behavioral uncertainty and supply risk management performance. This research identified not only the antecedents of supply risk management performance, but also the moderating effect of different supply risk management principles on the relation between uncertainty and supply risk management performance. Most importantly, our study shows the relevance of developing general supply risk management structures and capabilities (i.e. supply risk management process maturity) in order to manage supply risks successfully. Our findings indicate that even more important than the proper selection of individual risk monitoring and mitigation strategies is the implementation of a risk management process.

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### 1. Introduction: Measuring and improving the performance of supply risk management

Supply risk issues have gained prominence, both in academic discourse as well as in practical application. The field of supply chain risk management emerged because of several reasons such as recent crises and catastrophes, globalization, more dynamic market places, and modern supply chains which are substantially more vulnerable than traditional integrated production methods (Braunscheidel and Suresh, 2009; Harland et al., 2003; Roth et al., 2008; Tang and Tomlin, 2008; Wagner and Bode, 2008). The complexity of these modern supply chains and the increased reliance on the competitive advantage of the supply chain as a whole leads to an increased exposure to supply risks. Therefore, supply chain risk management is developing into a focus area in supply chain management research (Kleindorfer and Saad, 2005; Narasimhan and Talluri, 2009).

One of the key characteristics of risks (Yates and Stone, 1992) is an underlying construct of the transaction cost theory: namely

uncertainty (conceptualized as environmental and behavioral uncertainty (Ellis et al., 2011; Grover and Malhotra, 2003)). In situations with high uncertainty, transaction costs will be higher (Rindfleisch and Heide, 1997), whereas performance is likely to be lower when uncertainty is present (Jun et al., 2011; Kaufmann and Carter, 2006; Trkman and McCormack, 2009). This implies that in an exchange relationship comprising high uncertainty – as compared to situations with low uncertainty – supply risk management performance is likely to be lower.

On the other hand, supply risk management activities are regarded as having a positive influence on firm- and supply chain management performance (see for instance Berg et al., 2008; Ritchie and Brindley, 2007; Wagner and Bode, 2008). A supply risk management system consists of several stages. Different authors mention different supply risk management stages, but basically the following stages can be identified: risk identification, risk assessment, risk management and risk monitoring (see for instance Berg et al., 2008; Hallikas et al., 2004; Harland et al., 2003; Kern et al., 2012; Kleindorfer and Saad, 2005; Mullai, 2009). Reflecting the new situation of increased exposure to supply risk, firms are implementing these supply risk management principles to improve their risk management performance. However, the relationship between supply risk management and supply risk management performance has rarely been empirically tested

\* Corresponding author. Tel.: +31 53 4894282.

E-mail addresses: [p.hoffmann@utwente.nl](mailto:p.hoffmann@utwente.nl) (P. Hoffmann), [h.schiele@utwente.nl](mailto:h.schiele@utwente.nl) (H. Schiele), [j.j.krabbendam@utwente.nl](mailto:j.j.krabbendam@utwente.nl) (J.J. Krabbendam).

(Melnyk et al., 2004; Ritchie and Brindley, 2007). Current knowledge is not sufficient and most of the rare empirical research is descriptive (Wagner and Bode, 2008). Wagner and Bode (2008) plea for more empirical research in supply risk management to explain supply chain performance based on both the strategy process and strategy content.

Moreover, supply risk management is more than merely applying certain risk management methods such as risk assessment or monitoring. Developing a company's capabilities in supply risk management is suggested to increase the positive effects of supply risk management methods (Berg et al., 2008). As Pfohl et al. (2010, p. 40) argue, "supply chain risk management does not work simply by applying a number of methods. It rather is a philosophy that is supposed to be deeply rooted within the company and the supply chain". So, the development of general supply risk management procedures and capabilities is proposed to increase supply risk management performance. While extensive studies have been executed on maturity in supply chain management (see for instance Schiele, 2007), research on process maturity in a supply risk management setting is still in an initial stage.

Based on these identified inadequacies in supply risk management literature, our research goal is three-fold:

- First, we will test the transaction cost concepts of environmental and behavioral uncertainty as antecedents of supply risk management performance.
- Second, we will test the effect of supply risk monitoring and supply risk mitigation on supply risk management performance, as well as their moderating effects on the relation between uncertainty and supply risk management performance.
- And finally, we will also investigate the direct and moderating effect of supply risk management process maturity on supply risk management performance and its relation with uncertainty.

For doing so, we discussed previous findings from literature. Then, we filled in missing elements through an exploratory research approach. This paper relies on the results of two workshops with 13 firms, employing speed consortium benchmarking in order to design an "ideal" supply risk management system. The elements of this model have then been employed as input for a survey, identifying the practices used by successfully risk minimizing companies. The identified risk indicators and mitigation strategies are subsequently used as formative measurement items to conceptualize the constructs of risk monitoring and risk mitigation. These indicators and mitigation strategies can be used as management blueprint for designing individual supply risk management systems. Furthermore, we show that both environmental and behavioral uncertainty have a significant negative effect on supply risk management performance. The use of mitigation strategies contributes to supply risk management performance and moderates the relationship between environmental uncertainty and supply risk management performance. Risk monitoring has no direct effect, but positively moderates the relation of both environmental and behavioral uncertainty with supply risk management performance. Most importantly, developing an enhanced supply risk management process – i.e. supply risk management process maturity – contributes greatly to supply risk management performance while also moderating the negative effect of environmental uncertainty. These findings alert researchers to redirect their efforts, away from the current focus of identifying and classifying continuously more risk sources, to focusing on their measurement, mitigation strategies and the development of a supply risk management process in general.

This paper is organized as follows: we will first develop hypotheses derived from a reflection of transaction cost theory

and supply (risk) management literature. Then the empirical test will be described, which will finally allow us to draw conclusions.

## 2. Theory: Taking a transaction cost approach to supply risk management

Few theories are available that would place supply risk in their explanatory core (Shook et al., 2009). Nonetheless, from a resource dependency perspective it could be argued that the excessive reliance on a particular supplier increases the risks (Hillman et al., 2009; Nienhueser, 2009). While there is certainly explanatory content in this assumption, it might, however, only cover a very narrow range of possible supply risk sources. Likewise, a principal agent perspective involves risks, namely the risk of the agent not behaving in the way expected from the principal. Principal agent theory has sporadically been used to address supply management issues (Hawkins et al., 2008). This theory could be particularly fruitful for elaborating on strategic risks, i.e., the risk of a firm not being considered as a preferred customer by its supplier, the latter one therefore not dedicating the expected attention to the relationship (Hüttinger et al., 2012). Again, this risk is only one out of several types of risk. However, with its reliance on the central source of risk, uncertainty, a broader explanatory perspective is offered by one theory, which will subsequently be explored further: the transaction cost theory.

Transaction cost theory examines the transaction cost of an exchange relationship to define the best governance structure: market or hierarchy (Coase, 1937). Or, as Shelanski and Klein (1995, p. 336) state, "transaction cost economics studies how trading partners protect themselves from the hazards associated with exchange relationships". Transaction cost comprises of coordination costs – the cost of exchanging information and using that information for managing the exchange relationship-, and transaction risk – the risk that the exchange partner will duck out of his responsibility (Grover and Malhotra, 2003). For low transaction costs markets are the best governance structure, whereas vertical integration is the better option in situations of high transaction costs. Besides this vertical integration question, the transaction cost theory can also be used to study problems in interorganizational relationships (Rindfleisch and Heide, 1997), as is the case for the underlying study.

One of the key constructs of transaction cost theory is uncertainty, when unanticipated changes appear in the context of exchange relationships. The transaction cost theory distinguishes between environmental uncertainty and behavioral uncertainty. Environmental uncertainty is about the unpredictability of the environment, and can for instance occur in currency exchange rate fluctuations, natural disasters, complexity/volatility of the supply market or technological unpredictability (Anderson, 1988; Heide and John, 1990). Environmental uncertainty leads to adaptation problems for companies: when circumstances surrounding an exchange relationship change, it can be difficult to modify agreements (Geyskens et al., 2006). Behavioral uncertainty originates from difficulties in monitoring the contractual performance of exchange partners (Williamson, 1985), and materializes for instance as delayed deliveries, poor quality or strategic supply manipulation. For companies encountering behavioral uncertainty it will be difficult to verify and enforce compliance with agreements of exchange partners (Rindfleisch and Heide, 1997).

We would like to stress that the starting point of our research is the business challenge of successful supply risk management, so the research question did not originate from transaction cost theory but from the practical problem of managing supply risks. However, in searching for a theoretical lens that can help

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