Risks in global supply chains

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Name: Chimaa Abdellaue

Anr: 493361

Tutor: Dr. ir. J.S. Small

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Management summary

The motivation of writing this research-paper is the rise of the global village. The ability for customers and companies to connect to each other from all over the world has created a lot of opportunities for both of them. There are little or no restrictions anymore from the customer's perspective. Nowadays almost every customer is used to buy products from all over the world. Products that are made from materials from different countries or products made in other countries.

Also the firm is not restricted anymore to the national borders. Because of that, companies have gained access to cheaper sources of material and closeness to their customers. From the different types of industries, the manufactures were the first ones who set their factories up in foreign countries to benefit from the various advantages. But together with the advantages firms also faces a lot of risks.

The literature does not define global and local supply chains. However, based on the gathered literature there are differences between the chains due to the advantages and disadvantages. Local supply chains benefit from the fact that they are experts in the country they operate. They do not face the risk of fluctuating exchange rates, transfer prices etc. In contrast global operating firms are exposed to these types of risks. Nevertheless local operating firms have the problem that they not always use the cheapest resources to produce and serve fewer markets because of the distance. Firms with global supply chains gain from the use of the cheapest resources, closeness to customers, efficiency etc.

Due to the rise of the global village, the operating environment of the firm grew. Many local supply chain networks became global supply chains and have suppliers and customers in several countries. A smooth operating supply chain will optimize the advantages that a company can gain from being a part of a supply chain. However, supply chains become more vulnerable because they are exposed to more risks. Nevertheless it is not only important to know to which risks a company is exposed, it is also important to know what to do in case of supply chain disruptions. That is why a firm needs to have a backup plan in case of supply chain disruptions and how to manage risks to prevent the firm from these risks.

Risks can be classified into three sources; environmental, organizational and network related risks. From the literature review it can be said that there are not really differences between the risks which supply chains are exposed to, whether global or local. However, risks which disrupt global supply chains are more severe than those in local chains. The risks have also more consequences than local disruption.

The definition of risk management to manage supply chain disruptions is very general. The literature does not define a framework specific for global supply chains. A method for enterprises to prevent and recover from risks in supply chains is the failure mode and effects analysis. The analysis contains three steps to identify the likelihood of risks. The FMEA method can help the firm to identify risks and makes them think about strategy to recover from these disruptions in supply chains and create a plan for prevention of those risks. The third step of the FMEA method is to take action in case of disruptions. The ten principles defined by Kleindorfer and Saad (2005) is a list to go through in order to make a supply chain more risk proof.

It does not matter which supply chain a company has. Due to the fact that every company faces another type of risk, risk management is specific to each firm. That is why there is not a general framework how to make a supply chain more resilient. Because of this the risks capacity constraints, culture differences, disasters, exchange rates and system risk are explained in more detail and how to manage these risks when they occur.

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Chapter 1 – Introduction –

1 .1 Introduction

This thesis discusses the risks that can arise in a global supply chains. To create an insight in to these risks and where they come from, the characteristics of global and local supply chain are compared. Risks arising in global supply chains are a problem that every global company faces. It is important for a firm to acknowledge these risks and make a plan in order to manage these risks. This thesis describes the sources of risks and how a company can manage them.

1.2 Problem indication

In recent years causes such as fuel protests, the foot and mouth disease in the UK, terrorist attacks and the threat of weapons of mass destruction in the USA, or the SARS outbreak in China, Hong Kong and Canada caused widespread disruption all over the world. They have also highlighted the vulnerability of supply chains and transformed the perceptions of security across supply chain (Jüttner, 2005). In order to create a smooth working supply chain a company needs to recognize the risks that could arise in such a chain. According to Christopher (1992) a key characteristic of supply chain management is the coordination of activities between these interdependent organizations. Supply chain management has been defined as creating enhanced value to the end customer at lesser cost to the whole supply chain (Christopher, 1992). In order to do this, firms have to manage the relationships with suppliers and customers upstream as well as downstream (Christopher, 1992).The risks that can arise in the supply chain differ from company to company and from one chain to another.

Nowadays many take it for granted that they can use products from all around the world. They could not imagine what the products are going through before they arrive on the shelves and/or in their shops. In the past companies worked largely within the national borders. Thus suppliers and the customer company were located in the same country. Today there are still companies who have only a domestic supply chain, but the world is becoming a global village with global supply chains. Many products are produced all around the world, or various components are delivered from various countries. This means that there are many companies dealing with suppliers from outside their domestic market. Manufacturers set up foreign factories to gain the advantages of tariff and trade concessions, low cost direct labor, capital subsidies, and reduced logistics costs in foreign markets (Ferdows, 1997).

It is undeniably that risks arise in domestic supply chain also; they too can cause enormous disruptions that affect the performance of the supply chain. However, Jüttner (2005) argues that an international supply chain is exposed to greater risk because of its geographical distribution and increasing complexity. Firms competing in the global marketplace thus face the most pressing concern of supply chain disruptions and the associated operational and financial risks (Craighead, Blackhurst, Rungtusanatham, & Handfield, 2007). For example, hurricane "Floyd" flooded a plant of Daimler Chrysler producing suspension car parts. The consequences of the hurricane was that seven of the company's other plants across North America had to close their plants for seven days (McGillivray, 2000).

To react on or to be prepared for disruptions that can occur in a supply chains, managers needs to have an overview of what risks there could be and how they arise.

1.3 Problem statement and research questions

As the problem indication above states this research aims to analyze the risks that can occur in a global supply chain. The problem statement is phrased as follows:

How can companies identify and manage risks in global supply chains?

1.4 Research questions

To answer the problem statement the following research question will be discussed. These questions are state as follows:

- *What are the characteristics of global supply chain management compared with local supply chain?*
- *What risk factors have been identified for global supply chain management compared with local supply chain?*
- *What strategies have been developed to reduce risk and recover from failures in global supply chains?*

1.5 Research methods

The research consists primarily of a literature review. Data gathered through existing sources are called secondary data (Sekaran, 2003). The purpose of the thesis is to gather and document the significant findings from earlier research. The significant findings of early research served as the basis on which the theoretical framework for the current research has been built and the research questions developed (Sekaran, 2003). The material from sources like journals and books has been compared with each other.

The main databases that have been used are the ABI/Inform, Web of Science and ScienceDirect. More specifically, the data comes from various scientific journals with topics related to supply chain management. The focus of interest lies on identifying risks in a global supply chain management.

1.6 Academic and managerial relevance

The relevance of writing this thesis is the importance of a good risk overview in relation to global supply chain management. The information about this topic is scattered. In the past management dealt with problems inside the company. But operating in the whole wide world means a variety of risks. Many of the articles have various ideas of what the risks are and how to deal with it. The goal has been to make a comprehensive overview of what the risks are in a global managed supply chain, and further how a company in a supply chain could deal with the risks of a breakdown. Because of the global perspective it is an interesting view to look at the problem. To analyze the specific risks in the global chain it is interesting to also look at the local supply chain.

1.7 Structure of the thesis

The structure of the thesis is as followed. In the first chapter an introduction to the topic has been given. Chapter 2 addresses to answer the research question; 'What are the characteristics of a global supply chain management compared with a local supply chain?' In chapter 3 the question; 'What risk factors have been identified for global supply chain management compared with a local supply chain?' is answered. 'What strategies have been developed to reduce risk and recover from failures in a global supply chains?' is the research question dealt with in chapter 4. In the next chapter, the material that has been discussed for the research questions is the basis for addressing the problem statement; 'How can companies identify and manage risks in a global supply chains?' The last chapter of this literature

review is to conclude and detail the constraints of this research and the recommendations for further research.

Chapter 2 – Characteristics of a supply chain –

2.1 Introduction of the supply chain

Supply chain management is a term that is frequently used in academic journals. The importance of the supply chain management topic has different reasons and drivers. Companies cannot be seen anymore as individual operating companies. They must work together in a supply chain.

Over the last years the frequency of using the term supply chain management has increased (Cooper, Lambert & Pagh, 1997). There are many definitions of the term supply chain management. Some of the definitions refer to the management processes and others to structural organization or businesses (Harland, 1996). Oliver and Webber (1982) were the ones who first discussed and created the term "supply chain management". According to Oliver and Webber (1982) supply chain management had the potential benefits of integrating the focal company functions of purchasing, manufacturing, sales and distribution. Since this time various studies have redefined and specified the term. Ellram and Cooper (1993) defined supply chain management as "an integrating philosophy to manage the total flow of a distribution channel from supplier to ultimate customer" (Ellram & Cooper, 1993, p. 1). Harland (1996) stated that supply chain management consists of managing business activities and relationships, internally within an organization, with immediate suppliers, with suppliers of the suppliers and customers along the supply and with the entire supply chain. Craighead et al., (2007) described the supply chain as a "supply network" with different entities connected by the physical flow of materials. A supply chain defined by Mentzer, DeWitt, Keebler, Min, Nix, Smith & Zacharia (2001) is "a set of three or more entities (organizations or individuals) which are directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer" (Mentzer et al., 2001, p. 4). The definitions are in fact very similar according, though Ellram and Cooper (1993) and Craighead (1997) have a broader definition compared to Harland (1996) and Mentzer et al., (2001).

It is much easier to write a definition of supply chain management than it is to implement the definition. The degree of complexity of supply chains makes it nearly impossible for a firm to manage the entire supply chain (Lambert, Cooper & Pagh, 1998). Figure 1 illustrate that managing the whole supply chain is very difficult and challenging task. Lambert et al., (1998) argues if a company wants to manage their total supply chain they must manage all tiers of suppliers back to the point of origin and all tiers of

customers out to the point of consumption of the product/services. Figure 1 shows the structure of supply chain.

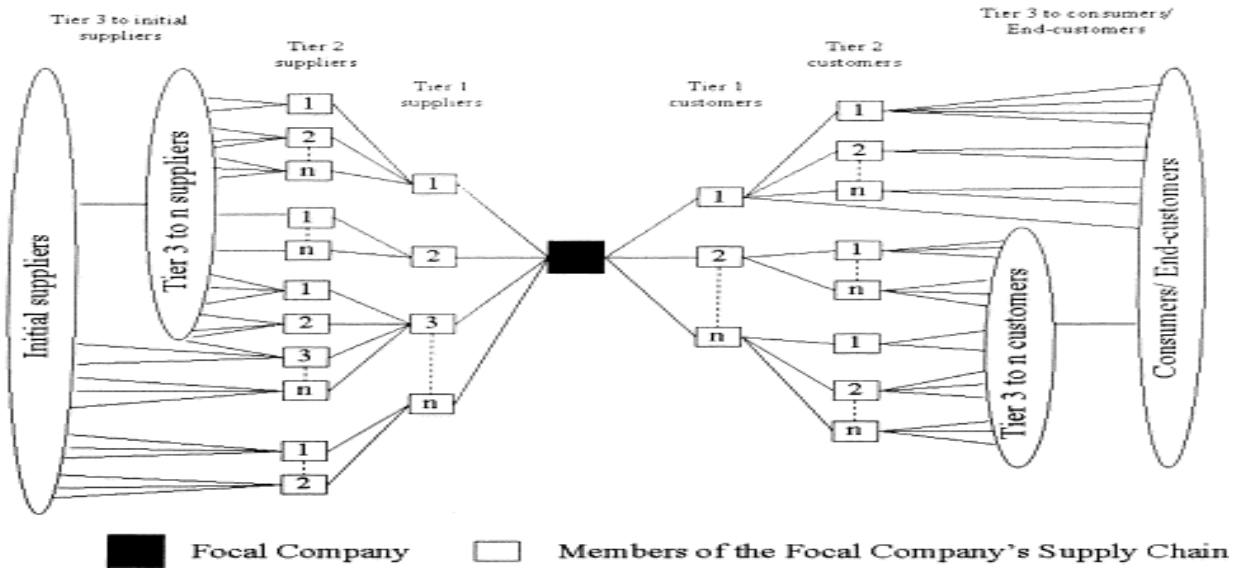

Figure 1: Supply chain network structure (Lambert and Cooper 2000).

Traditionally, the foundation of supply chain management has been focused on the upstream point of view, with a central focus on the leading contractor's supply chain management (Andersen & Christensen, 2005). However, today it is simply not enough to optimize only the internal structures and infrastructures which are based on the strategy of the company (Frolich & Westbrook, 2001). Frolich and Westbrook (2001) argues the internal processes, the external suppliers and customers have to be carefully linked together in order to be successful. According to Meixell and Gargeya (2005) the integration of companies with suppliers and customers is a must to stay competitive. The outsourcing of different tasks can have advantages in the form of reduced costs, increased revenues and improved reliability (Meixell & Gargeya, 2005).

2.2 The global and local supply chain

The literature does not explicitly defined supply chains for the local markets or global markets. What the literature does do is review the advantages and disadvantages of global supply chains. A local supply chain is a chain that only operates within national boundaries. According to McDougall (1989) domestic new ventures differentiated themselves by their focus on production expansion strategy and customer specialization. McDougall (1989) stated that the strategy of production specialization focuses on limited

geographical markets, maintaining excess capacity, and pursuing forward integration and the customer specialization strategy consists of the production of special products. For both of the strategies in a domestic context a consistent "closeness" between the supplier and consumer is implied (McDougall, 2002). But the previously norms of "local for local" manufacturing and sourcing have been eliminated with the rise of the global village (Christopher, Peck & Towill, 2006). According to Christopher et al., (2006) this is largely due to geopolitical events in line with technological developments and the deregulation of trade that made a reality of global sourcing and supply.

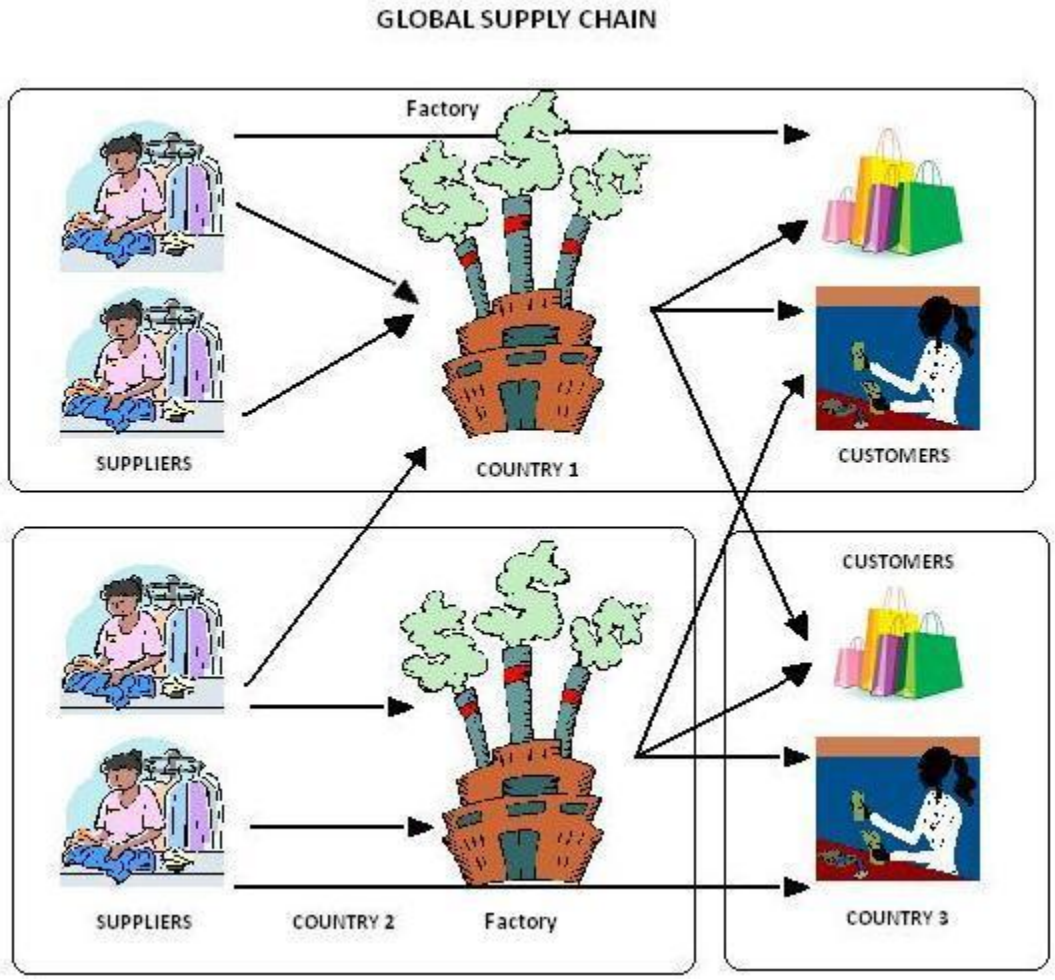

Figure 2: An example of a global supply chain (Adapted from Vidal and Goetschalckx, 1997)

The global supply chain is an extension of the local supply chain. As the figure above shows a company in a global supply chain deals with multiple countries (Vidal & Goetschalckx, 1997). Therefore, a global "supply chain of a final product can be described if all the interrelated processes needed to produce it as

well as all raw materials and input and output flows of intermediate goods are identified, wherever they are located" (Albino, Izzo & Kühtz, 2002, p. 121). These chains emerge because companies have to stay competitive. Therefore companies searched for cheaper sources outside of the domestic market.

2.2.1 Advantages and disadvantages of global chains

The benefits that a firm can gain of working in global supply chain are reduced costs; increased revenues and improved reliability because they use international manufacturing sources (Meixell & Gargeya, 2005). Christopher et al., (2006) mentioned that companies gain advantages of cost savings because of switching manufacturing from the developed world to emergent economies in other countries. Firms can save costs due to fewer regulatory controls and significantly lower wages (Christopher et al., 2006).

MacCormack, Newmann, and Rosenfield (1994) argue that benefits accrue due to access to overseas markets, organizational learning due to the closeness of the customers and improved reliability. Ernst and Kim (2002) report that the main purpose of these networks is to provide the buyer with quick and low-cost access to resources, capabilities and experience that are complementary to its core competencies but the real benefits result from the differentiation, exchange and outsourcing of knowledge and complementary capabilities. Also the demand for flexible response to the end customers is a driver for creating global chains (Andersen & Christensen, 2005).

Besides the advantages of global supply chains they also deal with the disadvantages. The flow of the supply chain is more difficult to coordinate than in a single country supply chain. A company deals with different taxes and duties, exchange rates, trade barriers, transfers prices, the uncertainty of government stability and the infrastructure (Vidal & Goetschalckx, 1997). Furthermore different local cultures, languages, and practices effect the effectiveness of business processes like demand forecasting and material planning (Meixell & Gargeya, 2005).

2.3 Conclusion: The local and global supply chain compared

Concerned the differences between the local and global supply chain there are not many. The global supply chain is an extension of the local supply chain. The main distinction between the two supply chains is the fact that firms with a local supply chain do not have suppliers outside the country. In

several industries a lot of firms regardless what size or age they were, were forced by competition to go across the borderlines. (Burrill & Almassey, 1993).

However there are differences in the benefits and disadvantages of global and local supply chains. Global supply chain benefits from reduced cost and better efficiency (Meixell & Gargeya, 2005). With better access to cheaper resources and closeness to the customer markets companies can gain a competitive position towards their competitors and local markets with their local supply chains (Ernst & Kim, 2002). On the other hand firms with local supply chains do not deal with different taxes and duties, exchange rates, trade barriers, transfers prices, the uncertainty of government stability and the infrastructure. Also locally operating firms have no difficulties due to cultural differences (Vidal & Goetschalckx, 1997). The advantages and disadvantages described in this paper are summarized in the table below.

Supply chain	**Advantages**	**Disadvantages**
Global	• Reduced cost • Increased revenues • Better reliability • Efficiency • Flexible response to end customers • Better competition position due to - Access to cheaper resources - Proximity to the customer	• Difficulties with coordination of supply chains • Difficulties with local culture, languages and practices • Different tax and duties • Fluctuating exchange rates • Trade barriers • Transfer prices
Local	• No tax differences and duties • No exchange rates • No trade barriers • No transfers prices • Local experts	• No access to cheaper resources • No closeness to customers all over the world

Table 1: The advantages and disadvantages; of global and local supply chains.

Chapter 3 – Risk factors in supply chain –

A company does not only gain the advantages of working in and being a part of a supply chain. A supply chain could work effective in a stable environment, but the chain is more vulnerable to different sources of disruptions caused by economic cycles, consumer demands and natural and manmade disasters (Tang, 2006). Tang (2006) reported that a disruption in a supply chain can have significant impact on a firm's short-term performance. For example, in 2000 Ericsson lost 400 million Euro's after the plant belonging to one of their suppliers caught fire and Apple lost many customer orders after an earthquake hit Taiwan in 1999 (Tang, 2006). Supply chain disruptions can also have a negative effect on the firm's long-term financial performance. According to Hendricks and Singhal (2005) because of disruptions within a supply chain, companies experienced 33–40% lower stock returns relative to benchmarks of their industry. It is not common anymore to asses only the risks of the company itself. In order to assess the vulnerabilities which a company is exposed to the company must consider the risk to all other entities as well as those risks caused by the linkages between the organizations and not only to the risks to their operations Jüttner (2005).

3.1 Defining the risks

Supply chains are exposed to numerous of risk and can be seen from various perspectives (Christopher & Peck, 2004). "All supply chains are inherently risky because all supply chains will experience, sooner or later, one or more unanticipated events that would disrupt normal flow of goods and materials" (Craighead et al., 2007, p. 131). In the academic literature there are many interpretations of a supply chain disruption. According to Kleindorfer and Saad (2005) supply chain disruptions are unplanned and unanticipated events that disrupt the normal flow of goods and materials within a supply chain. As consequence firms can suffer from operational and financial risks (Stauffer, 2003). Jüttner (2003) defined one aspect of supply chain risks as the possibility and effect to the mismatch between supply and demand. The sources of risk are the environmental, organizational or supply chain related variables which cannot be forecasted with certainty and which impact the supply chain outcome variables (Jüttner**,** 2003). Jüttner, Peck and Christopher (2003) identified the sources of risk as illustrated in the figure below (see Figure 3).

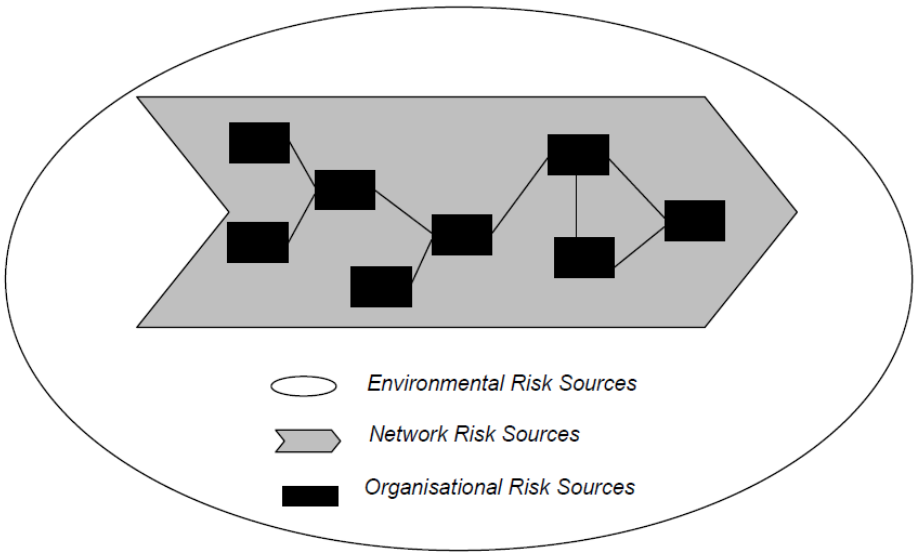

Figure 3: Risk sources in supply chains, (Jüttner, Peck and Christopher, 2003)

3.1.1. Environmental risk (external):

Risk sources in the environment consist of any uncertainties arising from interaction with the supply chain environment (Jüttner, Peck & Christopher, 2003). Such as risks that can arise from nature. A supply chain can suffer deeply because of natural disasters like earthquakes, hurricanes and storms. The Kobe earthquake in Japan in 1994 for example left California-based sound card maker Kelly Micro Systems and a lot other small companies without parts (Chopra & Sodhi, 2004). Other cases of nature disasters that disrupt different supply chains of companies are the Florida series of hurricanes in 2004, hurricane Andrew in 1992 caused huge shipping failures in Florida and the Far East, causing large losses to industry (Kleindorfer & Saad, 2005). Environmental risk also occurs in case of terrorism and political instability. A well know example is the attack on the World Trade Center on the 11th September of 2001 (Kleindorfer & Saad, 2005). Furthermore the environmental risk includes market risks and business-volume risk (Enyinda, Ogbuehi & Briggs, 2008).

3.1.2. Organizational risk (internal):

Organizational risk sources are sources within the boundaries of the supply chain partners and range from labor or production uncertainties to IT system uncertainties (Jüttner, Peck & Christopher, 2003). These include also operational risks (Enyinda, Ogbuehi & Briggs, 2008). One such case cited by

Kleindorfer and Saad (2005) is the grid blackout on August 14 2003 in the northeast region of the United States. Other organizational risk sources are bankruptcy (Kleindorfer & Saad, 2005).

3.1.3. Network-related risk (external):

Finally network-related risk sources arise from interactions between firms within the supply chain (Jüttner, Peck & Christopher, 2003). Jüttner, Peck and Christopher (2003) described everything which caused damage by suboptimal interaction between the organizations within a supply chain can be attributed to network-related risk sources. There are also other important contingencies that could disrupt the supply chain for instance the chance that a main supplier goes out of business or fraud at another company (Kleindorfer & Saad, 2005).

Das and Teng (1998) argue that environmental and organizational uncertainties are risk sources "to" the different links in the supply chain. Network-related are uncertainties are risk sources "of" the several links (Das & Teng, 1998).

3.2 Conclusion: Risks in supply chain

Global supply chains are the extension of local supply chains that operate domestically but both chains experience risks. The environmental, organizational and network-related risks are relevant for every enterprise within a supply chain globally or domestically. However, global supply chains are more risky than domestic supply chains because of the numerous links between a wide network of firms (Manuj & Mentzer, 2008). Manuj and Mentzer (2008) stated that these links in the network are prone to severe risks sources like disruptions, bankruptcies, breakdowns, macroeconomic and political changes, and disasters which leading to higher risks and make risk management difficult. Compared to sourcing from local markets, Wagner and Bode (2006) reported that global sourcing is usually associated with increased uncertainty, poorer transparency and visibility. The more structural complexity of a global supply chains increases the consequences of disruptions in the chain (Wagner & Bode, 2006).

Chapter 4 – Supply chain risk management –

Managing risk has emerged as an important topic in the research on supply chain management (Narasimhan & Talluri, 2009). Narasimhan and Talluri (2009) defined "Supply chain risk management (SCRM) as a strategic management activity in firms given that it can affect operational, market and financial performance of firms" (Narasimhan & Talluri, 2009, p. 114). "Risk management is the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence" (Normann & Jansson, 2009, p. 434). The process of risk management is focused on understanding the risk and minimizing their impact by addressing chance and direct impact (Normann & Jansson, 2004). Managing the consequences of risks is not easy; critical incidents could influence the perception of the firms by others (Harland, Brenchley & Walker, 2003).

4.1 Steps in risk management

If a company accepts the fact that uncertainty cannot be completely eliminated and acknowledge that there are several possible failures that can affect a supply chain network there are different approaches to reduce risk and recover in case of a breakdown in the supply chain. Normann and Jansson (2004) stated that the stages of the risk management process were similar among several authors.

Risk management usually consists of 3 general steps (Normann & Jansson, 2004):

1) Risk identification/analysis (or estimation)
2) Risk assessment (or evaluation)
3) Risk management

The steps described by Normann and Jansson (2004) are comparable with the steps in the failure mode and effects analysis (FMEA). FMEA is a systematic analytical quality planning tool that can identify and prevent potential problems (Layzell & Ledbetter, 1998). This method contains three steps:

1) Identify potential and previously unknown failure modes and all corresponding failure mode causes and effects (Layzell & Ledbetter, 1998, p. 175)

2) Rank causes of failure according to likelihood (probability of occurrence and of non-detection) and impact (severity of the effects of the resulting failure mode) (Layzell & Ledbetter, 1998, p. 175)
3) Provide for problem follow-up and identify corrective action to be taken (Layzell & Ledbetter, 1998, p. 175)

To guard the supply chain from future failures, breakdowns and disruptions or to recover from that a company has to make a plan and develop a strategy before anything happens.

4.2 Resilient supply chain

When a company identifies and priorities the risk they are exposed to, they can build a better, more resilient supply chain. The outcomes of the steps that have to be taken in order to build a more resilient supply are specific to each company. Building a resilient supply chain has also different approaches. Many firms leave risk management and continuity of business to security professionals, business continuity planners or insurance professionals (Sheffi & Rice Jr., 2005). According to Sheffi and Rice Jr. (2005) building a resilient company should be a strategic initiative that directs the way of operating of the firm and that increases its competitiveness.

In general there are two ways for a firm to build a resilient supply chain. Firstly, a supply chain strategy for a company who wants to return to a normal and planned level of product flow within the supply chain is called a recovery capability (Tang, 2006). Secondly, besides a recovery capability Tang (2006) developed another strategy called warning capability. This is more formally defined as the interactions and coordination of resources in the supply chain to search for a future or maybe past disruption and to subsequently spread the information about the disruption to the relevant suppliers within the chain (Tang, 2006).

Kleindorfer and Saad (2005) developed a plan to prevent risks from occurring and recover from risk in supply chains. These principles are a combination of the recovery strategy and the warning capability strategy developed by Tang (2006). The principles have been set up in such a way that the first rules shows what a firm can do to prevent risks and then what a firm can do to recover from occurred risks.

Kleindorfer and Saad (2005) defined ten principles to reduce risk in the future and recover from failure in case of a disruption:

1) First a firm must create a good working internal supply chain
2) Firms have to use the diversification theory[1]
3) Robustness of a supply chain is determined by the weakest link in the chain
4) Prevention is better than a curing process
5) Vulnerability increases with extreme leanness and efficiency
6) In perspective of principle 5 a firm must have established backup systems, contingency plans and maintaining reasonable slack
7) Collaborative sharing of information and best practices among supply chain partners
8) To understand potential harm to the business from supply chain risks, linking risk assessment and quantification with risk management options ex ante is important for evaluating and undertaking appropriate measures
9) Modularity of process and product designs, and other key elements of agility and flexibility for lean supply chain design
10) Implement total quality management principles, for example the Six-Sigma approach[2]

4.3 Specific supply chain risks

There is no general framework to work with to ensure the security of the entire supply chain. However, there are methods to manage the risk of specific supply chain risks. As already said supply chains are

[1] The diversification theory is an extension of portfolio theory in finance whereas the portfolio diversification reduces the risk of the investors (Lasher, 1997; and among others). The theory can be applied to risk management in order to minimize possible risk. This can be done by extending the diversification theory to include diversification of facility locations, products and services produced, logistics, sourcing options used, as well as operating modes and processes. (Kleindorfer & Saad, 2005)

[2] The six sigma approach reduces operating costs while achieving a higher supply chain security and reduces risks. (Kleindorfer & Saad, 2005)

exposed to many types of risks. Some of these supply chain risks are categorized into high, low risk for the global and local supply chain in the table below. Because of the numerous risks this research deals only with the first five supply chains risks that could harm the chain and how to manage these five risks.

	Global		**Local**	
Risk	**High**	**Low**	**High**	**Low**
Capacity constraints		**X**	**X**	
Culture differences	**X**			**X**
Disasters		**X**	**X**	
Exchange rates	**X**			**X**
System risk	**X**		**X**	
Operational risk	**X**		**X**	
Financial risk	**X**		**X**	
Mismatch between supply and demand	**X**		**X**	
Terrorism	**X**			**X**
Political instability		**X**	**X**	
Market risks	**X**			**X**
Business volume		**X**	**X**	
Labor, production and IT uncertainties		**X**	**X**	
Suboptimal interaction between organizations	**X**			**X**
Main supplier goes out of business		**X**	**X**	
Fraud	**X**		**X**	
Bankruptcy		**X**	**X**	

Table 2: Supply chain risks categorized into high and low risks for global and local supply chains.

- *Capacity constraints*

  Zsidisin (2003) defined capacity constraints as the inability of a system to produce a certain quantity of products in a limited time period. Capacity constraint can take place in every part of a supply chain. If a constraint occurs the firm has to move the production to another supplier to continue the product flow in the supply chain (Zsidisin, 2003). That is was what Nokia did when the Philips plant caught fire (Chopra & Sodhi, 2004). Almost immediately Nokia began to switch its chips order to other Philips plants, as well as to other microchips suppliers (Chopra & Sodhi, 2004). Because of this multiple supplier strategy and responsiveness Nokia's production didn't suffered as much as Ericsson who lost 400 million Euro's in sales (Chopra & Sodhi, 2004). Kleindorfer and Saad (2005) called this the diversification theory so a firm is not 100% dependent on one supplier. Ericsson had implemented the single source strategy (Chopra & Sodhi, 2004). This is a bit similar to a local supply chain. A firm operating only in their country has a limited number of suppliers to handle over the production in case of these constraints. Therefore a capacity constraint is more risky for a firm that operates only domestically.

- *Culture differences*

  As advantage for local operating firms, global firms face the difficulties of different local cultures, languages, and practices (Meixell & Gargeya, 2005). These difficulties can harm global supply chains because of possible miscommunications. The cultural differences can affect the effectiveness of business processes like demand forecasting and material planning (Meixell & Gargeya, 2005). According to Kleindorfer and Saad (2005) the solution to prevent such miscommunication is to manage these risks with collaborative sharing of information and use the best practices among supply chain partners.

- *Disasters*

  A disaster is a broad definition. There are different disasters like natural disasters, terrorism, and political instability. In case of a disaster a part or the entire supply chain will be affected. A disaster has a low risk for a firm with global supply chains because like the opportunities in case of capacity constrains a firm with a global network can move their production to another suppliers in and out of their operating country. In addition of Kleindorfer and Saad (2005) also Jüttner (2005) argues sharing information is critical to prevent crisis if a disaster happens. A disaster is a larger problem for domestically operating firms because it can fade away the entire chain. According to Narasimhan and Talluri (2009) this can happen also to a firm that operates

globally but has one single source. But with the diversification theory of Kleindorfer and Saad (2005) this can be prevented.

- *Exchange rates*

  Exchange rates are a risk to global supply chains. The fluctuations of the currencies are not predictable. Hedging can minimize the uncertainty of the fluctuations. Hedging is if a firm has a globally dispersed portfolio a negative effect of a currency fluctuation will not affect all the entities at the same time and the same magnitude (Manuj & Mentzer, 2008).

- *System risks*

  System risks are high for both of the supply chains. Today companies rely more and more on technology (Chopra & Sodhi, 2004). Although it is rare, a breakdown of the system can devastate the whole highly networked environments (Chopra & Sodhi, 2004). According to Chopra and Sodhi (2004) the best defense against a system breakdown is a robust backup system and well-designed, well communicated recovery process which makes a copy of all data and transactions. Principle 6 of Kleindorfer and Saad (2005) is quite similar to the defense of Chopra and Sodhi (2004).

4.4 Conclusion: Risk management in the global supply chain

There are various approaches to manage the risk in a supply chain. In the literature there no explicit frameworks for a domestic or a global supply chain. The methods explained are suitable for both types of chains. It is important for a firm to identify the risk for their supply chain and make a backup plan in case of failure and a plan to prevent the firm from risks that is suitable for their company. Risk management also must be a strategic initiative instead of a plan that is created at the time of a failure. The FMEA method is a tool to identify and priorities risks which that business is exposed to. The final step of the method is a step to take action. A firm has to have a strategy to lean in case of disruptions and a plan to prevent the company for the exposed risk. The ten principles defined by Kleindorfer and Saad (2005) are a combination of the recovery strategy and warning strategy of Tang (2006). These principles and strategy can make global as well as local supply chains more resilient.

Because of the general frameworks of risk management five supply chain risks are investigated more in-depth and how to manage them. Specific supply chain risks can be individually prevented and managed.

Chapter 5 - Conclusion and recommendations –

The problem statement of this research was: *How can companies identify and manage risks in global supply chains?* Three research questions have been answered in order to answer the statement.

The findings of the literature research have shown that there is not one general definition that defines a supply chain. However, the main characteristics of a supply chain are that the network where a company works within and collaborate to smooth the upstream and downstream flow of products to the end customer. In order to create a picture of what global supply chains are, the benefits and disadvantage of global chains and local chains are compared. The global supply chain is an extension of local supply chains. Firms with global supply chains collaborate with suppliers from different countries and/or provide customers all over the world while firms with local supply chains operate within the borderlines of their country. Due to the network of suppliers and customers all over the world a firm can benefits from different advantages like cost efficiency and proximity to customers.

There is no doubt that companies with global supply chains have advantages. This research has showed that firms with global supply chains are exposed to many of the same risks as locally operating firms. Nevertheless, firms with global supply chains are exposed to risks with higher consequences. Because of the various links within the network and the complexity of global supply chains the company faces more risk. It has been argued that global supply chains have increased uncertainty, poorer transparency and visibility.

In the literature three sources of risks are identified; environmental, organizational and network risks. Every company with supply chains is exposed to these risks, but every firm deals with different risks and different consequences. The environmental risk source is larger for global supply chains than for local ones. Research points out, that that disruption of supply chains can have significant impacts on the short term as well as on the long term financial performances.

Because of the severe consequences in case of supply chain disruption firms have to make a recovery plan or a strategy to minimize the chance of such disruption. The literature finds that companies need to implement risk management as a strategic initiative rather than a plan created in time of need. Risk management is specific for each company. This is due to the fact that every company faces different

risks and gives different priority to risk types. Yet, it is important to create a recovery plan in case of failure but also to have a plan to guard the firm from such disruptions. The FMEA (failure mode and effects analysis) method is one of the ways to identify, prioritize, prevent and recover from supply chain disruptions. Also the warning and recovery capabilities strategies are a perspective to look at the potential harm to the business. Kleindorfer and Saad (2005) have developed ten principles which are a combination of the warning and recovery capabilities strategies developed by Tang (2006). However, all these strategies are very general and cannot be applied to a specific firm.

Nonetheless, there are methods to manage the risk of specific supply chain risks. As said above supply chains are exposed to many types of risks. That is why five possible supply chain risks are pointed out in this research. Capacity constraints, culture differences, disasters, exchange rates and system risk are only a few of the numerous risks where a firm is exposed to.

5.1 Limitations

It should be noted that risks mentioned in the research are not the only risks that can occur in supply chains. Specific risks to a firm or industries are not described in this research to a firm.

Another limitation is the fact that risk management is a broad definition and like the risks mentioned in this research risk management is not specific. Risk management is a plan that is applied to one firm.

5.2 Recommendations

Based on this research there are recommendations for managers of firms with supply chain.

As the literature has shown it is very important for managers to invest in building a resilient supply chain. The severe consequences of disruptions can have a great negative influence on the financial performance of a firm. The pay offs of investing in risk management are not visible in the first place, though those who do invest have a big advantage in case of supply chain disruptions. In order to create a strategy to recover or to prevent disruptions good communication within the supply chain is required.

Recommendations for further research

As a result of the limitations of this paper there are recommendations for further research.

As stated in the limitations, there is little research done about the specific risks in different types of industries. Further research could be to investigate which risks are specific to a type of industry and what the main consequences are if these risks would occur.

Another recommendation for further research is research on risk management to build a more resilient supply chain. Current research on risk management is very broad. As mentioned in the former recommendation further research could be done on risk management with focus on specific types of industries.

References

Albino, V., Izzo. C., & Kühtz. K. (2002). Input-output models for the analysis of a local/global supply chain. *International Journal of Production Economics, 78(2),* 119-131.

AlHashim, D.D. (1980). Internal performance evaluation in American multinational enterprises. *Management International Review, 20(3),* 33-39.

Andersen, P.H., & Christensen, P.H. (2005). Bridges over troubled water: suppliers as connective nodes in global supply networks. *Journal of Business Research, 58(9),* 1261-1273.

Barry, J. (2004). Perspectives: supply chain risk in an uncertain global supply chain environment. *International Journal of Physical Distribution & Logistics Management, 34 (9),* 695-697.

Burrill, G. S., & Almassey, S. E. (1993). *Electronics '93 The New Global Reality: Ernst & Young's Fourth Annual Report on the Electronics Industry.* San Francisco: Ernst & Young.

Christopher, M.L. (1992). *Logistics and Supply Chain Management.* Pitman Publishing: London.

Christopher, M., & Peck, H. (2004). Building the Resilient Supply Chain. *The International Journal of Logistics Management, 15 (2),* 1-14.

Christopher, M.C., Peck, H., & Towill, D. (2006). A Taxonomy for Selecting Global Supply Chain Strategies. *International Journal Of Logistics Management, 17 (2),* 277-287.

Chopra, S., & Sodhi, M.S. (2004). Managing Risk To Avoid Supply-Chain Breakdown. *MitSloan Management Review, 46 (1),* 53-61.

Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply Chain Management: More Than a New Name for Logistics. *The International Journal of Logistics Management. 8(1),* 1-14.

Craighead, C. W., Blackhurst, J., Rungtusanatham, M. J., & Handfield, R. B. (2007). The Severity of Supply Chain Disruptions: Design Characteristics and Mitigation Capabilities. *Decisions science 38(1),* 131 156.

Das, T.K., & Teng, B. (1998). Resource and risk management in the strategic alliance-making process. *Journal of Management, 24 (1),* 21–42.

Ellram, L., & Cooper, M. (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. *International Journal of Logistics Management, 4(2),* 1-10.

Enyida, C.I., Ogbuehi, A., & Briggs, C. (2008). Global Supply Chain Risks Management: A New Battleground for Gaining Competitive Advantage*. Proceedings of ASBBS, 15 (1),* 278 -292.

Ernst, D. & Kim, L. (2002). Global production networks, knowledge diffusion, and local capability formation a conceptual framework. *Research Policy, 31(8/9),* 1417-1429.

Ferdows, K. (1997). Make the most of foreign factories. *Harvard Business Review, 75(2),* 73–88.

Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management, 19(2),* 185-200.

Harland, C. M., (1996). Supply Chain Management: Relationships, Chains and Networks. *British Journal of Management, 7(1),* S63- S80.

Harland, C., Brenchly, R., & Walker, H. (2003). Risk in supply networks. *Journal of Purchasing and Supply Management, 9 (2),* 51-62.

Hendricks, K., & Singhal, V. (2005). An empirical analysis of the effect of supply chain disruptions on long run stock price performance and equity risk of the firm. *Production and Operations Management, 14(1),* 35-52.

Jüttner, U., Peck, H., & Christopher, M. (2003). Supply Chain Risk Management: Outlining an Agenda for Future Research. *International Journal of Logistics: Research & Applications, 6 (4),* 197-210.

Jüttner, U. (2005). Supply chain risk management: Understanding the business requirement from a practitioner perspective. *The International Journal of Logistics Management, 16(1),* 120-141.

Kleindorfer, P., & Saad, G. (2005). Managing disruption risks in supply chains, *Production and Operations Management, 14(1),* 53–68.

Kogut, B., & Kulatilaka, N. (1994). Operating flexibility, global manufacturing, and the option value of a multinational network. *Management Science, 40 (1),* 123-139.

Lambert D. M., & Cooper M. C. (2000). Issues in Supply Chain Management. *Industrial Marketing Management, 29(1),* 65-83.

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998) Supply Chain Management: Implementation Issues and Research Opportunities. *The International Journal of Logistics Management, 9 (2),* 1-20.

Lasher, W. R. (2003). *Practical Financial Management*. Thomson South-Western: Ohio.

Layzell, J., & Ledbetter, S. (1998). FMEA applied to cladding systems - reducing the risk of failure. *Building Research and Information, 26 (6),* 351-357.

MacCormack, A.D., Newmann, L.J.I., & Rosenfield, D.B. (1994). The new dynamics of global manufacturing site location. *Sloan Management Review, 35(4),* 69–84.

Manuj, I., & Mentzer, J. T. (2008). Global supply chain risk management strategies. *International Journal of Physical Distribution & Logistics Management, 38(3),* 192-223.

McDougall, P. P., (1989). International vs. domestic entrepreneurship: A comparison of new venture behavior and industry structure in the computer and communications industries. *Journal of Business Venturing, 4*, 387-400.

Meixell, M. J., & Gargeya, V. B. (2005). Global supply chain design: A literature review and critique. *Transportation Research Part E: Logistics and Transportation Review, 14(6),* 531-550.

Mentzer, J.T., DeWitt, W.J., Keebler, J.S., Min, S., Nix N.W., Smith C.D., & Zacharia, Z.G. (2001) Defining supply chain management, *Journal of Business Logistics, 22(2)* , 1-25.

Narasimhan, R., & Talluri, S. (2009). Special Issue: Perspectives on Risk Management in Supply Chains. *Journal of Operations Management, 27 (2),* 114-118.

Norrman, A., & Jansson, U. (2004). Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. *International Journal of Physical Distribution & Logistics Management, 34 (5),* 434-456.

Oliver, R. K. and M. D. Webber (1982). '*Supply Chain Management: Logistics Catches Up With Strategy'*. In: M. Christopher (1992), Logistics: The Strategic Issues, pp. 63-75. Chapman and Hall, London, UK.

Oviatt. B. M., & McDougall. P.P. (1999). A framework for understanding accelerated international entrepreneurship. *Research in Global Strategic Management, 7,* 23-40.

Rice, J.B., & Sheffi, Y. (2005). A supply chain view of the resilient enterprise. *MIT Sloan management review, 47(1),* 41-48.

Sekaran, U. (2003). *Research Methods for Business: A Skill Building Approach*, 4th ed. Wiley: New York.

Stauffer, D. (2003). Supply-chain Risk: Deal with it, *Harvard Business School, April.*

Tang, C.S. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics, 103(2),* 451-488.

Tang, C.S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistisch: Research and Applications, 9 (1),* 33-45.

Vidal, C. J., & Goetschalckx, M. (1997). Strategic production-distribution models: A critical review with emphasis on global supply chain models. *European Journal of Operational Research, 98,* 1-18.

Wagner, S.M., & Bode, C. (2006). An empirical investigation into supply chain vulnerability. *Journal of Purchasing and Supply Management, 12(6),* 301-312.

Zsidisin, G.A. (2003). Managerial Perceptions of Supply Risk. *Journal of Supply Chain Management. 39(1),* 14-26.