Supply Risk Management of Automotive Suppliers

Development in a Fluctuating Environment

Master's thesis within: Business Administration
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May 2012
Acknowledgements

The authors would like to acknowledge the following people who have contributed greatly to this thesis.

First of all, the authors would like to thank all the respondents that have participated in the empirical study. Thank you very much for taking the time and explaining the risk management procedures of your company.

The authors further would like to take the opportunity to say thank you to their supervisor Henrik Agndal for his critical input and supportive opinions during the thesis writing process. Furthermore, the authors appreciate the precious feedback of their fellow students in the thesis seminars.

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Abstract

Background: The implementation of procurement concepts such as JIT or single sourcing have resulted in the emergence of new supply risks for automotive suppliers. The economic crisis in 2008 and volatile demand in recent years had enormous impact on the sector. Consequently, in association with lean purchasing models, new dimensions of supply risks have emerged. This creates the need for automotive suppliers to adapt and improve their supply risk management in response to the increased risk potential. There has been no research on how automotive suppliers have further developed their supply risk management recently.

Purpose: The purpose is to examine how automotive suppliers have adapted their supply risk management in response to the fluctuating economy since 2008.

Frame of reference: In this section the Kraljic matrix and the risk management process are presented. The theories lead to a synthesis including the research questions for fulfilling the purpose.

Method: This research is based on a qualitative multiple case study. In order to gather the necessary in-depth data, four automotive suppliers from Germany and Northern Europe were interviewed by the authors.

Conclusions: Automotive suppliers have clearly reacted on increased consequences of supply risks. The general grown awareness and sensitivity have lead to the implementation of new management tools. Particularly the cooperation between supply chain members has considerably intensified and contributed to a better risk reduction. Moreover, the financial stability of vendors has risen in importance and is considered more thoroughly. All the instruments and methods may, however, be more powerful and efficient if automotive suppliers had standardized and linked them into a consecutive process.
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1 Introduction

This chapter introduces the current market situation in the automobile industry and shows how the fluctuating environment influences the supply risks for automotive suppliers. It concludes with the purpose and structure of the study.

1.1 Background

The automotive industry has grown into one global dynamic market. Structural overcapacity is a severe problem that has worsened in recent years of low and volatile demand (Heneric, Licht & Sofka, 2005). The high global competition creates enormous pressure for the automotive sector that suffers from low profitability (Gurcayilar-Yenidogan & Sarvan, 2011). To stay competitive and survive on the market, firms have to improve their performance and reduce costs constantly (von Corswant & Fredriksson, 2002), although basic costs like raw material and energy increase (Fitzgerald, 2005). In addition, the industry has to cope with the enhanced customer requirement of bigger product variety and new developing technologies (Harland, Brenchley & Walker, 2003). Procurement occupies a key role in meeting these challenges (Monczka, Trent & Handfield, 2004). Global business and the growing trend of outsourcing have shifted automotive companies’ attention towards purchasing, because it now accounts for the largest component of many enterprises’ total costs (Sherkin, 1999). Hence, purchasing has experienced a transformation from an administrative function to a strategic activity regarding organisational performance (Giunipero & Pearcy, 2000).

Automotive firms in particular play a pioneering role in adapting innovative purchasing methods such as global sourcing, single sourcing, just-in-time (JIT) or keeping minimum stock (Blackhurst, Scheibe & Johnson, 2008). The implementation of those tools and the management of enhanced product variety cause increased complexity in managing and securing supply (Thun & Hönig, 2011). As a result, new supply risks have emerged and already existing ones have shifted (Harland, et al., 2003). Supply risk is defined as ‘the potential occurrence of an incident associated with inbound supply from individual supplier or the supply market.’ (Zsidisin, 2003, p. 14). The emergence of supply risks can lead to the inability of fulfilling customer wishes or to threats for the safety of end-customers (Zsidisin, 2003). Nowadays, automotive enterprises have to deal with purchasing risks such as supplier bankruptcy, supplier capacity constraints, quality problems, production technology changes, natural disasters or risk of fluctuating currency exchange rates (Zsidisin, Panelli & Upton, 2000).

The increased volume of procurement and the minimization of inventory enhance the probability of being affected by supply risks and the extent of risk impact (Shuguang & Jun, 2010). The failure of vendors to deliver ordered components with the required specification not only influences the company itself, but also the supply firms’ supply chain performance (Wu, Blackhurst & Chidambaram, 2006). Supply disruptions can cause the stoppage of production lines and inaccurate order fulfilment, which leads to dissatisfaction of customers (Pochard, 2002, Wu et al., 2006). Consequently, the emergence of risk can severely impact the financial results of enterprises in the long run. The introduction of tools for preventing and managing risks is therefore of vital importance (Cohen & Kunreuther, 2007).

Risk management and risk control became important during the 1990s (Hunt, 2000). The main issue of risk management at this time was loss prevention through insurance buying
or preventing financial risk with derivatives. The complex and dynamic nature of today’s supply systems and the enhanced importance of purchasing makes the management of supply risk to a much more challenging task (Wu et al., 2006). Purchasing managers have to ensure that vendors interests coincide with the interest of their own organization and those suppliers are able to serve them (Teague, 2007). Less than 50 percent of all risks in the supply chain are clearly visible to the buying firm (Harland et al., 2003). The identification, analysis and reduction of risks are therefore crucial to ensure the constant supply flow, because there are no inventory buffers left (Blackhurst et al., 2008).

1.2 Problem discussion

Within the last four years since the recession in 2008 the global economy has been extremely volatile. Particularly the automotive sector has been challenged with new dimensions of volatile demand (Dicken, 2011). The global sales of vehicles went down from 2007-2009 from around 53.2 Million sold vehicles to 47.8 Million vehicles (Production statistics, 2011). The average degree of capacity utilisation was around 66.7 percent in 2009, which underlines the low demand in that year (Leggett, 2009). As a consequence of the economic crisis in 2008, General Motors the world’s largest car manufacturer, went bankrupt and had to be bailed out by the American government (Isidore, 2009). In contrast, the worldwide sales of vehicles rose by 22 percent in 2010 and reached a total record of 58.48 Million sold items. (Production statistics, 2011). In 2011 the automotive sales reached new peaks, just two years after the recession. For instance, Volkswagen published a profit of 15.8 billion Euros for 2011, the highest ever profit in the automotive industry (Manager-Magazin, 2012).

Even though sales figures have recovered recently, market uncertainty is still very high. Risks like the debt-crisis in Europe or the danger of reduced economic growth in the developing countries, e.g. China (Financial Times, 2012), can lead to a sudden slump in car and truck sales. Automotive manufacturers and suppliers have to continuously adapt their purchasing activities to these fluctuations and must find ways to cope with high demand in peak periods and sudden market downturns. Especially, first tier suppliers of original-equipment-manufacturers (OEM) have been challenged by this uncertainty, because OEM transfer responsibilities (Johnson, Sun & Johnson, 2007) and thereby risks to the preceding supply chain stage. Suppliers cannot circumvent this development, due to the dominating bargaining power of car and truck manufacturers.

Automotive suppliers have to adapt their risk management to the fluctuating market and the development of supply risks. For instance, according to a study of the consultancy A.T. Kearney (2009), more than 50 percent of automotive suppliers in North America faced the risk of bankruptcy in 2009. The industry has to increase their effort in risk management to maintain the level of competitiveness. The enhancement of pro-active management of supply risks is necessary in order to prevent the possibility of supply disruptions and dissatisfied customers (Schmeltzer & Siferd, 1998; Pochard, 2002).

Supply risk management is a new research field (Christopher, Mena, Khan & Yurt, 2011) that has emerged due to the above-mentioned changes in the business environment. Consequently, a general lack of research exists in this field (Thun & Hönig, 2011). Particularly in the context of automotive industry only a few academics have dealt with the subject. For instance, Blackhurst et al. (2008) propose a supply risk assessment and monitoring approach for automotive manufacturers. Thun and Hoenig (2011) investigate
the probability and impact of supply chain risks as well as their key drivers in the German automotive industry. However, neither of these studies examined the impacts of the economic crisis in 2008 on supply risk management actions of German and Northern European automotive suppliers.

1.3 Research purpose
In spite of recent attention was devoted to risk management in the automotive sector, there appears to be no research looking at developments in practice since the financial crisis of 2008. This applies not least to supply risk prevention activities undertaken by German and Northern European automotive suppliers. Consequently, the purpose is to examine how automotive suppliers have adapted their supply risk management in response to the fluctuating economy since 2008.

1.4 Intended contributions
By fulfilling this purpose the following contributions should be made. The authors generally intend to conduct an empirical examination of the phenomenon supply risk management in the automotive industry. A theoretically supported discussion is provided about the changes in supply risk management practices since 2008 as a response to environmental uncertainty, with particular emphasis on which aspects of risk management have changed and the ways in which they have changed. Thereby, it can be identified whether German and Northern European automotive suppliers have pursued different strategies in order to adapt to the market volatility. Finally, general ideas and recommendations about how to develop and implement supply risks management in practice are presented.

1.5 Structure
The remaining parts of this thesis are structured as follows. In chapter two the Kraljic matrix and the risk management process are presented which serve as a basis for the formulation of research questions. The next sections deal with the used research methodology of this study and describe the data collection approach. In chapter five the empirical data are analysed and discussed as a subsequent step after the introduction of interview findings in chapter four. Finally, research conclusions and recommendations for further studies are explained.
2 Frame of reference

In chapter two a description about the two fundamental theories of the study, the Kraljic matrix and the risk management process is given. At the end the synthesis and the research questions are formulated.

2.1 Overview of the framework

Risk management research in the context of supply chain management and purchasing has just recently gained increased attention yet was mainly developed in the beginning of the 21st century (Christopher et al., 2011). Areas of supply risk research were among other subjects, risk perceptions (Zsidisin, 2003), risks and complexity (Choi & Krause, 2006), outsourcing risks (Lonsdale, 1999), or types of risks (Harland et al., 2003). In the following sector two theories are discussed which were much acclaimed in theory and literature of risk management.

The first theory, the Kraljic matrix, is a portfolio approach for structuring and managing the procurement activities. It recommends general strategies for different kinds of purchasing products, each with the goal of reducing and preventing risks in an uncertain environment (Kraljic, 1983).

Subsequently, a general risk management process is described as a strategic approach for coping with supply risks. The process consists of four action steps: identification, assessment, management and monitoring of risks and can be applied in the context of purchasing risks (Hallikas, Karvonen, Pulkkinen, Virolainen & Tuominen, 2004).

2.2 Kraljic matrix

During the 1980s Peter Kraljic created the first portfolio approach for managing purchasing activities (Gelderman & van Weele, 2005). The introduction of this model was lent support when managers advised that corporate purchasing needs a new approach in order to adapt to the new market requirements. Globalization, new developing technology and emerging risks (Pagell, Wu & Wasserman, 2010) create the necessity of coping with environmental change and of protecting the supply flow against severe interruptions. Therefore, purchasing has to convert into supply management (Gelderman & van Weele, 2005). Nearly thirty years after its introduction, the Kraljic matrix is one of the most appreciated models for determining supply strategy in the literature as well as in practice (Pagell et al., 2010). Several other researchers and authors used it as a basis for further investigations of the portfolio method. Those matrices are, however, similar in content, dimensions, and conclusion. Only the terminology used differs from Kraljic’s proposal (Pagell et al., 2010; Gelderman & van Weele, 2005).

The secure supply of parts and components at low costs is essential for being competitive in today’s economy. Especially global sourcing enhances uncertainties and the chance of suffering from supply or price interruptions (Thun & Hönig, 2011). Instead of just monitoring these trends, the Kraljic matrix provides a framework for coping with these problems (Kraljic, 1983). The model pursues the following two intentions:

(1) Its application ensures an efficient supplier management through the utilization of the firm’s purchasing power and through the optimal usage of suppliers’ technology, skills, and knowledge (Caniëls & Gelderman, 2007).
The portfolio approach focuses on securing supply through the reduction of supply risks and on the minimization of supply vulnerabilities (Kraljic, 1983).

Derived from these goals, the Kraljic matrix is built on the dimensions “profit impact” and “supply risk and complexity” (Gelderman & van Weele, 2002). Each buying part is evaluated qualitatively regarding these dimensions. It can either be classified “low” or “high” in the scale. The final 2 x 2 matrix consist of four categories, whereby each good is clearly allocated to one of the following quadrates (Gelderman & van Weele, 2002):

- Non-critical items: low profit impact, low supply risk
- Bottleneck items: low profit impact, high supply risk
- Leverage items: high profit impact, low supply risk
- Strategic items: high profit impact, high supply risk

The evaluation of a component’s profit impact or importance of purchase is determined by the annual purchasing volume and the influence on the enterprises´ financial results (Gelderman & van Weele, 2002). A commonly used ratio is a component’s percentage of the total product costs. The assessment of the second dimension supply risk and complexity consists of a combination of product and market factors. Criteria such as the number of sources, supply market complexity or substitution possibilities are heavily influenced by the product complexity (Kraljic, 1983). For example, the more complex the manufacturing processes of a component, the fewer suppliers have the capabilities of producing this part. Further evaluation factors are storage risks, logistics, and monopoly/oligopoly conditions (Kraljic, 1983; Gelderman & van Weele, 2002). There are several criticisms regarding the simplicity of the Kraljic matrix, because decisions are only based on the two dimensions profit impact and supply risk and complexity. Some important issues such as the context of networks, buyer-supplier relationship or the interdependence's between products are not considered (Geldermann & van Weele, 2005). However, in the authors’ opinion the profit impact and the supply risk and complexity are important factors for decision making in purchasing. Therefore, the Kraljic matrix is an appropriate theoretical foundation for this study.

Figure 2.1 shows the construction of the Kraljic matrix. For each product category a specific strategy and major tasks are defined (Caniëls & Gelderman, 2005). This includes the allocation of resources, the approach to as well as the communication with vendors and the best suitable relationship with suppliers. Due to this differentiation it is possible to manage each supplier according to its needs and the specifications of the purchased good. In total, these recommendations enable an efficient management and an appropriate treatment of the supplier base (Caniëls & Gelderman, 2005). In the context of supply risk management, the recommended strategies focus on the reduction and prevention of supply disruptions (Kraljic, 1983). Depending on the purchased goods’ classification, the supposed strategy enables an effective management of supply risks and the reduction of uncertainties. In the following paragraphs the management of each product category is briefly explained:
2.2.1 Non-critical items

Non-critical items consist of low value, low risk merchandises. Office supplies, travel expenses and services such as repair are examples that are not part of the finished product. Low value goods like screws and other small parts enter the final product, but represent only a fraction of the total costs (Gelderman & van Weele, 2002). In combination with the low possibility of supply risks, non-critical goods therefore have almost no influence on the firm’s competitiveness. These parts are purchased in big lot sizes in order to keep the administration costs down, which comprise a significant part of overall costs. The goal is to streamline and automate the handling and ordering processes (Langley et al., 2009). Regarding risk management, non-critical parts only gain low attention.

2.2.2 Bottleneck items

Bottleneck items are mostly complex engineering parts, characterised by low financial impact and high supply risk. Due to the complexity only a few suppliers in the market are able to produce the item with secure processes in order to achieve high quality at a competitive cost level (Langley et al., 2009). Hence, the focus on managing these parts lies on the risk dimension. The primary intention of bottleneck items is to ensure the supply through keeping stock or close supplier-buyer relationships. In the long run, bottleneck goods should be switched to the category of non-critical items (=reduction of supply risks and vendor dependency). This can be achieved by the implementation and development of new alternative sources as well as through the reduction of specifications (Gelderman & van Weele, 2002).
2.2.3 Leverage items

Leverage items or commodities have a high impact on the financial results and low supply risk. In consequence of the low product complexity, a great range of possible suppliers is available (Pagell et al., 2010). Here the recommendation is to purchase from multiple vendors in order to keep the risks at a minimum level and to increase the price competition between the sources (Langley et al., 2009). Enterprises should exploit the high buying power and use the possibility of switching vendors easily. The major attention is concentrated on negotiating cost savings. Furthermore, JIT should be implemented to reduce inventory costs (Langley et al., 2009).

2.2.4 Strategic items

Strategic items are high in profit impact and supply risk. They contribute the most to the competitiveness of the final product regarding cost level and technology (Langley et al., 2009). Therefore, it is essential to reduce procurement costs to be able to compete on the market. However, the number of possible sources is low, because of the component’s high complexity. Due to the high value, the inventory level is kept at a minimum level (Gelderman & van Weele, 2002). In order to avoid a production shut-down, it is essential to ensure the steady supply of strategic items. Therefore, a close long-term partnership with a financially sound world-class supplier is the recommended solution to keep purchasing costs at a minimum level and to mitigate supply risks (Gelderman & van Weele, 2002).

2.3 Risk management process

The risk management process is a basic guideline for managing business risks. Identifying, understanding and preventing risks are the main goals (Hallikas et al., 2004). The process is based on broad defined stages that can be adapted to particular specifications (Brindley, 2004). Hence, it is suitable for managing risks of a wide range of business fields, such as procurement risks.

A typical process for risk management (figure 2.2) includes four subsequent steps which are based on each other (Hallikas et al., 2004):

- Risk identification
- Risk assessment
- Risk management
- Risk monitoring

The literature provides a high number of variations of the process which differ only slightly in their content (Brindley, 2004). However, the quantity of included stages and their names vary between the researchers. The first step, risk identification can also be labelled as analysis, and risk evaluation is used as a synonym for assessment (Brindley, 2004). The four phases are explained in the following section including models for performing each stage.
2.3.1 Risk identification

The first step, risk identification, creates the foundation for the entire risk management process (Hallikas et al., 2004). Its thorough and conscientious execution is essential for the further success of the process. The responsible employees for this task, for instance the purchasers, have to become aware of future possible occurrences that could trigger problems (Brindley, 2004). The primary goal is to recognize and identify risks and uncertainties in order to prevent their emergence in advance (Brindley, 2004). One critical success factor is the internal communication and the information exchange about risks between the different functions (Eades, Isabella, Laseter, Rodriguez, Simko & Skurnik, 2010). The loss of important information through miscommunication between the involved employees must be avoided, and data have to be forwarded to the responsible persons.

Identifying all risks is generally a difficult task, especially in today’s business environment. The close cooperation of enterprises with its suppliers enhances the dependency and danger of being negatively affected (Hallikas et al., 2004). Furthermore, the extensively long and broad supply networks increase the complexity for predicting all possible risks and problems. Besides the direct relationships with the supplier, a company also has to consider the so-called indirect relationships along the supply chain (Brindley, 2004). It is more challenging to identify those risks because of the missing direct cooperation and information flow between both parties. Through so-called domino effects, indirect relationship can cause sudden risks with severe consequences (Brindley, 2004). It is therefore crucial to collaborate with direct suppliers regarding risk management. They must be encouraged to forward information about possible supply problems and other risks of preceding supply stages immediately (Brindley, 2004). Exchange of information and knowledge is beneficial for both, the buying firm and the entire supply network (Hallikas et al., 2004).

Harland, Brenchley and Walker (2003) further suggest the creation of risk categories. This is not included in the risk management process of Hallikas et al. (2004) and can, therefore,
be seen as one of the main criticisms (Harland et al., 2009). Firstly, the categorization provides the advantage of giving a framework for identifying supply risks. All these categories on that list must be examined for future disturbances in supply to cover the range of possible problems (Harland et al., 2003). For example, “interruptions, quality failures and delivery fluctuations are commonly strong signals of risks in the production systems” (Hallikas et al., 2004, p. 52). Furthermore, the categorization helps to assess and manage risks in the subsequent stages (Harland et al., 2003).

The second part of this step is the thorough analysis of identified risks in order to be able to manage them proactively. It is important to understand the risks, its triggers and its possible effects completely (Brindley, 2004). This knowledge and understanding is the basis for an accurate risk evaluation.

2.3.2 Risk assessment

The second step of the risk management process is the assessment of all identified risks (Hallikas et al., 2004). It is directly based on the preceding identification and in particular the analysis of risks. The knowledge and information gained during this analysis phase are essential for a proper assessment.

The outcome of this stage is a precise and well done risk profile that gives an overview of the risk landscape (Eades et al., 2010). Therefore, each individual risk has to be assessed and prioritized to be able to create a ranking according to its hazard potential and urgency. On the basis of this prioritization the company allocates its internal resources and starts managing its most pressing risks (Eades et al., 2010). Appropriate management measures are determined and based on the results of the risk evaluation and the prioritization (Brindley, 2004).

In order to receive the intended outcome the firms first have to clarify and determine two features of each risk (Hallikas et al., 2004):

1. Probability of occurrence
2. Consequences

Those two elements are the major points to determine during this phase. It is advisable to take environmental factors such as economic growth, market trends, customers, vendors, and other aspects into consideration (Brindley, 2004). These trends depend on the enterprises’ sector and supply market, and therefore, deliver necessary input for assessing risks correctly (Brindley, 2004).

“The likelihood of an event occurring depends partly on the extent of the exposure to risk and partly on the likelihood of a trigger that will realise the risk” (Harland et al., 2003, p. 53). The occurrence of supply risks can be partly influenced by employees, entire companies or can also be beyond their control (Harland et al., 2003). For estimating the probability, the firms’ knowledge and experience is of fundamental importance. Additionally, the direct suppliers and other partners can be consulted. However, there is always the possibility of subjective assessment, which should be avoided (Hallikas et al., 2004).

Secondly, potential losses for companies are assessed. Generally, the business impact of strategic risks like supply chain continuity is not easy to measure (Eades et al., 2010). However, some financial consequences of supply risks such as costs can sometimes be estimated precisely (Harland et al., 2003). For instance, companies can predict the amount
of costs that arise, if the production will be shut down for a while. More complicated is the estimation of immaterial losses like trust, quality problems, and brand damage, loss of customers or loss of knowledge (Hallikas et al., 2004). These consequences only have a small impact in the short term, but can cause severe financial losses in the long-term. It is hard to determine the long-term monetary consequence because of increased uncertainty of possible events (Hallikas et al., 2004). The evaluation of risks can be executed with a qualitative or quantitative approach. In the following section both alternatives are briefly discussed:

2.3.2.1 Qualitative assessment

A common qualitative approach to assess and prioritize risks is the usage of a risk map, as shown in figure 2.3. Each risk is classified into a scale according to its likelihood and financial impact (Eades et al., 2010). The probability ranges between “not probable” and “very high”. The monetary consequence is structured from “no impact” to “catastrophic impact” (Brindley, 2004).

The risk map is divided into four different quadrates that stand for three different categories of risk:

- High risk
- Medium risk
- Low risk

According to the classification of a risk within the four quadrates, the necessity of managing a risk is easily visible. High risk should get the enterprises’ immediate attention and be managed with highest priority (Eades et al., 2010). Whereas, low risks only capture low attention or can be delegated due to its low business impact and low probability of occurrence (Brindley, 2004).

--- Financial Consequence ---- >

*Figure 2.3 Risk Map. (Modified from Eades et al., 2010, p. 280)*
2.3.2.2 Quantitative assessment

Quantitative methods for assessing risks show the precise expected financial impact. In order to mathematically calculate the final overall assessment, the probability of occurrence and the estimated financial loss must be defined. These two factors are subsequently multiplied to achieve the final result (Eades et al., 2010). The risks with the highest final assessment are the ones with priority one, followed by priority two, and so on.

For example, the likelihood of a supply problem with a procured component is 5 percent. The financial consequences of that risk are 5,000,000 Euro. Therewith, the final assessment of this supply risk would be 250,000 Euro (0.05 * 5,000,000 €).

2.3.3 Risk management

The actual management and prevention of risks is the third step of the process. It is about decreasing the likelihood and financial impact of consequences (Hallikas et al., 2004). The risk map and the prioritization of risks created during the assessment phase serve as a starting point for managing risks (Brindley et al., 2004). Firstly, it provides an overview of all risks and reflects which risks have to be managed most urgently. Secondly, it gives an idea whether the reduction of probability or of financial consequence should be in focus (Brindley, 2004). Management actions can generally be divided into buffer strategies and improvement of processes (Zsidisin, Panelli & Upton, 2000). Commonly used strategies for coping with supply risks are:

1. Risk reduction
2. Risk avoidance
3. Risk transfer
4. Risk sharing
5. Risk taking

Both decreasing the likelihood and business impact of risks are options that can be applied by risk reduction. Activities of mitigating supply risks are the implementation of several suppliers for a component and additional inventory. (Brindley, 2004). More current actions are the creation of close, long-term partnerships with strategic suppliers and supplier development (Zsidisin et al., 2000). Thereby, supply processes can be improved and uncertainty reduced in cooperation with the supplier (Brindley, 2004).

By risk avoidance the possibility that a supply risk actually occurs is completely eliminated. This can be achieved by abolishing the triggers that cause the risks (Brindley, 2004). Replacing an incompetent supplier with more qualified and experienced one is an example.

Risk transfer is achieved by concluding contracts with insurance companies. Nowadays, companies have access to a wide range of insurance and agreements that remove or reduce the probability and/or consequences of particular risks (Brindley, 2004).

Moving risks partly or completely to supply chain partners upstream and downstream is called risk sharing (Brindley, 2004). Outsourcing of operations or moving inventory to suppliers are possible actions. An example for sharing risks with customers is the introduction of MTO-manufacturing (make-to-order). Risk sharing is an essential part in supply chain management in order to stay competitive. However, it is important to share not only risks, but also rewards with supply chain partners (Brindley, 2004). In the case of only burdening suppliers with risks, collaboration will never be successful and efficient.
Although there are four distinct alternatives for managing risks, firms must be aware that some supply risks can never be totally eliminated. Risk taking is, therefore, a fixed part of today’s business (Harland et al., 2003). Even though risk management is executed, some risks still come through and affect firms negatively. Besides that, especially low risks are often not managed at all due to their low probability and consequences. However, the decisions if it is worth to manage those risks, differ between the companies (Harland et al., 2003). This trade-off mainly depends on the firms’ size, its attitude towards uncertainty as well as the nature of its operations and supply market. An enterprise’s perception of risk taking is influenced by its employees, their knowledge and experience, as well as the companies past. If a company once has experienced severe supply problems in the past, it might generally handle risks more carefully (Harland et al., 2003).

Although the risk management process describes five management approaches, there is a lack of exact practical recommendations. The user of the process is not advised which of the management strategies should be applied in a particular case. The Kraljic matrix, for instance, proposes specific risk mitigating actions for each category (see chapter 2.2). In addition to the five strategies, companies should think about instruments against events that absolutely cannot be predicted or changed (Zsidisin et al., 2000). Incidents such as natural disasters are beyond the influence of any procuring enterprise. Possible solutions for natural disasters are the creation of stock along the supply network and the implementation of multiple-sourcing strategy for risky components (Zsidisin et al., 2000).

2.3.4 Risk monitoring

The final stage of the risk management process is risk monitoring and controlling. In today’s globalised economy, the market and its environment are constantly changing. Consequently, already managed risks can change (Hallikas et al., 2004). Risks have to be continuously monitored to be able to recognise any and all alterations. In these cases, the determined risk management actions have to be updated and adopted to the new conditions. Without those adjustments, the preceding risk management steps would lose their protective power or even become completely useless (Hallikas et al., 2004). Furthermore, one must check, if the chosen management actions were appropriate. In particular if risks actually arise, it is possible to evaluate the chosen management actions which had been setup in advance (Hallikas et al., 2004). Thereby, new input and knowledge can be gained for future risk management activities.

In addition to the monitoring and controlling of already identified risks, it is necessary to constantly screen the supply side of the company for new risks (Hallikas et al., 2004). Without risk monitoring the danger of being affected by new risks without any preparation in advance is possible. Changes in suppliers, production technology or strategies are signs for new emerging risks (Hallikas et al., 2004). Because of this continuous screening, the authors consider the risk management process as a cycle that always starts from the first step again.
2.4 Synthesis and research questions

As stated in the introduction, today’s supply market is getting even more complex and the risks in purchasing are constantly increasing. Therefore, risk management is getting more important and strategic models for risk management are required to identify all possible risks. For further analytical purposes the authors’ suggestion is to combine the Kraljíc matrix and the risk management process.

Both theories explained in chapter two are appropriate tools to manage supply risks. The Kraljíc matrix classifies purchasing components into four categories according to their profit impact, supply risks and complexity. For each category a purchasing strategy is recommended which also focuses on the mitigation of risks (Kraljíc, 1983). The risk management process is a general guideline for managing corporate risks. The four steps: risk identification, assessment, management and monitoring can be applied in the context of supply risks (Brindley, 2004).

The authors propose to combine the Kraljíc matrix and the risk management process. As a first step, the categorization of components according to the Kraljíc matrix serves as a foundation for the subsequent risk management process. The management of bottleneck and strategic products is essential for procuring organizations due to the high supply risk. Both categories cause purchasing risks more likely and should thus be handled with the risk management process. This process is a thorough, complex and time-consuming analysis of risks which is not worthwhile for non-critical and leverage items. The items are characterised by low supply risks, therefore, the management of supply risks is less important and the attention should be on cost reduction. The combination of the Kraljíc matrix and the risk management process improves the allocation of resources and provides a better focus on crucial items. The categorization of purchasing parts ensures that the efficient and time-consuming risk management process is only applied to products with a high supply risk.

The combination of the Kraljíc matrix and the risk management process is an appropriate tool for managing today’s supply risks and serves as a basis for the empirical examination. By creating a matrix (figure 2.4) based on the two dimensions of the Kraljíc matrix and risk management process, eight different fields emerge that were investigated in the empirical part. Thereby, the authors analysed the differences between bottleneck and strategic products, which have not been considered in previous research. This distinction shall improve the effectiveness of automotive suppliers in managing risks. Supply risk management has become fundamentally important for automotive suppliers in recent years of extremely volatile demand (see chapter 1). Hence, the authors examine whether companies have further developed their supply risk management. Thereby, the created matrix with the eight quadrates serves as foundation for developing the research questions.
In order to fulfil the purpose of the thesis, the following research questions were examined:

1. How have automotive suppliers further developed their risk identification of strategic and bottleneck components?

2. How have automotive suppliers further developed their risk assessment of strategic and bottleneck components?

3. How have automotive suppliers further developed their risk management of strategic and bottleneck components?

4. How have automotive suppliers further developed their risk monitoring of strategic and bottleneck components?
3 Methodology

This section describes the authors' research approach and the selection of case study objects. Moreover, some information about the used interview guide and the data selection are presented. Finally, the analysis process and evaluation is discussed.

3.1 Interviewed based multiple case study

The purpose of this paper is to examine how automotive suppliers have adapted their supply risk management in response to the volatile economy since 2008. The authors chose a qualitative approach, because this method has the advantage of gaining an in-depth knowledge which was needed to understand the mechanisms of change in this area (Gummesson, 2000; Yin, 2009). The way companies reacted to the volatile economy varied and were not known by the authors beforehand. Therefore, the required amount of data could not be collected in a standardised way like that of quantitative research (Saunders, Lewis, Thornhill, 2009). An inductive approach was chosen due to the unknown and changing situation in risk management and a lack of up-to-date literature.

The authors conducted a multiple case study in order to gain data for answering the research questions. A case study is defined as “a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence” (Robson, 2002, p. 178). This method generates a deeper insight and rich understanding of a specific topic (Saunders et al., 2009). According to Yin (2009), a complex phenomenon such as supply risk management is preferably examined through case study approach. Due to the fact that the research field was still being relatively unknown, a multiple case study was the best suitable method to gather the needed information (Marschan-Piekkari & Welch, 2004). The research questions of this paper were constructed as so-called ”how-questions”. Case studies are a recommended approach to examine these kinds of questions (Yin, 2009; Ghauri & Gronhaug, 2002).

A multiple case study enables the creation of more general knowledge about the subject than a single case study (Saunders et al., 2009). By gathering data from various organizations, the findings can either be confirmed or contrary findings can be made (Saunders et al., 2009). Four automotive suppliers were asked the same questions in order to compare the responses systematically and draw conclusions (Marschan-Piekkari & Welch, 2004). Personal interviews were selected for gathering information from the cooperating firms. This is the preferred method as it promotes understanding of how individuals see their situation. This reality is formed through the complex personal framework of beliefs and values that these individuals have developed throughout their lives. This helps to explain and even to predict events that could occur in their individuals' life (Easterby-Smith, Thorpe & Lowe, 2002). Due to the small scope of the empirical study with four companies, it was vital to gather detailed information from each respondent which was needed to fulfil the objective (Easterby-Smith et al., 2002). Interviewing provided the potential of getting detailed and extensive data, because people are generally willing to provide more information orally than through answering written questionnaires (Burns & Burns, 2008). Especially in the case of a student research paper this argument is of some importance. A face-to-face conversation helps to establish a rapport with the respondents and enhances the motivation to provide information (Burns & Burns, 2008). Furthermore, the interviewer is able to repeat and explain questions to the respondents in case of problems (Marschan-Piekkari & Welch, 2004). Thereby, it is possible to prevent
misunderstandings and to gain more honest and accurate responses (Arbnor & Bjerke, 1997).

### 3.2 Selection of study objects

The selection of study objects is one of the most important processes in conducting multiple case study research (Marschan-Piekkari & Welch, 2004). As an initial step for a further search of respondents, a target population was determined. Therefore, a number of defining criteria in relation to the problem and purpose were chosen (Marschan-Piekkari & Welch, 2004).

The fundamental criterion was the fact that only suppliers for automobile and commercial vehicle manufacturers were considered. As already mentioned in the introduction, automotive suppliers had to cope with heavy financial losses during the recession in 2008 and suffered enormously from the fluctuating demand. Thus, it was interesting and necessary to explore how supply risk management had changed in the previous years. To fulfil the author’s research purpose, it was important that the chosen firms are medium-sized or multinational companies. With regards to size, the authors chose firms with a turnover of minimum 200 million Euro and at least 750 employees. Those firms were well established suppliers and delivered products to the main actors in the automotive market. This ensured the fact that the companies were competitive in terms of technology, costs and processes. The professional management of purchasing activities is often the basis for implementing an effective supply risk management. Small enterprises usually did not have the abilities and resources to implement a modern risk management. Therefore, those firms were not taken into consideration. Furthermore, the degree of internationalization was an important factor. In order to be challenged by the major existing supply risks, it was a prerequisite that the firms source their purchasing parts globally. Operating production plants in several countries in the world was a criterion in line with the authors’ intentions.

The actual searching for Northern European companies was executed through the website “www.largestcompanies.com” which gave an overview of the Northern Europe based automotive suppliers. In addition to the above-mentioned criteria, the choice of firms was further limited by the location of companies (Marschan-Piekkari & Welch, 2004). Only firms that operate facilities in Northern Europe were accessible by the authors due to a lack of financial resources and time for travelling. Around 40 appropriate enterprises were found that met the set selection criteria. Those candidates were firstly contacted via personal e-mails and based on their response, the two most suitable automotive vendors were chosen. Furthermore, some German vendors took part in the case study, which fulfilled the criteria. They agreed to participate due to the existing frequent contacts with the authors. This provided the possibility to identify differences in managing supply risks between Germany and Northern Europe.

### 3.3 Interview guide

The creation of an interview guide is a fundamental preparatory task for conducting interviews (Saunders et al., 2007). It was used to direct the discussions between the researchers and the respondents in the right direction. Due to the limited amount of time for every interview, it was essential to structure the conversations (Marschan-Piekkari &
Welch, 2004). The guide served as a checklist to make sure that every important issue was addressed during the interviews and to prevent too much time spent on irrelevant topics. Additionally, the guideline was used as a framework for the subsequent comparison of answers (Marschan-Piekkari & Welch, 2004). The authors used a semi-structured interview guide and fairly standardised set of questions. It provided the main advantage of covering a broad list of themes and questions (Saunders et al., 2009). Additionally, it enabled an increased flexibility to react on and clarify the interviewees’ answers. The researchers were also able to ask further questions about a specific topic which was helpful to explore the different ways of how automotive suppliers have adapted to the volatile economy (Sims, 1993).

During the interviews the authors focused on the tools and processes that automotive suppliers have developed since 2008 with regard to the risk management process and the Kraljic matrix. All questions were, thereby, formulated in a simple way to prevent misinterpretations and the interview guide (see Appendix 1) was sent to the interviewees several days before the interviews. Questions one to four were considered as an introduction to the interviews and should remind the respondents of the financial crisis’ impact. Furthermore, it provided the authors an understanding of how automotive suppliers perceive the importance of supply risk management and categorize buying components regarding supply risks. The following 16 questions were used to examine how the risk management process for bottleneck and strategic products has changed since the economic downturn in 2008. In order to examine the development within the named time period, the researchers asked how the enterprises managed every step of the risk management process before the crisis and how they manage it in 2012. This allowed the authors to make their own analysis and conclusions about the development of supply risk management. The advantage for the respondents was an easier description of the management process of bottleneck and strategic products. They only had to give information about how they worked in this domain before the crisis in relation to the present situation and did not reflect how it changed throughout the time period. Question 21 should provide an understanding how the participating firms think about the appropriateness and efficiency of their current supply risk management actions.

### 3.4 Respondents and data collection

The empirical data were gathered from four automotive suppliers that are headquartered in Central and Northern Europe. As mentioned above, all these companies are highly competitive and operate on an international basis. All respondents are employed in a leading position in the purchasing department, e.g. as head of purchasing. Therefore, they are directly involved in the enterprises’ supply risk management in a responsible function and have proficient knowledge about the risk management activities. In the following section some facts about the conducted interviews are given (see also table 3.1). Some respondents were interviewed twice to ensure the accuracy and completeness of data. Besides the main conversations, the authors kept in touch with the interviewees via e-mail or telephone calls in order to clarify given responses and/or gain missing information.

The contact person of Company A was the corporate purchasing director who is responsible for the entire firm’s procurement activities. The data were gathered through a 45 minute interview on the 23rd of February 2012. An additional second interview of about 40 minute was conducted on April 16th, 2012.
Company B’s risk management was examined through a 50 minute interview on the 6th of March 2012. A second conversation of 40 minute was done on April 18th, 2012.

On the 22nd of March, the authors had an interview with the corporate purchasing director of Company C. The interview took around 40 minute.

The responses from Company D were given by a division’s purchasing director Europe on 20th of April 2012. The interview lasted 40 minute.

<table>
<thead>
<tr>
<th>Company</th>
<th>Respondent</th>
<th>Date 1st interview</th>
<th>Duration</th>
<th>Date 2nd interview</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>Corporate Purchasing Director</td>
<td>2012-02-23</td>
<td>45 min</td>
<td>2012-04-16</td>
<td>40 min</td>
</tr>
<tr>
<td>Company B</td>
<td>Vice-Purchasing Director</td>
<td>2012-03-06</td>
<td>50 min</td>
<td>2012-04-18</td>
<td>45 min</td>
</tr>
<tr>
<td>Company C</td>
<td>Corporate Purchasing Director</td>
<td>2012-03-22</td>
<td>40 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company D</td>
<td>Purchasing Director</td>
<td>2012-04-20</td>
<td>40 min</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.5 Analysis process

The analysis of data can be considered as the interpretation of findings (Robson, 2007). The messages that are included in the gathered raw data should become clear throughout the analysis process. The authors used a qualitative approach to get a deep insight into the complex research field supply risk management (Yin, 2009). Qualitative data analysis procedures enable the creation of theory and ‘helps to shape the direction of data collection’. (Saunders et al., 2009, p. 488) As a consequence of the richness and complexity of data gathered through verbal interviews, appropriate steps need to be taken in order to process the data and to draw final conclusions (Robson, 2007). Saunders et al. (2008) compare the data analysis with the process of completing a jigsaw puzzle. In this context data represent the pieces of the puzzle. ‘This pieces of data and the relationships between them help us as researchers to create our picture, our understanding of what the data is telling us!' (Saunders et al., 2009, p. 512).

In the following paragraph the analysis steps of this study are discussed briefly. Both authors were present at all the conducted interviews and made notes about the given responses. After conducting the interviews, the gathered data were immediately transcribed in order to not lose any important information. Thereby, the researchers could control each other and complement the transcripts. As a next step, it was necessary to reduce the huge amount of gathered data and to ‘condense it into something more manageable’ (Robson, 2007, p. 130). Redundant information which were not helpful to fulfil the research purpose were sorted out. Especially data about facts when the respondents drifted away from the subject matter at hand could be ignored. Additionally, relevant material was highlighted to facilitate the forthcoming process stages (King & Horrocks, 2010). Subsequently, the authors
generated the empirical study (chapter 4). Because a structured interview guide was used for asking questions and making notes, a rough structure of data already existed. So, only minor structural and organizational changes had to be made before completing chapter four. During the actual analysis phase (chapter 5), the authors processed each research question individually. The comparison of responses of the four interviewees with regard to each research question allowed a thorough discussion. The authors identified patterns and linkages in the responses in order to draw final conclusions in chapter six (Saunders et al., 2009). Furthermore, the findings were connected with already existing theory and research literature.

### 3.6 Evaluation

In the following section the authors critically assess the research of the study. It is divided into reliability, validity and transferability.

#### 3.6.1 Reliability

“Reliability refers to the extent to which data collection techniques or analysis procedures will yield consistent findings.” (Easterby-Smith et al., 2008, p. 109). Reliable research secures a high stability in research settings and that the research findings are replicable (King & Horrocks, 2010). Hence, following investigations should allow the same findings and conclusions, if the same procedures and techniques are used (Yin, 2009). There follows an explanation of how the authors ensured a high level of reliability by preventing negatively influencing participant error, participant bias, observer error and observer bias (Robson, 2002).

All respondents voluntarily agreed to participate in the multiple case study and gave information about their supply risk management activities. Through the anonymity of interview partners and organizations in the thesis, the authors ensured the confidentiality of secret business data. As a result the participant bias of getting dishonest and/or inaccurate answers was reduced (Saunders et al, 2009).

A thorough preparation is fundamental for conducting reliable interviews (Sanders et al., 2009). The authors considered several factors in advance of the interviews to prevent participant errors and to improve the reliability. Several days before the actual interviews, the respondents received the interview questions. This allowed the respondents to prepare themselves to give accurate and comprehensive answers. The time and location of the interviews were carefully chosen in order to meet the respondents’ wishes and to create a familiar conversational environment for them (Sanders et al., 2009).

An interview guide served as a structure in order to cover all relevant topics and to steer the discussion in the right direction (Marschan-Piekkari & Welch, 2004). The researchers guided all the interviews together to ensure a consistent way of asking throughout the case study. The authors think it is important to note that the interviews were conducted in English, the researchers and respondents second language. This enhanced the probability of misunderstandings and inaccurate responses of the interviewees. ‘The case study method provides excellent opportunities for respondents and researchers to check their understanding and keep on asking questions until they obtain sufficient answers and interpretations’ (Marschan-Piekkari & Welch, 2004, p. 111). Therewith, language problems and cultural differences among the respondents could be neutralized (Marschan-Piekkari &
Welch, 2004). To avoid observer bias and errors, both researchers made notes during the interviews ensuring all information was recorded correctly (Saunders et al., 2009). Besides the initial data collection further contact via e-mail or telephone was maintained with the respondents to clarify given responses and/or gain missing information.

3.6.2 Validity

The overriding question of validity is whether the findings are really about what they appear to be about, and whether there is a causal relationship between the two variables (Saunders et al., 2009). Therefore, it was important that the questions are closely connected to the answers and not influenced by any disturbances. There are several risks regarding validity, namely history, testing, selection of respondents, mortality, maturation, and ambiguity about causal direction (Saunders et al., 2009).

**History**: History refers to the previous events that have happened before the interviews which can have an impact on the interviewees. In the year 2012 the economy is still volatile and the financial crisis is still current for example in Spain, Greece, or Portugal. However, the automotive sector has outgrown the crisis in the last two years as already explained in the problem discussion. There is no dramatic crisis in the world economy during the research period that could influence validity.

**Testing**: Respondents may remember that they were tested before and bias could be repeated. This error is irrelevant, because for the interviewees it was the first time they had been interviewed in this topic. However, questions of the interviewees were answered and the risk management process and the Kraljic matrix were explained and sent to the interviewees.

**Selection of respondents**: The selection of respondents that are inappropriate can lead to bias in experimental design. All four interviewees occupied leading positions in the purchasing department. Therefore, the knowledge of the interviewees about risk management was high.

**Mortality**: This phenomenon can occur when respondents are not accessible for further contact during the research period, e.g. due to change of employer. All participants were available for the whole time and also answered further questions.

**Maturation**: This error refers to the fact that respondents do not have the same level of response during a later part of the interview than at the beginning. Even if the interviews were long and some information was missing, both researchers made notes during the interviews. Eventually, the written transcripts were sent to the interviewees and afforded them the possibility to read them, revise their answers as well as to add additional information.

**Ambiguity about causal direction**: This error emerges when it is unknown whether one effect causes the other or vice-versa. Regarding the interviews all statements were clear, especially so as the authors had the chance to ask the interviewees a second time.

3.6.3 Transferability

Transferability is ‘the extent to which the findings of a research study are applicable to other settings.’ (Saunders et al., 2009, p. 592). The qualitative research method enabled the authors to gather extensive data and in-depth knowledge about the respondents’ risk management activities (Marschan-Piekkari & Welch, 2004). To enable a higher
transferability and a better comparison between the four responding companies, only automotive suppliers were chosen. Through the examination of cases, positive and negative findings were made on how automotive suppliers have adapted their supply risk management in response to the volatile economy. However, because of the small and non-representative number of four case study objects, general conclusions about the entire industry’s adaption within the recent years can hardly be made. Therefore, further research is required in that field.

Furthermore, it is important to keep in mind that only companies from Central and Northern Europe were examined. Business cultures, organizational structures and management process significantly vary between different geographical regions (Hofstede, 2001). Therefore, the transferability of findings to automotive suppliers in other regions is limited. As already mentioned above, the authors only analysed one business sector, namely automotive suppliers. So, it is difficult to transfer these results to other business sectors. Additionally, only first tier automotive suppliers participated in the multiple case studies. There are constraints of applying the conclusions to companies that are located in earlier stages of the supply chain.
4 Empirical data

This chapter introduces the findings from the interviews with the four participating automotive suppliers. After providing general information about each company, the presentation of data is structured in relation to the research questions. During the data collection the authors discovered that companies do not differentiate between bottleneck and strategic items. Therefore, no distinction is made between these two product categories.

4.1 Company A

Company A manufactures plastic parts for the automotive industry. Its assortment includes a wide range of plastic components for the interior and exterior of vehicles. The medium-sized firm has more than 800 employees and is headquartered in Northern Europe. Additionally, it runs several production plants in Western and Northern Europe.

Company A’s purchasing director underlined that the procurement and production complexity has grown in recent years due to the increasing number of modules, varieties and options. Furthermore, the drive towards extremely low inventory and frequent JIT-deliveries triggers new challenges for managing supply. Therefore, the extreme demand volatility in the car/truck industry between 2007 and 2012 has created new and more serious supply risks. During the recession in 2008, Company A’s sales went down by 60 percent in comparison to the preceding year. The interviewee emphasized that the importance of supply risk management rose enormously in order to secure the product flow. Nowadays, Company A’s performance is measurably influenced by the fluctuating prices for raw material as well the increasing electricity price in Northern Europe. Moreover, the threat of supplier bankruptcy has risen due to the volatile demand. The respondent states that the current risk management is not sufficient to cope with these risks.

Company A purchases raw material as well as metal and plastic components for its production and final assembly. This differentiation serves basically as the classification of buying components regarding supply risk management. Several suppliers are approved for delivering raw material, wherewith a certain flexibility and security in supply is ensured. As a result the general probability of raw material supply problems is low and manageable. Furthermore, metal as well as plastic components are purchased for the assembly of final products. The company mostly applies a single sourcing strategy for those components, because of the high competition in the market. This policy enhances supply risks, however, automotive OEMs require and admit the increased risk potential.

4.1.1 Company A´s development of risk identification

Company A performs the proactive identification of supply risks to a large extent during the supplier selection phase. Before starting final negotiations with a new possible vendor, Company A examines the candidate enterprise. Thereby, the purchasers analyse several fields in order to assess the probability of supply stoppage and to finally choose the supplier with the lowest risk potential. The screening in context of supply risk management mainly concentrates on the financial stability as well as logistics and supply performance. The respondent stated the current pro-active risk identification is just partly more effective than before the crisis. This is because of the stable and well known supplier base which is mostly considered for sourcing of new components. Company A generally maintains intensive contact with its suppliers to gain information about their general performance or existing problems. So, it has the opportunity to identify risks such as supplier bankruptcy in
advance. However, the respondent emphasized that the enterprise nowadays invests more effort and resources in the screening of possible sources. The employees are now more aware of purchasing risks and analyse more thoroughly. One outcome of the grown awareness is that the framework which has existed for several years is used in a better and more efficient way. The respondent stated that nowadays one main factor is part of the supplier selection process that was not considered five years ago. The today’s high prices for raw material force Company A to apply a tool for identifying cost risks regarding raw material, electricity, and components that are strongly influenced by raw material prices.

The second part of Company A’s risk identification is a reactive monitoring system of supply. Any logistics or quality disturbances in supply are recorded in that automatic system. In case of disturbances, an employee creates a complaint report that is sent to the responsible purchaser, the quality department, and the supplier. Thereby, Company A has the ability to recognize risks as soon as some small warning signals emerge. This system is implemented in all the production plants of Company A. Since some suppliers deliver one product to several plants, the connectivity supports the secure spread of information about supply problems. This automatic system was introduced a few years ago as a consequence of the economic crisis. Before its implementation, the internal and external spread of information about supply disturbances was done by traditional contact via phone or e-mail. Today’s process is, however, ‘more powerful, structured and documented’ than the former procedure.

### 4.1.2 Company A´s development of risk assessment

The respondent stated that the ‘assessment of risks is slightly better’ compared to the time period before 2008. Nowadays, Company A uses the above-mentioned automatic supply monitoring system as a foundation for the risk assessment. All identified supply disturbances are evaluated according to their severity and frequency by the employee that is responsible for generating the complaint report. The scale for categorizing the supply risks with regard to both dimensions is structured from one to five. For instance, the risk of production stoppage is very severe and is, thereby, classified to level 5. Compared to the period before the recession in 2008, the tool and process for assessing risks remained very much the same. However, Company A now has a higher awareness and knowledge about supply disruptions, whereby, the interviewee explained that they are ‘better in assessing risks’ now.

Moreover, Company A further developed its assessment of pricing risks which is related to the fluctuating raw material prices and the increasing costs for electricity. The evaluation of those risks is done in cooperation with the financial department.

### 4.1.3 Company A´s development of risk management

According to the respondent, the close cooperation along the supply chain is an effective and essential tool to secure the production. Especially the collaboration between Company A as a first tier supplier and the OEMs is sophisticated and improved in the last years. There has always been cooperation, however, not at this advanced level. Nowadays automotive manufacturers accept the need and are more willing to be flexible in their assembly line. OEMs can change production schedules slightly on short-notice if necessary. Thereby, they can react to small supply problems such as shortages or delays of individual components and variations. Company A uses the better cooperation with its customers to reduce the consequences of supply problems. Additionally, Company A generally informs its customers about more severe supply problems that could affect the manufacturers. Due
to the improved collaboration, the customers often support Company A by solving supply problems.

The purchasing director stated that the risk of supplier bankruptcies has considerably increased in the automotive industry. Because of today’s demand volatility, this risk occurs regularly on the market. However, Company A has never performed and does not perform any specific procedures for managing insolvency risks. According to the interviewee, the compulsory processes that apply in case of insolvencies in the sourcing countries enable the effective management of this risk and secure the supply of goods. In effect, the probability of supply disruptions is quite low.

As a result of enhanced globalised business as well as the economic volatility, prices for raw material such as plastic granulate fluctuate enormously. In addition the price for electricity increases. The respondent underlined the importance of managing those price risks: ‘If you do not understand what you do, you can lose a lot of money’. Consequently, measures and reports are applied are created regularly in order to analyse and manage the development of those cost factors, and to identify trends and possible problems. Nowadays, the management is more efficient and centralized in the company’s headquarter. Several years ago, the controlling of those costs was of minor importance. Company A manages the volatile raw material prices through special long-term contracts with its suppliers. By doing this, it is easier to plan the emerging costs and it is possible to reduce the impact of price fluctuations. The management of financial risks based on increasing electricity prices is done by hedging which was not the case five years ago. By cooperating in this manner, the financial department substantially supports the purchasers.

Nevertheless, sometimes it is not possible to manage price fluctuations and its impact on the material costs. In such a situation, Company A has to negotiate and ‘approach customers to get compensated’ for the increasing purchasing costs. Nowadays, a better understanding exists for this at the manufacturer level which in turn is a consequence of the improved cooperation.

In contrast to the above-mentioned purchasing risks, supply disruptions caused by natural disasters like earthquakes, floods, etc. are not considered. The purchasing director said that this kind of risk is generally out of focus, because it cannot be handled. The reactor disaster of Fukushima, Japan in 2011 underlined this statement. Firstly, it is impossible to identify catastrophes and to determine the time and place of occurrence. Secondly, the actual management and prevention of supply problems triggered by natural disasters entails unreasonable high expenses. Only costly procurement methods, such as extensive buffer stock or multiple sourcing strategies, can cope with that problem.

### 4.1.4 Company A’s development of risk monitoring

As already mentioned in the risk identification section (see 4.1.1), Company A recently introduced an automatic supply monitoring system. This system is mainly used to control the logistics and supply performance of suppliers. In cases where a particular supplier causes supply problems, the monitoring system is an efficient tool to investigate the further development of the order fulfilment. Before the economic downturn in 2008 a systematical monitoring of deliveries with regard to supply risks was not performed.

In addition, the monitoring of raw material and electricity prices is very important for Company A. Nowadays, the creation of monthly reports about the development and status of prices is a fixed component that did not exist several years ago. Those reports are used
to evaluate where Company A stands compared to the market and the average market price. Furthermore, the firms can follow its hedging position with those reports. The respondent said that creation of reports has improved over the last years. However, there are still some categories less monitored than necessary.

### 4.2 Company B

Company B is one of the biggest automotive suppliers in the world with an annual turnover of above 40 billion Euros in 2011. The headquarters is located in Germany, but the firm is represented in more than 150 countries. The company produces and assembles components of various technological areas for the most important car and truck manufacturers. Company B suffered from turnover downturn of 50 percent during the economic crisis and had for the first time in the company history a financial loss in the year 2008.

Company B applies two different classifications of buying products. In the first scheme the components are categorized from A to D. Components with the risk categorization A are only available from one supplier and no further vendors are able to produce them due to the high specifications and requirements. Parts with the risk categorization B can be manufactured by various suppliers, but only one supplier is approved by Company B. Components of risk category C are produced by one supplier that runs several factories. So, the tools can be shifted between the production lines quickly within one vendor. Components with the risk categorization D are produced by several suppliers and are globally available. Although Company B classifies its procurements goods into four categories, the processes and instruments for managing supply risks do not differ.

A second categorization was developed in the beginning of the 21st century and firstly applied as result of the economic crisis in 2008. As a basic step Company B identified the finished products for which it operated as a single source. In these cases, the consequences of supply problems are more severe because there is no further alternative for its customers. Subsequently, it was investigated which suppliers deliver procurement parts for those finished products. Depending on the above-mentioned risk categorization Company B examined alternative scenarios and action plan to be able to replace this supplier.

The financial crisis and the reactor disaster in Fukushima in 2011 helped to make supply risk management a more sensitive and important topic. Company B has standardized and implemented all risk management processes globally. However, in the opinion of the interviewee the main difficulty is the costly implementation of risk management strategies combined with customers’ unwillingness to fully compensate the expenses. Risk management is essential during the crisis, but years later it can fall in oblivion. Therefore, it has to be established in the management processes and has to be audited regularly. The interviewee is not sure yet, if the processes are sufficiently established in Company B.

#### 4.2.1 Company B’s development of risk identification

Risk identification is part of the supplier selection stage. Before a decision regarding a new supplier is made, several requirements must be fulfilled. In the first stage Company B differentiates between known and unknown suppliers. In the case of an already existing supplier-buyer relationship data from audits and performance monitoring can be
considered. These data include all relevant information about the supplier; consequently an extra visitation is not required.

If the supplier is unknown, Company B uses an evaluation to analyze the potential of the candidate. Topics which are included in the questionnaire are quality, know-how, delivery performance, logistics, financial capability, and production capabilities. In this case every supplier has to reach a certain number of points in order to be considered. By taking these steps the enterprise reduces the probability of supply risks during a possible supplier-buyer relationship by searching for weaknesses of their suppliers. This process ensures the implementation of a reliable supplier base. Afterwards, the supplier gets an initial order, in which the partners agree on the type of relationship. Five years ago the risk identification was basically conducted in the same ways, but its execution is more sensitive today.

4.2.2 Company B’s development of risk assessment

Company B assesses risks by using audits like before the crisis in 2008. However, the attention to supply risks during the audits is increasingly higher nowadays. These standardized audits are performed by specialists, namely the supplier development department. During the audits different topics like the possibility to increase the order volume, the capability, the industrial facilities, and the financial health are examined. Furthermore, the quality, logistics and production capabilities are significant in the risk evaluation as well. Suppliers have to reach a score of 67 percent, otherwise orders cannot be placed. The objective is to reach a score of more than 95 percent by trainings and continuous improvement. In addition, suppliers have to fulfil certain requirements. For example, if a supplier is too dependent on one employee, Company B does not take this vendor into consideration.

4.2.3 Company B’s development of risk management

The management of supply risks has a higher significance in the purchasing activities nowadays. During the crisis the high inventory level was one of the major threats for suppliers to declare bankruptcy, because there was no demand for their parts. Previously the company was not aware of this problem/threat. In recent years Company B concentrated on decreasing the safety stock along the supply chain. In addition, the suppliers were pushed to implement new concepts such as JIT, kanban and new stock strategies. However, concerning suppliers without any second source the company holds a safety-stock of around one week worth of material, in order to react to delivery disruptions.

If problems occur during an audit or the supplier selection stage, employees of Company B or external specialists try to find a solution. Also, trainings for the suppliers are provided to realize continuous improvement. Company B has the philosophy to create a partnership with their suppliers and work with them in the long term. This philosophy was already implemented before the crisis. As a result of the recent market volatility, Company B implemented the position of a risk manager in its organization to manage supply risks more efficient. This employee only works with suppliers that represent a risk for the company and tries to solve these problems.

In recent times of volatile demand Company B has recognized that the supplier base is too complex and every additional supplier increases this problem. Small companies did not have the financial capability during the financial crisis which was problematic for them. Today, the company is trying to reduce the number of suppliers to have a better structured and manageable supply chain basis. Fewer suppliers will get a higher volume of orders and
the relationship with those will be closer. In consequence, the implementation of new suppliers has been complicated.

During the crisis Company B cooperated with competing automotive suppliers and some of the automotive manufacturers to reduce the impact of the crisis. For example, in meetings they informed one another about the importance of the suppliers. Based on this they decided whether they should reduce, and if yes, by how much they can reduce the orders. The main reason was to prevent bankruptcy of important suppliers. Even if companies are normally competitors in special situations they work together. The interviewee said: ‘By working together in special situations some risks could be reduced enormously, but should not exchange the structured risk management.’ Competitors had never worked together regarding supply risk management before the crisis in 2008.

One of the main risks was the sharply decreasing order volume in the supply chain. Automotive manufacturers cancelled orders and shifted the problem to the first tier suppliers. The focus within the enterprise to in-source and produce products lead to high investments and increased the problems. Company B also tried to reduce the orders, but it was not possible due to the financial capability of their suppliers and the inflexible contracts. In this case the risk allocation and the contracts were not balanced and as the interviewee said: ‘They were left to work on their own.’ The contracts with automotive manufacturers have been newly negotiated, but due to the power of its customers and the increasing competition the risk balance could just slightly be improved. However, a planning tool has been implemented between Company B and their supplier and customer. Customers forecast their demand for the next twelve months and provide this information to the company. These planning tools are updated monthly by their customers and increase the planning security in the whole supply chain. As a consequence of the steep decline of sales volume, Company B had problems due to the missing production flexibility as well. Nowadays, the firms performs the policy to hire a higher rate of employees with fixed-term contracts to enhance the internal flexibility. Furthermore, the increasing outsourcing ensures a faster reaction during a crisis.

4.2.4 Company B’s development of risk monitoring

Today, Company B performs a continuous and precise monitoring of suppliers. The Fukushima crisis reminded the enterprise to increase the effort in monitoring. The main aspect of risk monitoring is the financial stability of vendors. If a supplier has a turnover of higher than 30 percent with Company B, he is monitored and is annually asked to report his business development. If the supplier has a turnover with more than 50 percent the raster is even tighter. This method allows Company B to monitor the financial stability of suppliers that considerably depend on Company B. Those suppliers are in particular threatened of bankruptcy if Company B reduces the order volume. If employees of Company B want to increase the amount of orders for components of a supplier with a turnover of about 50 percent a special release is needed. This special release is only given in the case non-availability of other suppliers or high cost of change.

Before the financial crisis this tool was already implemented, but not properly used due to time and cost pressure. However, during the financial crisis some of the suppliers were not financially strong enough to survive without help. Therefore, the importance of this tool has enhanced.
4.3 Company C

Company C is a global automotive supplier with 20 locations around the world and is headquartered in Northern Europe. The business of the company is divided into five business areas namely interior systems, drive-line systems, actuation and chassis, fluid transfer systems, and power product systems. In total, approximately 10,000 people are employed in the five business units.

The respondent argues that the main risk in the volatile economy is the unforeseen dropping of demand. By an unforeseen drop, the stock along the supply chain is too high and cannot be reduced fast enough. This leads to tied up capital and financial problems for suppliers. The application of lean management shall reduce this risk and, therefore, has a substantial influence on the company. As a consequence of reducing the inventory level, the risk of supply disruptions increases, especially by pushing the components back to the supplier of the supplier.

Company C conducts no explicit classification for products regarding supply risks. However, the firm has a sharper focus on suppliers with a high purchasing volume, suppliers that produce several parts, and single sourced components. The respondent also underlined the strong dependency of Company C on its customers. Automotive manufacturers basically dictate which sub-suppliers should be chosen, whereby, Company C has only minor influence on the decision. This leads the company into the position that sometimes small and weak suppliers are approved due to customers’ wishes or specifications of components. More suitable candidates cannot be chosen, which leads to an increased risk potential. In addition to this, the interviewee stated that ‘every supplier is important and the focus is on the total value chain.’ Also the relationship with the suppliers has become closer, i.e. the forecasting in particular, due to its increased importance.

4.3.1 Company C’s development of risk identification

Company C has a stable supplier base, which it has used for years. From this pool of suppliers, the firm decides which supplier is most suitable to solve a problem or fits best for a certain project. Therefore, the monitoring of already existing suppliers provides fundamental data about supply risks for the supplier selection. This policy of using reliable partners was introduced before the crisis in 2008 and has not changed.

4.3.2 Company C’s development of risk assessment

The respondent stated that audits are used to examine the financial capability, production flexibility, the processes, and the technology of vendors. However, this is executed to assess the capability and probability of supply risks in general. Only companies that have been examined and reach a certain standard in each category are taken into consideration. Company C considers all supply risks on the same level of importance and there is basically no risk that is more crucial than another one. Therefore, they do not differentiate between any risks, because every risk can have a negative impact for the company. As the interviewee said, ‘I cannot say that one component or risk is more important than another.’ Company C only has a limited number of suppliers which it can source from due to customers’ restrictions. Thus, single sourcing and close relationships with suppliers are mostly the chosen strategy. Especially, single sourcing leads the company into dependency of the supplier and one disruption in the supply chain can lead to dissatisfaction of customers.
Before the recession in 2008 Company C performed the same policy regarding the assessment of supply risks.

4.3.3 Company C’s development of risk management

One major development of Company C’s risk management is the revision of procurement contracts. Previously, the signed agreements determined an approximate amount of components that had to be procured during a particular time period. Nowadays, Company C has the ability to only order the needed volume. Through this, the enterprise is more flexible and can react more efficiently on unpredictable demand fluctuations. The company only informs their suppliers about the expected demand for the next five months and the planned order volume for the next two weeks to reduce their risks. Their suppliers are encouraged to perform the same procedures with their suppliers to reduce their risks as well.

The cooperation between suppliers and Company C has increased significantly in recent years. When problems occur the company tries to help its suppliers in any way they can. Therefore, the supply risk team has been implemented and is the main change in managing risks. The supply risk team consists of experienced purchasers and only handles problems of the vendors. Before the crisis the relationship between the company and suppliers was strong already, but since the crisis the company intensified the relationships and has gained direct access to potential problems.

In alignment with the improved cooperation is Company C’s support of suppliers with materials and funds during and after the depression. Firstly, banks had less faith in their vendors during the crisis and denied to lend money, which created financial troubles. Secondly, the rapid growing demand of raw material and components after the slump was problematic for suppliers due to the restrictive lending policies of the banks. Smaller distributors were financially not able to purchase the high amount of raw material and components due to the low liquidity. Therefore, Company C financially supported some of them to secure the supply.

Meetings about supply risks also have been implemented, in which the purchasers inform the management about current supply problems. This identifies potential problems in advance and increases the speed and efficiency in managing risks. The interviewee said that introduction of regular meetings is a huge success and is supported by the management.

4.3.4 Company C’s development of risk monitoring

Before the economic crisis in 2008 the company implemented a lamp system to monitor supply risks, which is conducted in the same way nowadays. The main fields that are controlled are the quality, logistics, and financial risks. Thereby, each field is evaluated with the colours red, orange and green. All suppliers are scored on these three levels and audits with the suppliers are held regularly to keep track of the development.

The recent implementation of the supply risk team enables Company C to monitor the development of supply risks more thoroughly. Nowadays, in some cases a member of the supply risk team constantly accompanies and controls the supplier. Since the crisis monitoring is more important and the company is closer to the supply problems. As the manager said: ‘The company has learnt their lessons from the crisis, because suppliers went bankrupt or had not the capability when the economy grew.’
4.4  Company D

Company D manufactures and delivers mechanical, pneumatic, and electrical components to the commercial vehicle sector. The firm is headquartered in Germany and has around 9,000 employees worldwide. With its production, sales and service centres, the supplier is located in more than 20 countries. The economic downturn in 2008 severely affected the enterprise. The turnover went down by more than 50 percent, whereby, its suppliers had to cope with a similar decline.

Company D’s general business environment has worsened compared to the years before the crisis of 2008. The economic stability in Europe, but also all over the world has not returned to the level of five years ago. Fluctuations of raw material prices, melted down cash reserves of enterprises, and the political/financial crisis in Europe created enormous uncertainties. As a consequence of those uncertainties and fluctuations in the market, new threatening supply risks have emerged, according to the respondent. Especially the threat of supplier bankruptcy has risen because of the changing demand. A major risk for the secure supply of goods is steep increase of volume demand. Those can lead to raw material shortages and/or personal shortages, because suppliers along the supply chain cannot raise the capacity in this pace. A further problem that impacts the purchasing performance is the growing unpredictability of the sales planning. In the past this has been more stable and so called “frozen zones” for ordering goods enjoyed more respect. An additional important supply risk, also resulting out of the crisis, is the increasing Low-Cost-Country (LCC) sourcing share. Due to the crisis, many projects have been triggered in LCCs with the objective to generate cost savings. However, the management of sources from Asia or Easter Europe entails higher complexity and problems for securing supply.

In the context of supply risk management, Company D does not categorize its buying goods. All components are managed with the same processes and tools. According to the respondent, Company D still has a more re-active driven risk management for the supply base. Particular, ‘the close contact to the suppliers and a tight contract landscape prevents a lot’.

4.4.1  Company D’s development of risk identification

As a consequence of the economic crisis in 2008, Company D created a financial risk management process as a standardized and structured management tool. It was necessary to implement this tool in the process landscape due to financial problems of several suppliers that emerged after the steep drop of sales. The interviewee stated that today no explicit tool for identifying financial problems of suppliers exists. The recognition of warning signals is mainly based on the communication with its reliable suppliers that inform Company D about emerging troubles. Furthermore, the extensive network of business partners in the industry provides news and rumours from the market. For instance, common indicators of financial risks are repeating ownership change or pre-payment requests. Before the downturn in 2008, the enterprise identified its supply basically in the same way.

The execution of audits is a way to identify logistics, quality and process risks. Company D performs several different kinds of audits, e.g. VDA process audits are typical for the automotive industry. Those audits are firstly done during the supplier selection phase in order to assess whether a potential supplier has the ability to meet the market requirements. Furthermore, audits are executed regularly during the supplier-buyer relationship by the quality department. At the beginning of every year, a supplier audit plan is created as a guideline. In the last years Company D has only made minor adaptations in that domain.
In the case of a regular buyer-supplier relationship Company D controls incoming goods. Thereby, it is possible to detect whether the delivered goods meet the required specifications and whether the order fulfilment is accurate. In the case of deviations explained below management actions (see 4.4.3) are initiated to prevent the emergence of further supply disturbances. Company D has not further developed the inspection of incoming components.

4.4.2 Company D’s development of risk assessment

In the case of detecting warning signals about financial troubles of suppliers, Company D recently implemented a tool box consisting of three different instruments to assess the risk of bankruptcy: SCHNECK-Rating, DUNS-Reporting, PRE-Audit. Depending on the situation, the most suitable one is chosen to evaluate the financial performance, credibility and risk of becoming insolvent. As a result, a report is created that enables Company D to assess the risks of bankruptcy, possibly leading to supply stoppage. As a result, the financial stability of the examined vendor is reflected from 0 percent to 100 percent.

Company D created an own quality management guideline for procurement that is related to the common ISO/TS 16949 certification. This guide determines several quality requirements for suppliers that are checked during the audits. For instance, there are specifications on how the product approval process of Company D is structured and which special clauses the supplier has to observe. In relation to that, a compliance evaluation form has to be filled out during the supplier selection process in order to evaluate to what extent the supplier fulfills the quality requirements of Company D. A traffic light system makes the rough fulfillment visible. Consequently, Company D is able to assess the general ability of the supplier and it becomes evident in which operational fields supply risks could emerge more probable. A new edition of this guideline was released in 2008 with the revision of some clauses as a consequence of changed market requirements.

4.4.3 Company D’s development of risk management

The subsequent step of the financial risk management is the determination of management actions. Vendors that achieve a rating of more than 60 percent are kept as a supplier. However, if a supplier achieves a result below 60 percent in the preceding assessment, the following actions must be applied. Firstly, a committee is established that consists of at least three members: division manager, purchasing manager, and responsible purchaser. This action team has to make the basic decision, whether the supplier should be stabilized for an on-going supplier-buyer relationship. If the committee determines to maintain the relationship, actions and supporting steps need to be taken depending on the individual situation. For instance, the placed order volume should be reduced stepwise until the supplier is stabilized to reduce the impact of a possible bankruptcy. Furthermore, a safety stock can be built up to cover the supply of about three weeks and the search for a replacing/second source has to be initiated.

The volatile and growing raw material prices are factors that burden the financial performance of Company D nowadays. Therefore, the efficient planning and management of raw material prices is essential. As a response to that development, material surcharge contracts have been concluded along the supply chain. The primary goal is to reduce the financial burden of vendors and to share the risk of increasing prices. However, these contracts influence the financial results of Company D considerably due to the increased material costs. Therefore, the firm also signs material surcharge agreements with its customers that finally have to pay for raw material price changes. There has been a strong
focus on the establishment of these kinds of contracts since 2007 and this has tied up
substantial resources.

One further important action for managing supply risks is the establishment of feasibility
agreements. Those agreements have already been implemented for a longer time period;
however, since 2008 every supplier is forced to sign it. Without the feasibility agreement no
supplier gets the approval to deliver components. With the signature of this contract, the
vendor assures among other clauses that it understood the products’ specifications and that
it has the ability to produce the product with the necessary requirements. Eventually, the
vendor guarantees the fulfilment of ‘order volume, delivery dates and quote price with the existing or
planned production and resources (incl. personal), so that no unexpected costs arise.’ Company D
ensures through the feasibility agreement that a supplier has to bear all emerging costs in
the case of delivery disruptions and production stoppage. According to the interviewee, all
suppliers agree to this contract without any notable discussion.

Company D’s respondents stated that the risk of supply disruptions as a consequence of
steep increases of volume demands has grown significantly in recent years. Based on the
strong and unexpected increase of sales, such as it happened in the commercial vehicle
sector in 2010, suppliers can have the problem of not being able to raise the production
capacity. In handling this problem, Company D has improved its collaboration with truck
manufacturers by stabilizing demand planning for 2nd and 3rd tier suppliers through the
establishment of so called “frozen zones” of demand. Therewith, the suppliers know the
exact purchase quantity about two to four weeks in advance. Consequently, the supplier
can improve its production scheduling and enhance its ability to serve orders accurately. A
further management action that is increasingly applied nowadays is the introduction of
consignment stocks. Therewith, Company D raises its stock level and reduces the
possibility of production stoppage without additional costs. Especially the enhanced
application of LCC-sourcing since the economic crisis encourages the implementation of
consignment stocks. Before the crisis in 2008, Company D did not concentrate on the
implementation of consignment stocks.

In the case of supply problems like inappropriate quality or inaccurate order fulfilment
Company D uses a management process, which was performed similarly five years ago. If
the income department detects quality or logistical problems, the quality department
requires a problem report from the supplier. It involves explanations how the
complications had emerged and how the supplier plans to avoid such occurrences in the
future. If the problems occur more frequently, or if the problem is significant, the vendor
will be put in special focus. Suppliers that are positioned on the so-called WATCH-list have
to create more thorough reports and measure how to improve the performance in
cooperation with Company D. If this action step does not entail an appropriate
improvement, the supplier is considered as a phased-out candidate.

4.4.4 Company D’s development of risk monitoring

The final step of Company D’s recently established financial risk management process is
the monitoring of suppliers’ development. Three months after the first PRE-Audit a
second evaluation takes place in order to analyse the progress of action steps and to have
current data available. On the basis of these data, the committee repeatedly has to decide
whether to keep or to phase-out the supplier.

Besides the establishment of material surcharge contracts, the implementation of
monitoring methods was promoted in order to control the development of raw material
prices. In 2004, Company D started to implement the hereinafter described tool, whose application has been considerably intensified since 2007/08, when the raw material prices reached new peaks. Nowadays, Company D adapts material surcharge with its suppliers on a monthly or quarterly basis. Therefore, the development of total material surcharge costs has to be controlled every month. All in all, the focus in monitoring lies on the difference between material surcharge expenses and the material surcharge compensation that Company D receives from its customers. If this gap increases further, negotiations with suppliers or customers are necessary to reduce the negative impact on the financial results.
## 4.5 Summary of empirical findings

Table 4.1 Overview development of risk management

<table>
<thead>
<tr>
<th>Risk Identification</th>
<th>Company A</th>
<th>Company B</th>
<th>Company C</th>
<th>Company D</th>
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</thead>
<tbody>
<tr>
<td>-Introduction of supply monitoring system</td>
<td>-More thorough screening of supplier candidates</td>
<td>- No development</td>
<td>-More thorough screening of supplier candidates</td>
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<tr>
<td>-More thorough screening of supplier candidates</td>
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<td>-New tools to identify raw material price risks</td>
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<tr>
<th>Risk Assessment</th>
<th>Company A</th>
<th>Company B</th>
<th>Company C</th>
<th>Company D</th>
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</thead>
<tbody>
<tr>
<td>-Better evaluation of supply risks</td>
<td>-Increased focus on supply risks during audits</td>
<td>-No development</td>
<td>-Three new tools to assess financial stability</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>-Revision of evaluation of weaknesses</td>
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<tr>
<th>Risk Management</th>
<th>Company A</th>
<th>Company B</th>
<th>Company C</th>
<th>Company D</th>
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<tbody>
<tr>
<td>-Improved cooperation with OEMs</td>
<td>-Implementation of risk manager</td>
<td>-Revised contracts to increase order flexibility</td>
<td>-New process for managing insolvency risks</td>
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</tr>
<tr>
<td>-Establishment of contracts to manage volatile raw material prices</td>
<td>-Safety and inventory stock has decreased</td>
<td>-Implementation of supply risk team</td>
<td>-Establishment of contracts to manage volatile raw material prices</td>
<td></td>
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<td></td>
<td>-Reducing supplier base</td>
<td>-Improved cooperation with suppliers</td>
<td>-Force to sign feasibility agreement</td>
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<tr>
<td></td>
<td>-Enhanced cooperation with partners</td>
<td>-Financial support of weak suppliers financially during the crisis</td>
<td>-Introduction of more stable demand planning and consignment stocks</td>
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<td></td>
<td>-Revised contracts to stabilize demand</td>
<td>-Implementation of regular internal meetings about supply risks</td>
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<td>-New demand planning tool</td>
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<tr>
<th>Risk Monitoring</th>
<th>Company A</th>
<th>Company B</th>
<th>Company C</th>
<th>Company D</th>
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<tbody>
<tr>
<td>-Introduction of supply monitoring system</td>
<td>-More thorough monitoring of suppliers</td>
<td>-Establishment of supply risk team enables more efficient monitoring</td>
<td>-PRE-audits to monitor financial stability</td>
<td></td>
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<tr>
<td>-New monthly reports to monitor raw material prices</td>
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<td>-New monthly reports to monitor raw material prices</td>
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5 Cross case analysis and discussion

In this chapter the different responses of the multiple case study are discussed and compared in order to answer the research questions. Thereby, the theories of the frame of reference are linked with the interview findings and the authors’ personal opinions.

5.1 Differentiation between strategic and bottleneck items

The authors discovered during the interviews that automotive suppliers do not distinguish between bottleneck and strategic items. Furthermore, they do not have different categories for their buying products with regard to supply risk management. Hence, the supply risks of all components are treated the same. One reason is that the supply disruption of any component can lead to a production stoppage. Therefore, bottleneck products as well as strategic products are of equal importance. This argument was underlined by the interviewee of Company C who said: ‘I cannot say that one component or risk is more important than another.’ Consequently, automotive suppliers use the same tools and methods for managing supply risks of all components. The Kraljic matrix was created with the purpose to reduce supply risks (Kraljic, 1983). Thereby, for each product category, risk mitigation actions are recommended depending on the purchasing characteristics (chapter 2.2). The interviews showed that the suggestions of the Kraljic matrix are partly not applicable in the automotive industry. Kraljic (1983) for example recommends the establishment of multiple sources for bottleneck products to diminish purchasing risks. In today’s globalised automotive sector a single sourcing policy is, however, essential to keep costs low and stay competitive on the market. According to the respondents, more than one supplier for a product is rarely implemented.

Supply risk management is still a relatively new and developing management area. Enterprises have been aware of the significance of supply risks for a few years. Therefore, risk management is still a developing domain and companies are establishing risk management actions continuously. In general, the knowledge and experience in risk management is still low and trainings in this area are almost not possible. Even though companies want to improve the knowledge of risk management, external training is rarely offered. Company B for example tried to coach an employee, but no consulting firm offered risk management training in Europe. This might be some reasons why automotive suppliers having not introduced more sophisticated supply risk management approaches including differentiation between product categories, yet. However, as stated in section 1.2, the authors suggest the implementation different categories to improve the efficiency of supply risk management. Furthermore, the improved allocation of resources leads to reduced labour costs.

5.2 Development of supply risk management

None of the examined firms applies the risk management process of Hallikas et al. (2004) explicitly, although it is a standardized approach that enables the sustainable implementation of supply risk management in the operational processes. Only the respondent of Company C was aware of its existence, but the firm does not use the procedure. One of the reasons might be that the risk management process was published in 2004 by Hallikas et al. and in the last eight years it has not spread in the sector of automotive suppliers.
All four examined firms use tools and methods that reflect the individual steps of the risk management process. This can be interpreted as an indirect application, however, the firms themselves were not aware of the fact that their actions can basically be allocated to the four sequential phases. In comparison to Hallikas et al. (2004) suggestions, the enterprises’ actions are less connected and structured. These steps are more individual and a process that links all activities is not visible. Only Company D implemented a financial risk management process which is based on several sequential stages. However, this is not related to the risk management process of Hallikas et al. (2004). A reason for the rare implementation of entire processes is the still limited allocation of human resources to the domain, although the awareness about supply risks has risen considerably in recent years. In the following section, the development of the four risk management process stages since 2008 is analysed. Thereby, the responses of the participating organizations are discussed and compared with the theory of chapter two.

5.2.1 Risk identification

The practical identification of supply risks can basically be separated into reactive and proactive procedures. According to the responding automotive suppliers, the proactive identification is mainly conducted during the supplier selection process. Before making decisions regarding new sources, the candidate firms are screened regarding their supply performance, logistics, and quality management. Furthermore, all respondents stated the financial stability as a factor that has grown considerably in importance. Thereby, the firms gain information whether a potential supplier has the ability to meet the market requirements. It is possible to identify in which operational fields supply risks could emerge during a subsequent supplier-buyer relationship. The examined firms underlined that in recent years the awareness of risks has risen. Therefore, the screening of possible sources is performed more carefully and with an increased attention to supply risks in order to ensure the choice of a reliable vendor. However, the actual processes and tools remained almost unchanged. Only the respondent of Company A stated one main change in the supplier selection process. The financial risk of volatile raw material price is nowadays part of the screening and plays an important role. As already mentioned above, the risks of supplier insolvency have gained more attention in recent years. However, the companies have not implemented any new tools to identify this risk. Company D for example relies on the contact with suppliers and on its extensive network in the automotive sector that provides news from the market.

In general, the collaboration with suppliers has intensified in recent years, as the respondents stated. A close relationship and frequent communication can be an efficient tool to gain information and warning signals about possibly emerging supply risks beforehand. Particularly reliable and close suppliers are willing to provide information about supply problems in advance. In their research paper Hallikas et al. (2004) generally recommend the proactive identification for the overall management of risks. Nowadays, automotive suppliers conduct the proactive recognition of supply risks before and during cooperation with suppliers. Enterprises recognized that the close relationship with supply chain partners enables the proactive identification of risks, therefore especially the collaboration during a partnership has generally improved. Thereby, the examined firms nowadays fulfil the suggestion of Hallikas et al. (2004) to a greater extent, although the tools and processes have remained almost unchanged.

Company A implemented a supply monitoring system in response to the economic recession in 2008. This system enables the recognition of supply disturbances and provides
the necessary information about the disruption to the involved internal as well as external
parties. Company D uses a similar reactive system for identifying supply risks, however,
with less focus on supply risks than the one of Company A. Those supply monitoring
systems are reactive methods to identify risks when the supply problem already emerged.
Hallikas et al. (2004) do not mention reactive methods for recognising risks. However,
those systems are vital for an effective supply risk management, because not all risks can be
identified beforehand, e.g. inaccurate order fulfilment. Hence, reactive tools are vital in
today’s uncertain environment.

5.2.2 Risk assessment

Company B, C, and D only concentrate on the general performance and fulfilment of
determined requirements of suppliers. The usage of audits in the supplier selection stage
and during the ongoing relationship enables the assessment of weaknesses and bottlenecks.
This entire assessment can be seen as an indirect assessment of the likelihood that a risk
emerges. However, there is no attention to single risks as Hallikas et al. (2004) propose.
The respondents said that the processes and evaluation forms have only undergone minor
changes in recent years. However, the actual assessment and execution of audits is done
with a higher awareness of and a focus on supply risks. Only Company A enhanced its
attention to the assessment of pricing risks and implemented it into the supplier selection
audits.

On the contrary, Company A performs an actual evaluation of every supply risks that is
detected through their supply monitoring system. An employee that is responsible for
reporting the supply disruption has the task to assess its severity and frequency. Those two
evaluation criteria are very similar to the suggested assessment of Hallikas et al. (2004). In
their paper they recommend the two dimensions of probability and consequences of.
Company A’s severity category reflects the consequences of a risk, and the frequency can
be seen as the probability of occurrence. Company A uses a qualitative assessment
approach in which the supply risks are categorized into a scale from 1 to 5. The respondent
of Company A stated that the firm enhanced its efficiency and accuracy in assessing risks in
recent years. Even though the process framework stayed stable, the performance could be
improved considerably. Finally, Company A performs the suggested qualitative risk
evaluation of Hallikas et al. (2004) to a great extent. Thereby, it is visible which risks have
to be handled with the highest priority and resources can be allocated accordingly.
Company B, C, and D have not implemented a fixed method or scale for evaluating
individual supply risks. Thereby, the firms are missing a ranking of risks that illustrates the
urgency for the subsequent risk management. As consequence, those companies are
threatened of wrong prioritization in risk management and waste of resources, which can
have severe consequences. The implementation of single risk assessment, as described in
section 2.3.2.1 enables the avoidance of these problems.

Besides the operational supply and logistics risks the financial threats are also considered at
the second stage of the risk management process. As a consequence of the substantially
increased risk of supplier bankruptcy since the crisis in 2008, all respondents of
participating organizations stated an increased attention to the financial performance. This
general development is, however, just partly reflected in the progression of assessment
tools. Company A does not conduct an explicit financial analysis, whereas Company B and
C implemented the evaluation in their regular audits. Both firms underlined the awareness
of and also the focus on assessing insolvency risks has grown in importance during the
supplier selection and supplier-buyer relationship. Company D implemented a thorough
assessment of suppliers’ financial stability during the economic crisis of 2008. Compared to the other enterprises Company D increasingly concentrates on the financial performance of suppliers, which is reflected by the availability of three different tools. By assessing the risk of supplier insolvency, the responding companies only consider the probability of occurrence. Hallikas et al. (2004) further propose to take the risk consequences into account. In practice this criteria is probably not regarded, because a supplier bankruptcy mostly results in supply stoppage.

As a final statement it is important to note that none of the responding firms applies a quantitative assessment of purchasing risks. It is very difficult to assess the exact probability and financial impact as Eades et al. (2010) describe. This time-consuming method includes a high level of uncertainty that obviously prevents companies from implementing it. The qualitative assessment is easier to conduct and, therewith, more appropriate to implement.

5.2.3 Risk management

The major development in response to changing supply risks has occurred in the actual risk management. The companies have become more sensitive in this part and implemented different tools to handle the increased risk potential. Due to the huge variety of actions and the similarity to the theory, the authors structured the development according to common risk management strategies. Hallikas et al. (2004) determined five strategies for coping with supply risks, which were explained in chapter 2.3.3.

There are two new methods that cannot be clearly allocated to one of the various management strategies. Some of the companies have introduced risk managers or entire risk management teams. These specialized employees interfere in the case of severe supply problems and use their experience to find solutions. Implementing a supply risk team or a risk manager illustrates that companies are more aware of the topic risk management and use more human resources. In addition, Company B helps to solve the problem of the suppliers by using external specialists or providing trainings to suppliers, something not offered by any of the other interviewed company. The empirical investigation showed that the two biggest companies have implemented risk managers due to a bigger supplier base and higher financial capability. In addition to the above-mentioned risk management tools which are sorted into different categories, Company D implemented a further tool that cannot clearly be allocated. In recent years all suppliers have to sign the so-called feasibility agreement. The introduction of this contract does not pro-actively reduce or prevent the probability and consequences of risks. However, it states that a supplier has to bear all the costs that emerge as a consequence of supply disruptions. Hence, Company D is indirectly able to reduce the consequences after a risk actually emerged. This is not in line with Hallikas et al. (2004) pro-active management actions and is, therefore, not allocated to the five management strategies. Those two examples illustrate that Hallikas et al. (2004) is rather theoretical and limited, because not all currently existing management actions are considered in their creation of distinct management strategies.

Risk reduction:
All managers said that the buyer-supplier relationship is crucial in today’s business environment and the relationship in the supply chain has become closer since the economic crisis in 2008. The improved communication and trust between automotive suppliers and manufacturers enables the noteworthy reduction of the probability and consequences of supply risks. For example, Company A nowadays informs its customers on short-notice about possible emerging supply delays. Due to the better relationship, the
customers are willing to adjust the production schedule slightly in order to reduce the consequences of supply problems. Moreover, the sales planning in the automotive supply chain has further developed in response to the recent volatile demand. For example, Company B introduced more accurate demand planning with its customers. This information is provided to the suppliers and allows a higher planning stability than before the crisis. Company D has improved their collaboration with the automotive manufacturers by establishing so-called “frozen zones” of demand. By implementing this in case of capacity bottlenecks, the demand planning for the company itself, but also for tier 2 and tier 3 suppliers is more stable and supply disruptions can be prevented. All these examples show that the collaboration in the supply chain, both upstream and downstream has been enhanced since the financial crisis in 2008 to increase stability and prevent supply disruptions. Furthermore, all respondents agreed that the support from management has improved since the financial crisis and is more sensitive today. For example Company C has implemented a meeting in which the purchasing department informs the management about current supply disruptions.

An interesting fact is that the enterprises have worked out different inventory strategies since the crisis in 2008. For Company B the main threat was that their suppliers had produced too many components and a cash return for the components was not given. In combination with the sudden drop of demand, the risk of supplier bankruptcy increased in 2008. Therefore, the company introduced new sourcing concepts such as JIT or kanban. This allows the company itself and their suppliers to reduce the stock. In contrast, Company D established a number of consignment stocks. In doing so, the suppliers have to bear additional costs which enhances the risk of supplier insolvency. This contrast makes obvious that both companies perform different strategies in securing supply. Company B also focuses on the financial stability of suppliers, whereby Company D just concentrates on securing supply without additional costs.

Risk avoidance:
During and after the financial crisis the responding enterprises intensified the management of supplier bankruptcy. Different tools and strategies have been created to cope with the increasing risk. Company D for example introduced a committee, which devotes its attention to suppliers threatened of bankruptcy. The committee has to decide whether to stabilize or phase out the concerned vendor. Company B reacted in a straight forward manner to the economic crisis and reduced the supplier base and increased the order volume for the remaining stable suppliers. Another advantage is that a higher order volume will increase the financial stability of the supplier. Depending on the situation, both policies are appropriate to avoid the possibility of supplier insolvency. In contrast, Company C does not have the possibility to change their supplier base due to constraints of automobile manufacturers. Therefore, Company C is constrained in managing the supplier bankruptcy risk. On the contrary, Company A does not perform any procedures for managing the insolvency risk. It relies on the compulsory processes in the case of bankruptcies, which are efficient enough to secure the supply of goods.

Risk sharing:
In the context of risk sharing, contracts with suppliers, employees as well as with automotive manufacturers have been newly negotiated. As Brindley (2004) pointed out, agreements are an essential part to secure supply today. All four interviewed respondents are aware of this phenomenon and consider risk sharing along the supply chain as more important. However, they use contracts for the management of different risks that have emerged in recent years. For example, Company C could not reduce the contractually fixed
order volume during the crisis which was a main purchasing risk. Today the company can order the components more flexibly due to the changed contract clauses which were introduced in the last years. Thereby, it can react faster on the volatile demand. In alignment is the problem of Company B which identified the cancelled orders from the automobile manufacturers and the uneven risk allocation as the main risk during the financial crisis. Company B tried to decrease the flexibility of order cancellation by automotive suppliers, but only had limited success due to the negotiating power of automotive manufacturers and the increasing worldwide competition. It shows that OEMs try to prevent risk sharing. Therefore, Company B had to increase its internal flexibility by using employees with a temporary contract and a higher degree of outsourcing. Even if a sudden crisis like in 2008 cannot completely be covered, the impact of the company can be reduced. All companies have reacted to the fluctuating economy and shared risks along the supply chain. However, the automotive manufacturers try not to be involved in the risk sharing and it seems to be a difficult relationship between automotive suppliers and manufacturers. There is room for improvement in this field, as Hallikas et al. (2004) specify that a successful relationship cannot be evolved, if only suppliers are burdened with risks.

Company A and D regard the volatile and increasing raw material prices as a main risk that has influenced the financial performance negatively in recent years. As a consequence, both enterprises implemented agreements to share this financial risk with their partners along the supply chain. Company A established long-term contracts with their suppliers in the last years, which allow an improved planning and management of raw material price fluctuations. Additionally, the firm increasingly negotiates with its customers to get compensated for growing raw material costs if the financial burden cannot be reduced with other tools. Company D reacted similarly to the volatile raw material prices by concluding material surcharge contracts with suppliers and customers.

**Risk taking:**

The respondents stated that not all risks can be managed proactively, because of financial limitations. Especially the consequences of natural disasters cannot be managed beforehand. For example the reactor catastrophe in Fukushima in 2011 had an enormous impact of Company A and B in particular. Some components were only single sourced and the companies were not prepared for a sudden supply stoppage. Since the reactor disaster of 2011 Company A as well as B have increased the stock for single sourced components to limit the impact. This is in line with Zsidisin et al. (2000) suggestions to enhance the inventory level and to implement multiple sourcing strategies. In practice, the recommendations of Zsidisin et al. (2000) can, however, only rarely be implemented due to the high cost pressure in the automotive industry. Nevertheless, the risk of supply disruption triggered by catastrophes still remains although the inventory has been increased.

### 5.2.4 Risk monitoring

All four companies regard risk monitoring as more important than it was before the financial crisis in 2008. In the monitoring phase, the financial stability of suppliers nowadays plays an important role, because of the considerably increased risk of supplier bankruptcy. Therefore, a frequent examination of suppliers’ financial performance has recently been implemented to monitor its development. Company B and D are using regular audits to observe financial performance. Company B uses a raster to examine how the financial performance develops. Depending on the turnover a supplier achieves with Company B, it has to hand in financial data in shorter or longer regular intervals. Thereby,
Company B is able to monitor a dependents supplier more strictly and efficient. During the crisis in 2008, Company D introduced so-called PRE-audits to monitor if a financially weak supplier has improved its stability. This tool is applied every three months once financial problems were detected. The usage of those approaches confirm the theory of Hallikas et al. (2004) that recommends a continuous monitoring to recognize any changes in risks. This enables enterprises to maintain or improve the efficiency of risk management actions by adjustments.

General systems are used to monitor the performance of suppliers. Company A recently implemented an automatic system to monitor the development of supply and logistics problems. Company C has been using a lamp system for several years that controls the quality, logistics and financial risks. This system is constantly adapted to the changing market requirements and needs. The systems of Company A and C are quite sophisticated as they enable constant monitoring of supply risks and general performance.

Moreover, the monitoring of volatile raw material prices is of major significance for many automotive suppliers. It is necessary to follow the current development of raw materials prices and to identify trends that could influence the material costs negatively. Therefore, new reports and monitoring tools have been implemented in the last five years. Company A mainly controls where it stands compared to the market and the average market price. It is able to evaluate if the concluded long-term contracts with suppliers are beneficial. Company D for example implemented a monitoring of the gap between material surcharge expenses and compensation. The development of this difference is controlled because it directly affects the financial results.
6 Conclusion

In this chapter the theoretical as well as managerial contributions are presented. Finally, the authors critically reflect the study and give suggestions for future research.

The purpose of this study is to examine how automotive suppliers have adapted their supply risk management in response to the fluctuating economy since 2008. A multiple case study with four automotive suppliers from Central and Northern Europe was conducted. The authors performed interviews with the responding purchasing directors of each enterprise to gather the data.

6.1 Main conclusions

The empirical investigation showed that companies do not classify their buying components according to the dimensions of the Kraljic matrix. Companies do not differentiate between bottleneck and strategic components, because they are characterised by a general high supply complexity. Both categories are of equal importance regarding the ability to supply, thus, there is no differentiation of supply risk management activities. Especially in the automotive sector some recommendations of the Kraljic matrix cannot be implemented due to the cost pressure of global competition. Therefore, the practical use of the Kraljic matrix seems to be not appropriate as a basis for distinguishing supply risk management activities. However, the multiple case studies illustrated that firms classify vendors in the context of supply risk management. This field was not further analysed in this study.

The entire risk management process, as described in chapter 2.3 is not applied by automotive suppliers. Many enterprises are not familiar with this procedure, meaning they are also not cognizant of its characteristics and advantages. This is in alignment with the general limited knowledge about risk management in the industry, as the case study illustrated. Automotive suppliers mainly utilize a loose range of tools that are not directly linked with each other. However, those instruments can often be allocated to the four steps: risk management, risk assessment, risk management and risk monitoring. As a consequence, the management of supply is less structured and synchronized than proposed by Hallikas et al. (2004).

It became visible through the research that automotive suppliers have recently reacted on the increasing volatility and risk potential in the market. The enhanced effort in supply risk management is particularly well illustrated by the grown input of human resources, e.g. establishment risk managers. The sector has further developed its supply risk management by implementing new tools and adjusting already existing ones to the volatile environment. Thereby, a huge variety of different tools among the companies is available. Depending on the actual identified risks and kind of sourced products, companies adapted differently to the individual situation. In general, the awareness of supply risks and the sensitivity to cope with it has risen considerably. A difference in supply risk management of German and Northern Europe companies has not been recognized. As a consequence of the high connectivity of the European automotive industry similar developments in the regions regarding the emergence and management of supply risks were detected.
The focus on *risk identification* mainly lies on the supplier selection process. Thereby, audits are conducted to analyse potential vendors in different fields like financial stability or logistics performance. Especially the analysis of suppliers’ financial stability has intensified since the economic downturn in 2008. However, the applied instruments have only slightly changed, but enterprises are more sensitive in their screening of suppliers and consider the criterion supply risks as more important.

*Risk assessment* is performed to a great extent by the usage of audits during the supplier selection stage and also during the supplier-buyer relationship. Automotive suppliers evaluate the general performance of suppliers in various operational areas. In recent years, the significance of supply risks as part of the general evaluation has raised considerably. The evaluation tools themselves have only undergone minor changes and adaption to the market development. In particular the assessment of financial performance has grown in importance. The assessment of individual supply risks is not common throughout the automotive sector; however, since the crisis in 2008 companies started implementing it in response to the more severe consequence of risks.

The major revision has been made in the *risk management* stage. During and after the economic crisis new tools have been implemented and already established ones have been improved to be able to manage the increasing amount of risks. Especially the cooperation along the supply chain has been enhanced with suppliers as well as with automotive manufacturers. One of the most crucial risks is the bankruptcy of suppliers; therefore different tools have been implemented to reduce the possibility of the same. Another interesting fact is that all automotive suppliers identified the contract as not sufficient during the crisis in 2008. The main priority of companies was to increase the flexibility of the orders and/or to reduce the impact of volatile raw material prices.

In recent years *risk monitoring* has been strengthened in order to control the constant changing environment of supply risks. The tools, which have been implemented of the examined firms, vary enormously amongst the companies. Automotive suppliers which are dependent on raw material prices have implemented reports to have a better control of its development. The financial stability is continuously examined by the companies to keep track of the management progress. In addition, enterprises have introduced continuous monitoring of suppliers’ performance. This is a sophisticated tool to receive warning signals and detect trends that could lead to supply problems beforehand.

### 6.2 Managerial contributions

The research detected a wide range of risk management tools for coping with supply risks. Not all of them are appropriate for managing the high probability and consequences of current and future risks. The authors recommend the establishment of entire risk management processes with various subsequent steps. Structured and connected systems for managing risk are the most effective approaches for preventing and reducing risks. These risk management activities must be implemented in the process landscape of automotive suppliers and become a fixed part of daily business in order to ensure its constant application. For the further development of risk management it is essential to train employees as well as managers in this domain. A better knowledge about existing risk management tools as well as a higher the awareness of supply risks in the corporations would enhance firms’ capabilities. It is important to manage risks more proactive instead of reacting on occurrences and, thereby, just reducing the risk impact.
In recent years the cooperation along the automotive supply chain has notably improved and it has exposed its importance in today’s volatile market. In particular the identification and communication of risks is supported by close relationships and enables the proactive management of supply problems. In the future automotive manufacturers should be increasingly involved in risk sharing to be able to manage the supply chain risks and to secure the product flow. The implementation of specialised risk managers, additionally, enhances the effectiveness and supports the mutual solution finding. Furthermore, certain flexibility in procurement contracts and production is necessary to handle steep drops and rises in demand along the supply chain. Thereby, an accurate and constantly updating sales planning is required to mitigate the impact of volatile demand. As a result of the fluctuating sales volumes, the focus on suppliers’ financial stability has to be sharpened to avoid suppliers’ bankruptcy. Moreover, the raising and more volatile raw material prices require the introduction of risk sharing contracts and monitoring reports. A connected monitoring system in the supply chain is further essential to control the development of actual risks and the changing market conditions. Common standards and requirements should be implemented supply chain-wide to improve and facilitate the collaboration. This is, in addition, fundamental for the efficient proactive identification of supply risks and allows a better communication between partners.

6.3 Final reflections and suggestions for further studies

During the empirical study the authors recognized that automotive suppliers do not distinguish their supply risk management between different buying products, they rather differ between suppliers. This differentiation was not further examined in this research and also in other academic research papers this domain has not been evaluated. Thus, it would be interesting to examine how firms classify their vendors in the context of supply risk management and how management actions differ between the categories.

As already stated in chapter 2.1, supply risk management is a research field that has just gained great attention in the last several years (Christopher et al., 2011). In alignment are the statements of some responding managers that the supply risk management tools are still not appropriate for managing current and future risks. Therefore, it is necessary to investigate the future development of supply risk management activities.

Furthermore, the authors had problems to identify common approaches at each step of the risk management process, because the responding companies are using a wide range of differing tools. Hence, the founding empirical study with four automotive suppliers was not sufficient to draw reliable conclusions. A larger study including a higher number of automotive suppliers is recommended to get more thorough and credible data. It has to be examined whether the same tools are used by other firms or whether additional methods are applied.

Finally, the researchers did not detect differences between German and Northern European automotive suppliers. All the firms had to cope with similar supply risks and no fundamental differences became obvious in managing those risks. This might be due to the close cultural and organizational characters as well as the high interconnectedness of the markets. A future research suggestion is to involve diverse geographical regions. It has to be revealed whether different risks occur in other markets and how the concerned enterprises manage those risks.
List of references


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Appendix

Appendix 1: Interview guide
1. What impact did the economic crisis 2008 have on your company?
2. Do you think that risk management is nowadays more important than 5 years ago?
3. What are the major supply risks and how have they changed?
4. How do you categorize buying products with regard to supply risk?

How have automotive suppliers further developed their supply risk management of strategic components?
5. How did you identify supply risks of strategic components before the crisis?
6. How do you identify supply risks of strategic components today?

7. How did you assess supply risks of strategic components before the crisis?
8. How do you assess supply risks of strategic components today?

9. How did you manage supply risks of strategic components before the crisis?
10. How do you manage supply risks of strategic components today?

11. How did you monitor supply risks of strategic components before the crisis?
12. How do you monitor supply risks of strategic components today?

How have automotive suppliers further developed their supply risk management of bottleneck components?
13. How did you identify supply risks of bottleneck components before the crisis?
14. How do you identify supply risks of bottleneck components today?

15. How did you assess supply risks of bottleneck components before the crisis?
16. How do you assess supply risks of bottleneck components today?

17. How did you manage supply risks of bottleneck components before the crisis?
18. How do you manage supply risks of bottleneck components today?

19. How did you monitor supply risks of bottleneck components before the crisis?
20. How do you monitor supply risks of bottleneck components today?

21. Do you think that you invest enough resources for risk management?
22. May we contact you for further questions?