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Managing Risks in Supply Chains

How to Build Reliable
Collaboration in Logistics



ERICH SCHMIDT VERLAG

Managing Risks in Supply Chains

How to Build Reliable Collaboration in Logistics

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Preface

The supply chain management approach has been discussed intensively in practice and research since its appearance in the early eighties. Most companies today organise their supply chains in accordance with this approach and try to collaborate closely with their suppliers and customers. Especially in the field of reducing inventory and streamlining activities within supply chains important improvements have been realised during the last years. However, beside these successes some new problems occur with the increasing appliance of the supply chain management concept.

One of these challenges is the growing exposure to risk many companies are faced with. Reasons for the increasing risk exposure are the reinforcement of traditional business risks like uncertain demand as well as the occurrence of new risks due to the close cooperation and dependence within many supply chains. The attempt to form lean supply chains by reducing buffer stocks and the concentration on fewer suppliers lead to an increasing vulnerability of supply chains. Companies within these chains are depending on the risk situation and the risk management capabilities of other their partners as well as the supply chain as a whole. Simplified it can be adhered that the more companies integrated in supply chain management the higher is their potential exposure to risks. In this context it is necessary to define a manageable risk level which is a tradeoff between reducing costly buffers and being responsive in the case of incidents. Keeping this risk level a further integration in supply chain management is only possible with an advanced collective risk management. An inter-organisational risk management approach is a necessary base to form lean supply chains with a maintainable risk exposure for all partners. Unfortunately, a certain number of companies do not remain on their defined risk level and enlarge their risk exposure until an incident in their supply chain takes place which threatens their own business as well as the business of all Supply Chain Partners.

The aim of this book is to highlight by the means of profound scientific concepts, empirical analyses as well as by practical examples how the implementation of supply chain risk management concepts can be enhanced. Therefore the first section contains a theoretical framework of managing risk and uncertainty as well as concepts to combine supply chain risk management with complexity and performance management. The second section provides a practical perspective of risk management focussed on vulnerability and reliability of supply chains. Especially the consideration of auditors experience in this field allows a differentiated point of view on inter-organisational risk management. In addition the underestimated force of behaviour risk is emphasised in this section. The third section deals with analys-

ing risks in the supply chain context. Focussed on product non compliance and uncertainty in delivery it is shown how risk can be assessed. Key risk drivers for logistics outsourcing are identified, also. The enrichment of supply chain risk management through the transfer of other management approaches and methods is discussed in the last chapter. Here the application of the system and the agent theory to supply chain risk management is shown for instance.

We would like to thank the authors for their excellent contributions to this book. All papers show a high quality and provide a part to the scientific progress in supply chain risk management research. An additional thank should be given to the publishing company, the Erich Schmidt Verlag, especially to Dr. Joachim Schmidt who has convinced ourselves with his very professional, friendly and cooperative manner. This book would not exist without a good organization and preparation. We would like to thank Dipl.-Ing. oec. Philipp Hohrath and Dipl.-Ing. oec. Christian Martin Meyer for their efforts to prepare, structure, and finish this book.

Hamburg, August 2006

Wolfgang Kersten and Thorsten Blecker

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Supply Chain Risk Management: Development of a Theoretical and Empirical Framework

Wolfgang Kersten, Mareike Böger, Philipp Hohrath, and Hagen Späth

Abstract

This paper shows why the vulnerability of supply chains and therefore supply chain risk is increasing. First, the definition, the sources and the drivers of supply chain risk are examined. Second, a framework for Supply Chain Risk Management is developed which uses theoretical as well as empirical findings. To use this framework, a combined inter- and intra-organisational supply chain management process is proposed.

Keywords: Risk, Supply Chain Risk Management, Vulnerability, Risk Management Process

1 Introduction

Due to trends such as globalisation and the increasing saturation of markets, competition has become more intense in the last years. These developments forced companies to collaborate more closely using the concept of supply chain management. Supply chain management is an approach to design value chains by optimising the inter-organisational flow of material, information and capital in order to reduce costs and enhance customer value. According to an empirical study of the authors at Hamburg School of Logistics, the cost-related objectives are of greater importance in current practice. But besides the aimed cost reductions, the transfer of concepts such as lean management to supply chains can also have negative implications. One of these is the growing dependence of the partners on each other which is e.g. caused by strongly synchronised interfaces between companies and a reduction of inventory. The dependence leads to the increase of risk in the supply chain. Due to the growing number of companies in a supply network and division of labour, supply chain complexity increases, too.

To handle this increase, the supply chain management concept has to be extended by methods of complexity and risk management. However, to transfer these management concepts from the intra- to the inter-organisational level, some modifications are required. Due to these modifications, two new management concepts

result from the combination of complexity and risk management with supply chain management: supply chain complexity management and supply chain risk management. The latter will be covered in this paper.

By using these concepts, changes of risk and complexity can be recognized, monitored and managed. This is due to the fact that the design and the operation of a value chain on the inter-organisational level determine both the complexity and the risk within that value chain. The actual levels of complexity and risk are important influencing variables and affect supply chain management via the modules of supply chain risk management (SCRM) and supply chain complexity management (SCCM) (cp. Figure 1).

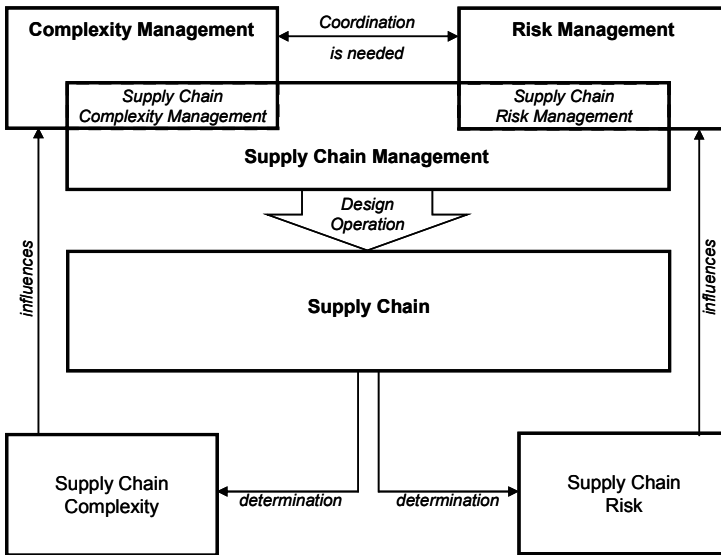


Figure 1: Supply Chain Risk and Supply Chain Complexity Management

Since the management of risks affects not only the level of risk but also the level of complexity and vice versa, a need for coordination emerges which goes beyond the simple integration of both concepts into the supply chain management. Increased complexity of a system generally leads to the emergence of new or the aggravation of existing risks. Correspondingly, a reduction of complexity often leads to a decrease in risks. Despite this causal connection, some measures with the objective to reduce complexity can also cause a negative change of the risk portfolio of a supply chain, thus creating conflicts between risk management and complexity management. The risk portfolio is the sum of all risks a company or supply chain is exposed to. Thus, an increase of the risk portfolio can either mean that new risks emerge or that already existing risks aggravate. If there are conflicts between risk management and complexity management, it is required to develop a closer link be-

tween the two management concepts and to develop a common basis of methods and instruments.

2 Supply Chain Risk

In the literature, the definitions of the term “risk” as well as the instruments that are used for risk measurement strongly depend on the chosen field of research (cp. Christopher and Peck, 2004). Common definitions of risk are based on the volatility of possible return, the concept of information deficits and the willingness to accept a potential loss if positive returns are expected (Baird and Thomas, 1990). In traditional decision theory, risk is defined as the variation in the distribution of potential results, their probability of occurrence and their subjective value (Arrow, 1965). In this case, variance is an instrument for risk measurement that allows quantifying the deviation from an expected value. Thus, risk may indicate both positive and negative deviations from an expected outcome. However, an empirical investigation by March and Shapira showed that risk often is reduced to its negative component in practical business, whereas positive deviations are considered as “chances”. Correspondingly, risk may be defined as the product of the probability of occurrence of a (negative) event and the resulting amount of damage (March and Shapira, 1987).

With respect to the value chain and based on March and Shapira’s general definition, we define Supply Chain Risk as follows: Supply chain risk is the damage - assessed by its probability of occurrence - that is caused by an event within a company, within its supply chain or its environment affecting the business processes of at least one company in the supply chain negatively (cp. Kersten et al., 2006a). In contrast to March and Shapira’s general definition of risk management, this definition includes the origins and sources of potential risks as well as all affected companies of a value chain.

The risks of a company can be classified according to their sources. A literature review provides several classifications. Here, Christopher and Peck’s common classification is used (see Figure 2). They identify five groups of sources of risks within the three areas considered: company, supply chain and environment. The sources of process and control risks are located within the company. Process risks basically comprise disruptions within the production processes, while control risks include management failures and wrong or inflexible decision rules that lead to irregularities. Risks within the supply chain are mainly triggered by disruptions of the material, information or capital flow between the partners. According to the direction of the risks it is possible to distinguish between supply and demand risks (Jüttner, 2005). In contrast, environmental risks represent all potential damage caused by socio-political, macroeconomic or technical changes (Christopher, 2005).

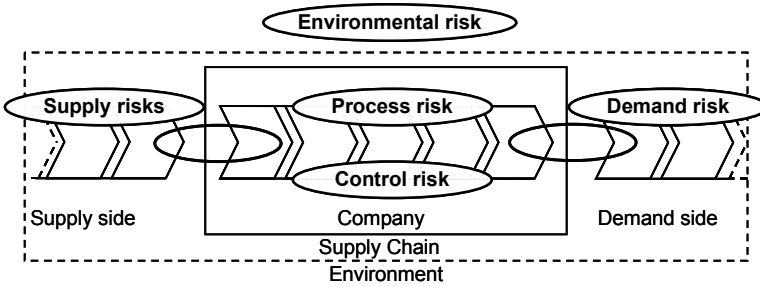


Figure 2: Sources of risk within a supply chain (Kersten et al., 2006b)

In 2005, the authors of this article conducted an empirical study in order to investigate the relevance of the above-mentioned sources of risk. Companies were asked to assess different risk sources with respect to their potential impact and their probability of occurrence. A scale from zero to four was used, where low values correspond to low impact and low probabilities of occurrence. Figure 3 shows the results of this survey for manufacturing companies and logistics service providers. The risks of the two internal sources “process” and “control” are aggregated in the category “company”. Around the average rating of these four sources, the variation of the individual risks is shown.

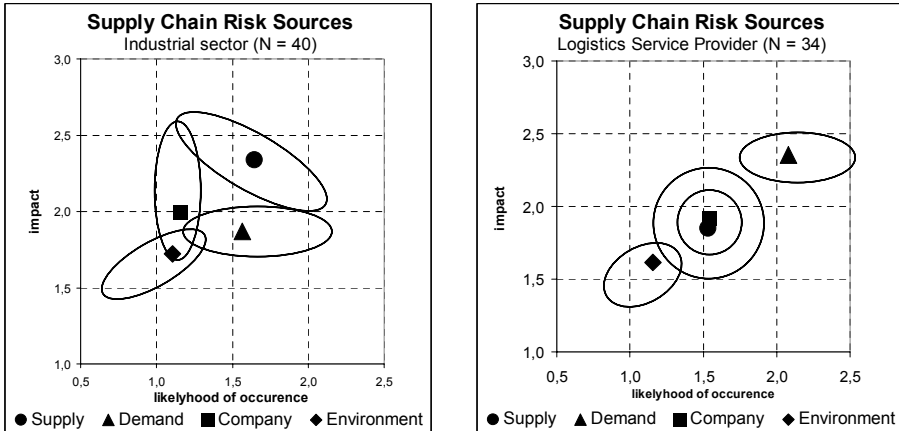


Figure 3: Assessment of the sources of risks within a supply chain by producing companies and logistics service providers.

Risks that combine high values with regard to both dimensions in Figure 3 are considered dangerous, while risks with low values in both dimensions are rather unimportant to companies. Risks with ratings that vary heavily in both dimensions cannot be clearly classified, since there is a strong dependence on the respective company. Figure 3 shows that risks emerging from the supply chain represent the

biggest threat to both groups of companies. Manufacturing companies rated supply risks high with regard to both dimensions, while the logistics service providers assigned high values to demand risks. Likewise, the other source – that is demand risks in case of manufacturing companies and supply risks in the case of logistics service providers – was estimated to be relatively threatening. Environmental risks, that were rated rather unimportant as well, are only a marginal threat from the point of view of both companies groups.

In recent years, the composition of the risk portfolio changed for most companies due to new market conditions. Besides “traditional” risks that arise from the business activity of each company, new risks emerge from sources that are often related to close cooperation (Giunipero and Eltantawy, 2004). The Cranfield School of Management identified the following drivers as causes for the emergence of these new risks (Jüttner, 2005):

- Globalisation of supply chains
- Reduction of inventory holding
- Centralised distribution
- Reduction of the supplier base
- Outsourcing
- Centralised production

The combination of these risk drivers leads to an increasing vulnerability of the supply chains and, hence, to an increasing risk portfolio of each company within that supply chain.

E.g., globalisation leads to an increased geographical complexity in supply chains, while outsourcing and centralised distribution result in organisational and logistical complexity. Simultaneously, companies in a supply chain become more and more dependent on each other when they outsource functions and reduce their supplier base.

Particularly the concentration on a small number of suppliers, or single sourcing in the extreme case, may result in a significant increase of supply risks (Blecker et al., 2005). The breakdown of one supplier may then lead to serious disruptions of the production process of a company. In addition, the ability to compensate disruptions through buffers decreases, e.g. because of reduced inventory (cp. section 2). Companies which are unable to react to such problems might even collapse themselves and pass the initial disruption on to the next company in the production chain. Because these companies reduced their risk buffers as well, disruptions can lead to significant damages. This effect can proceed through the entire supply chain and the breakdown of one company may lead to a damage of partners much further down the supply chain, although they are geographically widely dispersed.

If companies pass their own, mostly internal risks on to their partners, this leads to a larger risk portfolio for all companies of this supply chain. However, companies are often unable to react to this part of their risk portfolio, because the respective risk sources are out of their range and in many cases also out of their visi-

bility. Consequently, these risks can only be integrated into risk management indirectly as supply and demand risks.

The level of vulnerability of a supply chain and the extent of the described effect is proportional to the level of the temporal, functional and relational dependencies within that supply chain (Svensson, 2004). Since the mutual dependency of companies within a supply chain is closely linked to their cooperation and since the importance of this cooperation for the company performance is growing continuously, the vulnerability of the whole supply chain and individual companies will increase further. In addition, the growing intra-organisational complexity, e.g. caused by high variety of variants, causes a higher complexity within the whole supply chain. This complexity, introduced to the supply chain by its members, is an additional risk driver in the supply chain context.

Hence, due to measures of a single company, the risk portfolio changes and risk might increase for all companies in the supply chain. The risk that arises for an individual company simultaneously becomes the risk of another company. Thus, companies have an interest that their supply chain partners manage their risks internally more effectively. At the same time, the question arises of how to divide risks among the partners. In analogy to the concept of profit sharing, risk sharing becomes an issue in supply chain risk management. This aspect of managing co-operations has not yet been covered in greater detail in the literature.

3 Supply Chain Risk Management

A recent investigation by Wildemann (2006) shows that the importance of risk management is growing for most companies. The majority of the investigated companies expected an increased importance of risk management in the future for all areas considered. Own empirical results also indicate the future importance of inter organisational risk management in supply chains (cp. Kersten et al., 2006b). In this context *Supply Chain Risk Management (SCRM)* is defined as a concept of *Supply Chain Management*, which contains all strategies and measures, all knowledge, all institutions, all processes and all technologies, which can be used on the technical, personal and organisational level to reduce supply chain risk (Kersten et al., 2006a).

The process of managing risk in the supply chain context takes place on both the supply chain level and the company level. On both levels the process contains similar steps: identification, analysis, assessment, handling and control of risks (Wildemann, 2006, Hallikas et al., 2002, Chapman et al., 2002, Norrman and Jansson, 2004). First, the individual process steps have to be performed by each company separately on the company level. Before starting the next step on company level, all companies need to coordinate their activities. As mentioned in the previous section, there are many risks which are transferred along the supply chain. A single company is not able to identify and to evaluate all risks which it is exposed to.

▮ The supply chain management approach is prevalent in economical practice today. Important improvements have been realized during the last years. However, the attempt to form lean supply chains by reducing buffer stocks and the concentration on fewer suppliers lead to an increasing vulnerability of supply chains. Numerous managers and researchers have experienced that beside the successes of supply chain management, the exposure to risk is growing for many companies.

This volume, edited by Wolfgang Kersten and Thorsten Blecker, offers the most important perspectives on supply chain risk management. The contributions written by named experts provide actual information about

- workable approaches for supply chain risk management
- analyses of supply chain risks
- identification of key risk factors for logistics outsourcing
- assessment of the uncertainty of delivery.

With this book you will gain central insights how to handle approaches for supply chain risk management within your business. You will learn how to manage risks effectively to build leaner supply chains with a maintainable risk exposure for all partners in industry and services.

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