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Supply chain risk in turbulent environments—A conceptual model for managing supply chain network risk

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ABSTRACT

Supply risk or the likelihood of supply disruptions is emerging as a key challenge to supply chain management. The ability to identify which supplier has greater potential of a disruption is a critical first step in managing the frequency and impact of these disruptions that often significantly impact on the supply chain. This paper presents preliminary research concepts regarding a new approach to the identification and prediction of supply risk. This approach to the assessment and classification of suppliers is based on supplier's attributes, performances and supply chain characteristics, while it is also modified by factors in the supplier's specific environment. The challenges posed to supply chains due to a turbulent environment (both from within the industry and external influences) are examined. A new method for the assessment and classification of suppliers based on their characteristics, performances and the environment of the industry in which they operate is presented. The findings are explained within the contingency theory.

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1. Introduction

The risk of disruptions caused by both factors within supply chains (SCs) and outside environmental forces is one of the main concerns of both practitioners and researchers. Supply chain risk management (SCRM) is therefore a field of escalating importance and is aimed at developing approaches to the identification, assessment, analysis and treatment of areas of vulnerability and risk in SCs (Neiger et al., 2009). Various trends that enhance exposure to risks, such as the increased use of outsourcing, globalisation, reduction of the supplier base; reduced buffers, increased demand for on-time deliveries or shorter product life cycles (Norman and Jansson, 2004) are ratcheting up the importance of SCRM. This is highlighted by several practical examples of the high cost

of improper preparation for and response to various events (Chopra and Sodhi, 2004).

Currently, SCRM approaches seek to measure either supplier attributes or the SC structure, use the findings to compare suppliers and predict disruption. The results are then used to prepare proper mitigation and response strategies associated with these suppliers. SCRM is most often a formal process that involves identifying potential losses, understanding the likelihood of potential losses, and assigning significance to these losses (Giunipero and Eltantawy, 2004). A typical example of such an approach is the PRAM methodology developed by the Dow Chemical Company to measure SC risk and its impacts. This approach examines the following factors of a SC: supply market risk, supplier risk, organisation risk and supply strategy risk (Hackett Group, 2007).

Due to the relative newness of the SCRM field it is currently chaotic and somewhat disorganised. There are several different classifications of risks and methodologies and too often they focus only on the prediction of disruptive events instead of the root causes of

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uncertainties. Frequently, only disruptive events (such as bankruptcy, natural disaster or the possibility of a terrorist attack) are included, whereas continuous changes due to a turbulent environment (e.g. a change in customer tastes, technology shifts or supplier priorities) are ignored.

While important, such approaches also usually neglect the fact that the market, technology and environmental turbulence in the supplier's particular market segment are significant factors influencing the relationship between supplier attributes, performance in a SC and the potential for disruptions. Since various suppliers (and suppliers' suppliers) operate in different markets and environments, their turbulence varies and therefore the forces influencing a supplier also differ. While a certain supplier strategy (e.g. ordering large batches to decrease procurement costs or single-source suppliers with long contractual commitments) may be acceptable in a non-turbulent environment, it may be detrimental in a more turbulent one (e.g. in the presence of quick technological advances such as microprocessors or large commodity price swings). Considering all of this, the same supplier attributes, strategy and structure may pose considerably different risks of disruption. Therefore, a comprehensive approach to SCRM has to include supplier-associated turbulence as well as various sources of uncertainty due to supplier attributes such as strategy, structure and performance.

This paper suggests a framework for the assessment of supplier risk of disruption based on their strategy, structure, performance and attributes as modified by turbulence in their specific environment. The approach is grounded within the contingency theory. Since there is no single best way of organising SCs to manage uncertainties and risks, firm-to-firm risk comparisons are therefore the result of environmental demands and attributes that tend to be firm-specific.

The structure of this paper is as follows. First, the role and challenges of SCM in a turbulent environment are presented. Then the main sources of uncertainty and risks are identified and classified. The role of endogenous (market, technology) and exogenous uncertainty in SCRM is analysed. Several approaches to supplier selection, performance measurement and management are discussed. The role of SC strategy and structure is emphasised. Then, a conceptual model for measuring supplier performance is proposed along with an approach to supplier classification and portfolio management. Finally, the application of the framework is shown with the case study from automotive industry.

2. Theoretical background

The claim is often heard that in today's world competition is no longer between individual companies but between SCs (Trkman et al., 2007; Li et al., 2005). Therefore, in order to understand a firm's position a larger network has to be studied and not just a dyadic relationship with a supplier (Wathne and Heide, 2004) since the quality, cost and risks of a product or service offered in the market is a function not only of the particular firm's

capabilities but also the supplier network that provides inputs to the enterprise (Modi and Mabert, 2007). In theory, SCM means a proactive relationship and integration among various tiers in the chain (Trkman et al., 2007). Yet, in practice, increased dependency between companies also means they become more exposed to the risks facing other companies (Hallikas et al., 2004). Consequently, SCs are fragile, in particular due to environmental disruptions beyond their control (Zsidisin et al., 2005). A typical example is the bankruptcy of the Chrysler supplier Plastech, driven by liquidity and cash-flow problems, which led to the temporary shutting down of four Chrysler plants in 2008 that resulted in Chrysler losing millions of dollars.

Effective management of a SC is therefore no easy task since market leaders must face and cope with a multitude of different turbulence factors as well as each supplier's individual issues and relationships (Chakravarthy, 1997). This makes it very difficult to create an effective disruption management strategy, which is a necessary component of a firm's overall SC strategy (Tomlin, 2006). Consequently, effective SCM is rarely fully realised in practice (Li et al., 2005). This leads some to claim that environmental uncertainty can cast doubts on the effectiveness of SCM as a tool to improve a firm's operational performance and profits (Hsu, 2005). It could also be claimed that environmental uncertainty increases the importance of SCM—while many suppliers can perform well in a stable environment fewer can perform well in a more turbulent one. A supplier in a non-turbulent market can operate with a flawed strategy or structure and still achieve an average performance while such a supplier in a turbulent environment could pose a significant risk to the whole chain.

To add to the complexity involved, each focal firm has different sorts of turbulence in its environment that are driven by factors such as industry forces, branches, locations, downstream SC factors like distributors and customers, etc. Accordingly, the same management approach and performance rankings cannot be used to manage the same supplier that may service different company locations or divisions. In addition, the importance of suppliers in a particular SC varies. Some are more important for the overall success of the chain than others. It is likely that risk in relationships with strategic suppliers is more important for SC performance (Hunter et al., 2004).

Our research contributions in this paper can be explained within the framework of the contingency theory. This claims that there is no single best way of organising/leading and an organisational/leadership style that is effective in all situations (Fiedler, 1964) and there is no universal set of choices that is optimal for all businesses (Gingsberg and Venkatraman, 1985). Therefore, firm-to-firm strategy differences are the result of environmental demands and tend to be firm-specific. This lack of generalisability precludes organisations from utilising a universal strategy (Fredericks, 2005). A firm's business performance is affected by how well its organisational resources match with the corresponding business environment (Kim and Pae, 2007). However, in today's

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