JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
JÖNKÖPING UNIVERSITY

Risk Assessment of an Internal Supply Chain

- a case study of Thule Trailers AB Jönköping

Paper within Bachelor Thesis in Business Administration

Author: Alexandra Fors
Madeleine Josefsson
Sofia Lönn Lindh

Tutor: Jens Hultman

Jönköping January 2007

Acknowledgements

We would like to thank Thule Trailers AB in Jönköping for their cooperation, and for the opportunity for us to get an insight into the company's operations. We would especially like to thank Jan Björsell, local manager, Cecilia Liimatainen, logistics planner, Mattias Fredriksson, assistant production manager, and Tomasz Kurowski, operations manager in Poland. In addition we would like to thank Magdalena Markowska, PhD-student at Jönköping International Business School for helping us with Polish translations, as well as our supervisor Jens Hultman for his support and guidance throughout the process of writing this thesis.

Jönköping, January 2007

Alexandra Fors Madeleine Josefsson Sofia Lönn Lindh

Bachelor Thesis within Business Administration

Title:	Risk Assessment of an Internal Supply chain – A case study of Thule Trailers AB Jönköping
Authors:	Alexandra Fors Madeleine Josefsson Sofia Lönn Lindh
Tutor:	Jens Hultman
Date:	2007-01-15
Subject terms:	Supply chain risk, internal supply chains, risk management, supply chain mapping

Abstract

The concept of supply chain management has become an important issue for companies today in order to keep or gain competitive advantage. It is all about managing your supply chain to reach the highest possible efficiency and increase profits through cooperation with your supply chain partners. A supply chain is however vulnerable to several threats, or risks, that decreases the overall efficiency and influences the business performance.

The purpose of this thesis is to identify the *internal risks* that can be found in a basic *internal supply chain* in order to make an assessment of their manageability and impact using a specific case. To do this a case study of Thule Trailers AB in Jönköping was conducted. Thule Trailers AB chose to offshore their main production of components to Poland in 2003, so the company's internal supply chain was expanded outside of Sweden. This research looks closer at the interactions between Thule Trailers AB in Jönköping and their internal supplier plant in Poland. The research was conducted using a qualitative method with several interviews with representatives in both Jönköping and Poland, during which a number of internal risks were identified in Thule Trailers AB in Jönköpings' internal supply chain.

The conclusions made are that the internal risks identified, i.e. communication risks, quality risks etc, might not have as great an influence on the company as would external risks, they can however in comparison be managed. The findings suggest that the issues with e.g. quality and delivery basically come down to insufficient communication inside the internal supply chain.

Another conclusion that could be drawn is that since the internal risks in the internal supply chain all are ripple effects, its source is almost always external, which implies that their avoidance is difficult. At least they cannot be eliminated completely by the company itself, it needs to be done in cooperation with the company's external supply chain partners.

There is potential to solve most of the internal problems that can be managed internally if both parties are prepared to put some real effort into reducing the risk sources. The risks are manageable and need to be managed to reduce the impact it has for the customer and end customer in turn. The authors of this thesis believe that for a company to be successful, the end customer has to be prioritized in almost every situation, and this goes for all of the members in the supply chain, especially the internal ones.

Table of Contents

1 Introduction

The reader will be introduced to the concept of supply chain risk and be brought to understand the vitality of supply chain risk management. The reader will also be made familiar with factors that influence supply chain risk, and find out why the authors of this thesis find this an interesting subject. Also a short introduction to the researched company and the purpose of the thesis will be given.

Supply chain management has in recent years become an important issue for many companies. Having an efficient supply chain gives all members in the supply chain an opportunity to gain competitive advantage and increase profits. There are though many threats, or risks that can influence a supply chain negatively (Giunipero & Eltantawy, 2003). Risk has always been a part of a company's business environment and common traditional strategies to deal with risks are multiple sourcing and buffering of inventories. Buffering inventory is however very costly, mainly because of inventory holding costs (Ballou, 2004). Supply chain risk management deals with identifying all sorts of risks that can lead to interruptions in the supply chain (Giunipero & Eltantawy, 2003). A US research company derived in 2003 to an estimate that approximately one in five companies would eventually encounter some kind of supply chain disruption, and out of these 20 percent, 60 percent would most likely go out of business (Christopher, 2005). This shows the great importance of knowing your supply chain and the uncertainties and potential risks that can trigger a negative chain reaction throughout the entire supply chain (Deloitte Enterprise Risk Services, 2004).

The risks associated with supply chains have increased in the last decade for several reasons. The markets have become more volatile, there is greater pressure on firms since product life-cycles are becoming shorter, which in turn makes it difficult to predict demand. Other reasons for the increased vulnerability in supply chains are that companies today, rather than focusing on effectiveness, focus more on efficiency. Decreasing inventories and concepts like Just-In-Time makes a company more efficient, but also more vulnerable. Another quite obvious reason is the extended globalization. As companies expand abroad, transfer their production to low cost countries, and applies offshore sourcing, their supply chain gets larger and larger. Outsourcing is another popular concept that does not come without risk. The more a company focuses on its core competencies and outsources other areas, the more complex the company gets (Christopher, 2005).

Complexity and risk often go hand in hand. The more intricate the supply chain gets, the more vulnerable it is since it often loses some of the control. When it comes to procurement, some companies choose to source from a single supplier and others from multiple suppliers. Those that choose to source from a single supplier expose themselves to a greater risk since they have no alternative should something happen to the supplier (Christopher, 2005).

Especially important are the internal risks within the supply chain, since if these are not handled correctly they might break the company (Fishkin, 2006). Even more important is the internal supply chain, since its performance will influence the external supply chain in turn (Hill, 2000).

1.1 Thule group

Thule Group is a global company with production and sales at over 30 sites around the world, with an estimation of 3 700 employees worldwide. Thule Group is owned by the British venture capital company Candover, who acquired the organization in 2004 (Johansson, 2006). The company has a large product portfolio and develops, manufactures and markets rooftop boxes, roof rails, bike carriers, snow chains, trailers and accessories for motor homes and caravans (Thule Group, 2006). In order for them to provide such a broad portfolio, the company is divided into a number of different divisions (see also Figure 1):

- The first division is Europe/Asia, which has its main production plant in Hillerstorp, Sweden. This division mainly focuses on constructing roof racks, roof boxes and bike racks.
- The second division is Thule Trailers, which has two factories in Sweden, one in Poland, one in Denmark, three in the USA, one in Italy and one in South Africa.
- The third division is Automation that constructs car rails. The rails are delivered directly to the automotive industry.
- The fourth division is Snowchains. They have one factory in Austria and one in Italy.
- The fifth division is USA and is similar to the Europe/Asia division. It is separate due to its geographical location.
- The last division is Towbars, which is the latest acquisition.

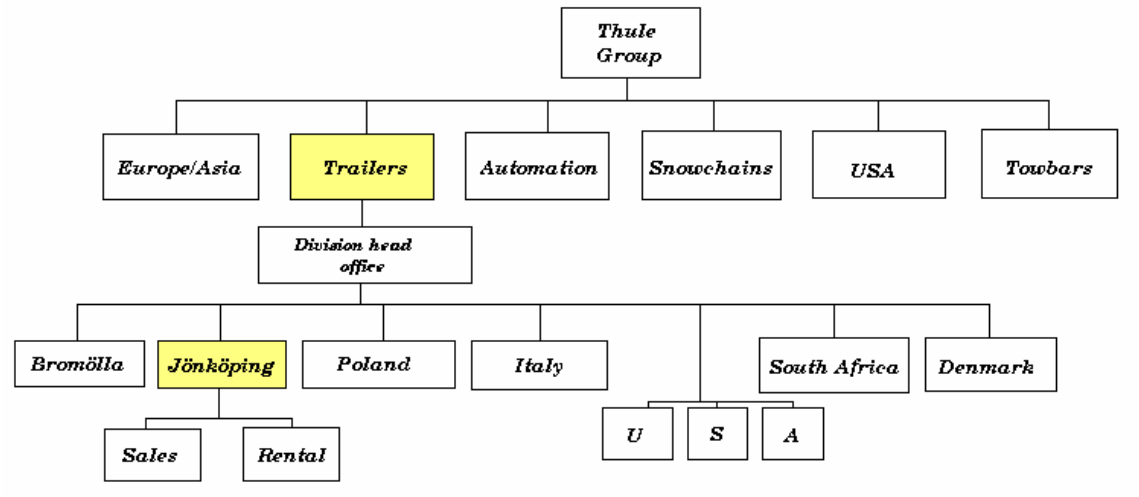

Figure 1 - Thule group

Today Thule Group has a turnover of approximately 7 billion SEK. The main business idea for the company is to grow both on its own, but also through acquisitions. During the last couple of years quite a few acquisitions have occurred, the latest being the acquisition

of another trailer factory, the snowchain and the towbar division. Each division is responsible for its own results (J. Björsell, personal communication, 2006-11-03).

1.1.1 Thule Trailers AB

Thule Trailers AB in turn is divided into different production sites as seen previously in figure 1. These are situated in Jönköping, Bromölla, Denmark, Poland, Italy, South Africa and also three plants in the USA. The have two branches as well, one in Norway and one that belongs to Brenderup, Denmark, but is situated in Oslo (C. Liimaitinen, personal communication, 2006-11-14). The Trailers division works with both sales and rental (J. Björsell, personal communication, 2006-11-03).

Thule Group's annual report for 2005 shows that the Trailer division has doubled its sales from 2003 to 2005, and also tripled its profits in the same period of time. Reasons stated for this rise is a focus put on management, who in turn put emphasis on product development, which was facilitated by moving the production to Poland (Thule Sweden, 2005).

Thule Trailers AB produces trailers within four different segments; boat trailers, consumer trailers, commercial trailers, and horse trailers. Most of the trailers the company has are sold under different brands that have been acquired, like Fogelsta and Tranesläpet (C. Liimatainen, personal communication, 2006-10-12; Thule, 2006). Other brands acquired are Gisebo Proffsvagnen, Brenderup and Easyline (Johansson, 2006). Thule Trailers AB have the largest market share in Scandinavia and is among the three largest producers in Europe and stand for 22% of the total Thule Group sales.

The unit in the Trailer Division focused at is the interaction between the unit in Jönköping and the unit in Poland. The main activity at the production plant here is to assemble trailers from parts that they procure internally from Poland. These parts were earlier produced in Jönköping, but now, when part of the production has been offshored to Poland, Jönköping buys larger parts and then assemble them (C. Liimatainen, personal communication, 2006-10-12; Thule, 2006). The production plant in Jönköping has about 110 employees and during the peak season they also employ about 20 people for a short period (Johansson, 2006).

1.2 Problem discussion

From the introduction about supply chain risks, it should become clear that it is very important to be able to identify and manage risks in supply chains. Hauser, Simester, and Wernefelt (1996) believe that in order for a supply chain to function smoothly, the *internal supply chain* must be the first priority since it will affect the external supply chain in turn. Thule Trailers AB in Jönköping is of special interest since they have offshored the largest part of their production to Poland, and therefore have an internal supply chain that extends over borders. The company has agreed to let the authors of this thesis look into their internal supply chain to see how the internal risks are managed. After the offshoring of the production to Poland, the Polish plant is acting as an internal supplier to all units within the Trailer Division. A supply chain is generally a relationship with at least three actors, however, there is also something called a dyad relationship according to Brindley and Ritchie (cited in Brindley, 2004), which is the relationship between two actors in a supply chain. They refer to this as the *basic supply chain*. The dyad relationship between the plants in Jönköping and in Poland will therefore be of special interest to our research since they act as internal supplier and internal customer. Thule Trailers AB is a part of a very large corpo-

ration of interconnected parts (C. Liimatainen, personal communication, 2006-10-12), but it becomes even more interesting, when the focus is set narrowly. The focus will mainly be on the internal risks that may lead to disruptions in the internal supply chain. There are many things to regard when trying to handle risks in a supply chain, among others, quality, information flow and delays (Chopra & Sodhi, 2004).

1.3 Purpose

The purpose of this thesis is to identify the *internal risks* that can be found in a basic *internal supply chain* in order to make an assessment of their manageability and impact using a specific case.

1.4 Delimitations

The company selected as a source of information for our research is Thule Trailers AB in Jönköping and especially the most important link in the internal supply chain, namely the link between Jönköping and their internal supplier in Poland. The limited time available has not made it possible for us to look deeper into the interaction of all the actors in Thule Trailers AB internal supply chain. The authors of the thesis are however confident that most findings can be generalized to all units in Thule Trailers AB.

1.5 Clarification

From here on Thule Trailers AB in Jönköping will be referred to as "Jönköping" or "Thule Trailers Jönköping" in order to keep the unit apart from the rest of the division, and the production plant in Poland will be referred to as "Poland".

2 Method

This chapter briefly describes the chosen research method and explains the methods used during the creation of this thesis. The authors will also explain how the conclusions where drawn.

2.1 Qualitative vs. Quantitative research methods

There are two major research approaches that are generally used – the qualitative and the quantitative research methodologies that can be seen as using different aspects of looking at the same research (McCracken, 1988). The most obvious difference between the two methods is the usage of numbers and statistics in the quantitative method of research, whereas the qualitative method is used to categorize data found through observations. Furthermore, the quantitative method is more structured and the researcher can control much more due to all of the statistical tools available. Some of the theory and the problem statements are pre-structured which makes the analysis of quantitative data easier to perform (Marshall & Rossman, 1999). Since no questionnaires have been used to collect data for this thesis, there are no numbers or statistics to analyze. It has therefore not been an option to apply the quantitative approach, thus the authors of this thesis have conducted a qualitative research.

Most research conducted in the area of supply chain management in the past have on the other hand been quantitative. Golocic, Davis, and McCarthy (cited in Kotzab, Seuring, Müller, & Reiner, 2005) suggest though that qualitative studies should be applied more in this field of research, since the complexity in the businesses environments have increased. Its dynamics have become more difficult to research and understand using only quantitative approaches, thus supporting the choice of conducting a qualitative approach in this case.

Merriam (1998) describes the concept of qualitative research as a so called umbrella concept, where different kinds of questions help the researcher to gain an understanding of a social phenomenon. The qualitative research method often includes some fieldwork in order to make as accurate observations as possible. The authors of this thesis have made visits to the company's facilities in Ljungarum where representatives were interviewed, and the production assembly lines were shown.

Also, the person conducting the research is alone responsible for gathering and interpreting data in comparison to quantitative research methods where computers might be involved (Merriam, 1998). Since the researcher is the primary interpreter in the qualitative research method, it is of great importance to be critical of the findings. I.e. the qualitative approach is more interpretative than the quantitative approach where explanations of correlating causes is the primary focus. A significant source of error is the human factor, which makes it extra important for the researcher to be objective (Merriam, 1998). To avoid this to the greatest extent possible, all empirical data gathered, i.e. information gathered through interviews, have been recorded using a dictaphone, and later transcribed into a Microsoft Word document. Telephone interviews have also been recorded and transcribed in the same way.

2.1.1 Case study

In order to get a deeper insight into an internal supply chain, this research was conducted as a case study of a single company. The reason to study activities present inside a single company can be that case studies allow researches to ask questions like Why? and How? Golicic et. al (cited in Kotzab et. al., 2005). This was considered an appropriate approach in the process of answering the purpose of this thesis. A case study usually contains several sources of empirical information such as interviews, questionnaires, and observations, and might end up being either qualitative or quantitative, or even a mixture of both. The focus is not on the outcome but rather on the process (Bryman & Burgess, 1999).

A case study can be either descriptive or interpretive, where the interpretive orientation is used when there is not much theory to go back to and a lot of interpretation is needed. There is a lot of literature in the field of supply chains and supply chain risks, but it mainly has an external focus, which lead to a lot of interpretation in order to apply this theory on internal supply chains and internal risks. This does not however mean that an interpretive case study is not descriptive, it only allows the researcher to make assumptions between relationships (Merriam, 1998).

2.1.2 Inductive vs. Deductive

A qualitative analysis has two different perspectives, inductive and deductive. When the inductive approach is used the researcher collect and explore the data, and from that he/she develop theories that are later related to the literature. The deductive approach indicates that existing theory and literature is being used to help identify theories and ideas. This gives the research a clear theoretical position that will be designed before the data is collected (Saunders, Lewis, & Thornhill, 2003). The information gathered for the frame of reference mainly comes from books and articles found at the university library, the internet, and from different databases like ABI/Inform, Google Schoolar, Google.com and JSTOR. Important keywords when searching for information have been; supply chain risk management, internal supply chains, internal risks, risk management, supply chain mapping and supply chains. In doing this the theories have been drawn up, which later were tested together with the data gathered.

If the data found is equivalent to what has been foreseen through the theory literature that was earlier collected, this will show where possible threats to the strength of the conclusions made from the research can be found (Saunders et.al, 2003).

The research conducted in this thesis is as explained above based on recognizing theories that have later been used to test the data found by evaluating the internal supply chain in Thule Trailers Jönköping, meaning that this thesis is leaning towards the deductive appoach.

2.1.3 Validity and Reliability

In a qualitative study like the one conducted here, the researchers are the instruments used. The researchers ask the questions and are in control. The validity therefore, when using the researcher as the main tool, depends on how well the researcher performs the fieldwork, as well as the competencies and skills that the researcher has (Quinn Patton, 1990).

According to Quinn Patton (1990), the word validity means being sure that the instrument chosen is the right one for this special research. Furthermore, validity in a qualitative re-

search is about interpretation, whether the researcher is qualified enough and if he/she really sees what it is he/she thinks is being seen. The question lies in if the chosen instrument provides the right and valid data (Kirk & Miller, 1986). The authors of this thesis have increased the validity by recording and transcribing the empirical data gathered as mentioned before.

In order for a researcher to increase the reliability of a report, a continuous method of documenting is recommended by Kirk and Miller (1986). All documents received and made have for this reason been saved. When this is done it increases the chance for someone to compare two reports with the same objective. To measure the reliability further, a good idea would be to train the people interviewing in interview techniques (Kirk & Miller, 1986). Literature on interview methods and techniques were studied by the authors of this thesis before conducting the interviews.

2.1.4 Interview method

The traditional way of gathering information in a qualitative research is to perform interviews where the most typical form of interviews are conducted face-to-face. The purpose of an interview is to collect information that cannot be observed. There are three main types of interviews; highly structured/standardized, semi structured, and unstructured/informal. Questions to avoid are multiple questions, leading questions, and yes-and no questions. Good questions can be hypothetical, interpretive, ask the interviewee to describe the ideal position, or challenge the interviewee to take the opposite standpoint (Ryen, 2004).

A qualitative interview should be conducted like a regular conversation. It enables the interview to be more spontaneous, reflective and also gives the possibility to go more in-depth into subjects that are of special interest. The interview is to a lesser extent structured in advance. If the interviewer in this way is guiding the conversation within specific themes with some keywords, it is called a semi-structured interview (Ryen, 2004). According to McCracken (1988) an interview guide can be very helpful when conducting a qualitative interview, which was developed before conducting the interviews for this thesis. It can be found in Appendix 1.

2.1.4.1 The interviews conducted

The source of the empirical information gathered in this thesis is interviews with representatives from Thule Trailers in Jönköping and Poland. The representatives interviewed for this thesis are the following:

- Cecilia Liimatainen, *logistics planner* at Thule Trailers Jönköping. With her we had two personal interviews, 2006-10-12 at a local café and 2006-11-14 at another local café since it was easier for her to meet after business hours. We have also had some e-mail correspondence and short telephone conversations throughout the process of writing this thesis when small questions came up.

- Jan Björsell, *local manager* and board member of Thule Trailers Jönköping and CEO of Thule Trailers Bromölla. We had one personal interview in his office in Ljungarum, Jönköping 2006-11-03, and in addition a telephone interview 2006-11-28. Due to clashes in the schedule, the authors of this thesis were unable to do this second interview in person.

- Tomasz Kurowski, *operations manager* at Thule Trailers Poland, with whom we had a telephone interview 2006-11-20 due to the distance to his location in Wielen, Poland. Additional e-mail correspondence with minor questions have also taken place.

- Mattias Fredriksson, *assistant production manager* at Thule Trailers Jönköping was interviewed in person in Ljungarum, Jönköping, in the company's conference room 2006-11-22. The interview was originally scheduled to be with the production manager Johan Hyltse, who at our arrival was unable to receive us. In his place we got to talk to Mattias Fredriksson, who also was kind enough to show us the assembly lines. Additional e-mail correspondence has also taken place for minor questions.

The interviews were all recorded digitally and transcripts were made afterwards to ensure the accuracy of the empirical data. The interviews were conducted in a semi-structured way in order to get as much information as possible.

Also, to get as many views as possible we have tried to reach the Polish assistant production manager, as well as floor worker representatives and union representatives in Jönköping, but unfortunately we have been unsuccessful to reach anyone of them.

2.2 Data collection

Using a qualitative approach, Golicic et. al (cited in Kotzab et. al., 2005) claim that the first step is to gather data. The authors also argue that literature reviews are best made parallel throughout this process. This thesis was started out by collecting theory literature and literature on methodology in order to gain a deeper knowledge in the area of interest. The reason why this was done was that it was deemed necessary in order to be able to formulate an interesting and relevant purpose. Questions arose during the literature review and were later used as a base for the interview guide.

A first meeting took place with the logistics planner, who gave an overview of the company, what they produce, who their customers are, what her role in the company is and so on. After this meeting it was easier to see the whole picture, and more relevant theory was found and some was removed. It also helped develop the main questions that were prepared for the second meeting which took place with the local manager. He provided a more detailed overview of the company as a whole, with all divisions included. He further explained the cooperation with their suppliers and made some general comments on strengths and weaknesses. After this interview a second interview was scheduled with the logistics planner since she on a daily basis works intimately with the internal supplier. After the two first interviews it was now easier to know which questions to ask, and more detailed information was retained. The fourth interview was with the Polish operations manager, who gave us the hint that there are conflicting views inside the company, which gave the idea of the basic frame for the empirical presentation. At the fifth interview conducted it was the aim to get a view of how the production was affected by the cooperation with the internal supplier. This interview was held with the assistant production manager who gave some very interesting information and got down to the bottom of the perceived problem. After this it was deemed necessary to have an additional interview, the sixth, with the local manager to get his view on the issues that had arisen during the other interviews.

After having had six interviews it was considered to be time to start to plot down the empirical chapter. Certain issues had been mentioned by all or several interviewees and were easier to plot down. Other issues were identified by the authors of this thesis after reviewing all interviews and interpreting the answers.

2.3 Data analysis

In order to analyze the data, we have carefully read and re-read both the theoretical and the empirical framework. A model was developed to tie the different theories together with the purpose of giving the reader a clear overview of the theoretical field presented, and facilitate the further understanding of our discussion. From the empirical data gathered the authors of this thesis were also able to map the internal supply chain. In order to analyze we have first had discussions in the group, made use of whiteboards to sketch our brainstorming, and during this process of analyzing the gathered data we were also able to reach many of the conclusions. To avoid the risk of copy-paste from theory and empirical data and instead take it to the next level, we started out by looking at each chapter and asking ourselves questions that would be interesting to get answered. These questions in turn facilitated our discussion that later lead to our conclusions.

3 Identifying and managing risks in supply chains

In order to fully comprehend the theoretical framework, this chapter will start out with a short introduction of supply chain management and the concept of supply chains. This is the base for our argumentation and facilitates the readers understanding of the underlying concepts that will not be elaborated further on in the thesis. The chapter will after that guide the reader through the deeper aspects of supply chain risk management and risks in internal supply chains. It will also be shown how to map a supply chain in order to evaluate where the risks are in the supply chain.

3.1 Supply chain management

The concept of logistics has through history been developed through three stages. First, logistics was seen only as the transportation, handling and transfer of goods, as well as warehousing. The second stage was more flow oriented and tried to coordinate different areas like procurement, production, distribution and disposal. Today, the third stage has been reached, called *supply chain management*, and is the new subject focused on where the overall coordination of a company is considered, facilitated by important factors like information, planning, and control (Pfohl, 2004).

Delfmann and Anders (2000) reason in the same way and also argue that the concept of supply chain management is nowadays used as a synonym to old concepts such as logistics, logistics management, operations management, distribution channels, transport, warehousing and packaging just to mention a few (cited in de Koster & Delfmann, 2005). Others like Brindley (2004) claim that supply chain management is an extension of logistics. A part of supply chain management is also the coordination of internal activities such as materials handling, manufacturing, and internal logistical activities (Tan, 2001).

Supply chain management involves management at the operational, tactical, and strategic level, but has as its key goal to increase customer satisfaction and at the same time optimize supply chain coordination and supply chain profits (Pfohl, 2004). This means that supply chain management involves both tangible and intangible dimensions. It has become increasingly important for firms today to have a well managed supply chain in order for them to keep or gain competitive advantage. This has increased the exposure to risks in supply chains and there are different sources of risks, external and internal, that we will examine further on in chapter 3. First however, we will look at what a supply chain really is.

3.1.1 Supply chains

A supply chain can be defined as follows according to the Council of Supply Chain Management Professionals:

"(1) Starting with unprocessed raw materials and ending with the final customer using the finished goods, the supply chain links many companies together. 2) The material and informational interchanges in the logistical process stretching from acquisition of raw materials to delivery of finished products to the end user. All vendors, service providers and customers are links in the supply chain" (Council of Supply Chain Management Professionals, 2005, p 96.).

There are two different kinds of supply chains, internal and external, where the internal supply chain deals with for example procurement, manufacturing, and distribution, and the external supply chain with supply chain partners such as suppliers and customers (Chopra

& Meindl, 2004). In comparison to the external supply chain that comprises the flows to and from the organization (Krajewski 1990, cited in Shah & Singh, 2001), the internal supply chain involves the supply flow inside the company, hence the relationship between the internal customers and the internal suppliers (Hauser et al., 1996). Andel (2001) explains that you need to start by focusing on the internal supply chain, i.e. the internal flow of products and information, in order to get the perfect supply chain. A supply chain is often thought of as a network of interconnected companies, where the internal supply chain connects the different areas inside a company. There are many things that can influence a company's performance both negatively and positively. Risks of different kinds are influencing companies and, especially their supply chains (Christopher, 2005).

Next section will start to look at how to visualize a supply chain in order to get a better understanding of its complexity and how to easier identify risks. To get an overview of a supply chain there is something called supply chain mapping that can be used for several different reasons, one of them being risk identification. In order to address the different risks it is important to identify them, and realize that there are different levels of risk that influence in different ways, and learn how to manage them (Peck, 2005). In order to identify where in a supply chain risks occur, a good beginning could be to start out with a mapping process.

3.2 Supply chain mapping

It is not only important to visualize a supply chain, there is also a need for it to be easily transferable. However, the process of mapping the supply chain is getting more problematic as companies choose to outsource more and more of their production (Gardner & Cooper, 2003). Steel (2006) quotes an interview with Norrman, an associate professor at the Department of Industrial Management and Logistics at Lund University, in his article, that outsourcing makes the supply chain *"leaner and meaner"*. The risk gets out of control with outsourcing and that is one of several reasons to map a supply chain.

There are several other reasons for a firm to map its supply chain, some of them are:

- enhancement of the strategic planning process
- to make it easier to distribute important information
- to visualize the different channels of a company
- to give everyone in the supply chain the same perspective (Gardner & Cooper, 2003).

However, the supply chain mapping should be distinguished from the process mapping, which is when you describe your operation systems by flowcharts (Gardner & Cooper, 2003). Since the focus in this thesis is on internal supply chains, the internal supply chain and the process mapping presumably have much in common, enabling a more internal perspective. There are three main factors in which they differ generally.

	Supply Chain Mapping	Process Mapping
Orientation	External	Internal (typically)
Level of Detail	Low to moderate	High
Purpose	Strategic	Tactical

Table 1 - Distinguishing strategic supply chain mapping and process mapping (Gardner & Cooper, 2003)

The *orientation* of supply chain mapping, as shown in the figure above, is usually external with focus on having as good flow of information, goods, and money as possible in both upstream and downstream directions. Furthermore, the *level of detail* is seen from an overall perspective with high level measures making it easier to view. Finally, the *purpose* of supply chain mapping is to provide the company with a basis for strategic decision making (Gardner & Cooper, 2003).

A map in general has always been used to see the world, which in reality is too large and complex, in a minimized version. This also applies for the supply chain map. A supply chain can have arms that reach far away from the focal point, which in turn can be very difficult to understand and explain to someone. To have a supply chain map available elevates the explanation process. A map can be viewed from an upstream perspective, meaning a supplier oriented map from the focal point, in comparison with the downstream perspective, towards the end customer (Gardner & Cooper, 2003).

When a company has mapped their supply chain it should become obvious to them what parts that belong to their internal supply chain. The meaning of this concept is further explained in the next section.

3.2.1 Internal supply chains

Especially during the the start-up phase of a company it is important to integrate the external supply chain with the internal. Furthermore, the harmonization of the internal supply chain puts more emphasis on the horizontal processes, from raw material to the finished goods. The different steps in between are made to cooperate in order to harmonize the work flow (Hill, 2000).

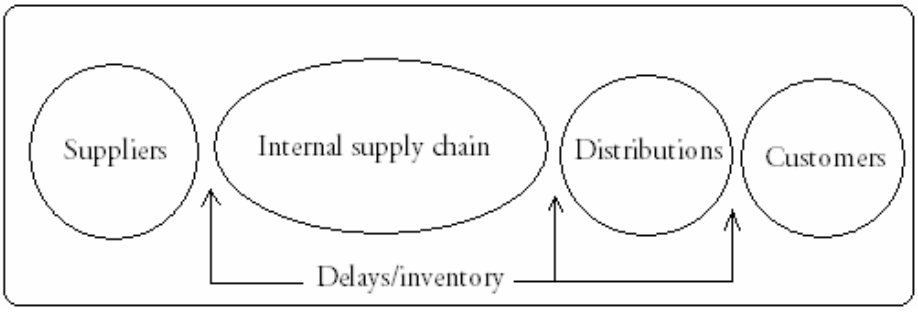

Figure 2 - Integration of the supply chain activities within a business (Hill, 2000)

The internal supply chain of a company refers to the manufacturing process, from raw material to finished products, which might involve in-house logistics or the use of a logistics provider if the production is distributed across production sites or even across countries (Krajewski, cited in Shah & Singh, 2001). It is often true that a company's worst enemy is themselves, meaning that the disruptions in the internal supply chain can destroy the very foundation of the large supply chain.

Examples of sources that leads to disruptions that often occur in the internal supply chain are:

- shortage of internally produced parts
- new products or new designs
- forecast and information errors (Krajewski & Ritzman, 2002).

Hauser et al. (1996) show the interdependencies in an internal supply chain in the following way:

Internal supplier → Internal customer → Customer

Figure 3 - Internal supply chain relationship (Hauser et al., 1996)

In this simple description, it becomes clear that the end customer is affected by the actions of the internal players in the company. Internal suppliers might not have the same vision as other actors in the company and conflicts may arise. According to Hauser et al. (1996), there has been research done showing that internal suppliers do not necessarily see the customers as their first priority. It is obvious though that the internal supplier's actions affect the internal customer, which in turn affects the end customer.

The next section of chapter 3 further explains what risks in supply chains are, first generally, then it develops further into two dimensions of risk, internal vs. external. Finally in line with the purpose, the concept of supply chain risk management will be elaborated on.

3.3 Supply chain risks

Supply chain risk has historically been defined as for instance the risk for strikes by transport workers, fires at a key supplier's plant or missed deliveries. Today, world political events are an increasingly important aspect, but there are also several other conditions that create risks in a supply chain. These include product availability, distance from source, industry capacity, demand fluctuations, changes in technology, changes in labor markets, financial instability and management turnover (Barry, 2004).

There is no one true definition of risks associated with supply chains. This area of research is relatively new and most definitions found in the literature deals mainly with financial risks. There is a fine line between risk and uncertainty, but Brindley (2004) argues that within businesses, risk and uncertainty are the same. The term risk also explains the variation in business results or performance that cannot be forecasted. Risk has also often been allocated to aspects that are either external or internal to the company that is impacted of the risk. Therefore, risk really refers to a source of risk. Some general examples of risk, referring to risk sources, are terms like for instance political risk and competitive risk. Such terms can be linking unpredictability in the firm performance, to specific uncertain environmental components (Miller, 1992). For that reason, when dealing with risk it is important to develop a forecast of the future and take action as a result (Fishkin, 2006).

The uncertainty within in a company refers to the unpredictability of organizational variables that are impacting corporate performance, or the lack of knowledge about these variables and therefore increases risk (Miller, 1992). Ritchie and Marshall (cited in Brindley, 2004) also mention that risk is a function of several variables. They concluded that there are three main characteristics of risks based on these variables. They are prevalent in supply chains; environmental, industry and organizational characteristics. The first two are referred to as systematic risk or risks that cannot be avoided, i.e. external. The third one is referred to as unsystematic risk, risks that arise due to strategies and decisions within the organization itself (Brindely, 2004). This is also the characteristics of internal risks that will be further discussed in section 3.3.2.

When a supply chain is well managed, a certain amount of supply chain risk can provide an organization with a significant competitive advantage, whereas poor management of supply chain risk can deteriorate relationships with customers and suppliers and lead to a bad reputation for the firm (Fishkin, 2006).

Chopra and Sodhi (2004) categorized some of the most common risks in supply chains in order to find a strategy on how to manage them. They identified individual drivers of risks for each category.

Category of Risk	Drivers of Risk
Disruptions	• Natural disaster • Labor dispute • Supplier bankruptcy • War and terrorism • Dependency on a single source of supply as well as the capacity and responsiveness of alternative suppliers
Delays	• High capacity utilization at supply source • Inflexibility of supply source • Poor quality or yield at supply source • Excessive handling due to border crossings or to change in transportation modes
Systems	• Information infrastructure breakdown • System integration or extensive systems networking • E-commerce
Forecast	• Inaccurate forecasts due to long lead times, seasonally, product variety, short life cycles, small customer base • "Bullwhip effect" or information distortion due to sales promotions, incentives, lack of supply chain visibility and exaggeration of demand in times of product shortage
Intellectual Property	• Vertical integration of supply chain • Global outsourcing and markets
Procurement	• Exchange rate risk • Percentage of a key component or raw material procured from a single source • Industry wide capacity utilization • Long-term versus short-term contracts
Receivables	• Number of customers • Financial strength of customers
Inventory	• Rate of product obsolescence • Inventory holding cost • Product value • Demand and supply uncertainty
Capacity	• Cost of capacity • Capacity flexibility

Table 2 - Drivers of risk (Chopra & Sodhi, 2004)

To decrease the effects that can ripple through a supply chain due to present risks, it can be started by identifying the drivers of risks. Peck (2005) has done this and divided them into different levels.

3.3.1 Levels of risk

Peck (2005) concludes that there are several sources that drive risk in a supply chain. These are divided in to four different layers.

- *"Level 1 – value stream/product or process*
- *Level 2 – assets and infrastructure dependencies*
- *Level 3 – organizations and inter –organizational networks*
- *Level 4 – the environment" (Peck, 2005, p. 218)*

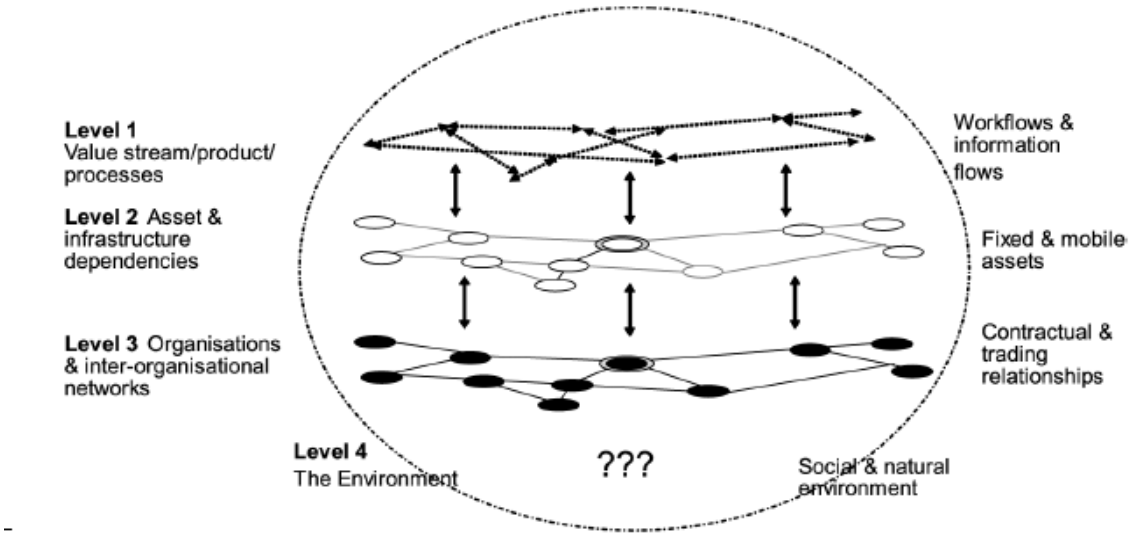

Figure 4 - Levels of risk (Peck, 2005)

Cranfield Centre for Logistics and Transportation (2003) explain that Level 1 in Figure 4 sees the supply chain from a management perspective, with an end-to-end view. L*evels* 2-4 introduce the more in-depth analysis of the risk sources. The disruption can make the managers efforts, to maximize the efficiency in the supply chain, to fail (Cranfield Centre for Logistics and Transportation, 2003).

Level 1 can be connected to concepts like lean manufacturing and demand-driven logistics (Peck, 2005). Furthermore, Cranfield Centre for Logistics and Transportation (2003) describes the supply chain as a "*linear pipeline*" at this level, pushing the value-stream forward in the supply chain. The goal is to get a good flow of information and material between the different actors in the supply chain. The risks to consider at this stage are financial or commercial that becomes the result of disruptions connected to quality in the supply chain (Cranfield Centre for Logistics and Transportation, 2003). Reliable information between the different actors is crucial to avoid the risks (Peck, 2005).

Level 2 includes the infrastructure built up to handle the flow of goods and information (Peck, 2005). In other words, it is dependent on the assets and infrastructure included in the supply chain (Cranfield Centre for Logistics and Transportation, 2003). The infrastructure of the supply chain consists of many different sites or facilities, factories and distribution centers (Peck, 2005). Included in the infrastructure are also IT assets that make the communication easier (Cranfield Centre for Logistics and Transportation, 2003). All of these are needed to produce goods and to ship them off to the next point in the supply chain. Risks included here are loss of links in the chain as well as a possible loss of operational assets that a company is reliant on. For example the choice a firm makes of transportation will give a certain level of risk (Peck, 2005).

Level 3 takes a more objective view, where the supply chain is the integrated network of organizations (Peck, 2005). It is also here that the vulnerability can be found, with a microeconomic perspective (Cranfield Centre for Logistics and Transportation, 2003). The circles in Figure 4 at this level are organizations in the network which have as their responsibility to manage a part of the infrastructure, described in the previous section. The whole

supply chain relies on a confidence among the organizations to not take advantage of each others positions (Peck, 2005). It has become increasingly common that companies use single sourcing in order to avoid having a large supplier network. This has though given birth to one the largest most fatal supply chain risk sources – being reliant on a single supplier (Cranfield Centre for Logistics and Transportation, 2003).

Level 4 takes the macroeconomic and natural environment into consideration, where all of the above discussed areas are placed; the infrastructure, the assets and the organizations that the company does business with (Cranfield Centre for Logistics and Transportation, 2003). The factors that a company needs to consider while analyzing level 4 is political, economic, social and technological. These four factors can further be analyzed using the so called PEST, which is the base for the PESTEL framework that is commonly used to do environmental scanning. Together with these there are also some natural phenomenon's to look at, geological, meteorological and pathological. All of these stated factors have an impact of the supply chain in each and every one of the three previous levels. Even though disruptions at this stage can be very difficult for a manager to handle, the sensitivity of the networks to known factors can alert the managers. If assessed in advance well informed decisions can be made to render the impact (Peck, 2005).

The subject of vulnerability in the supply chain is relatively new, some authors consider this area of research to still be in an infant stage. Figure 4 shows that the subject of risk in a supply chain is very dynamic and has a fairly wide scope (Peck, 2005). However, even though the framework divides the problems with supply chains into four levels, it should be remembered that an occurring event can impact several levels simultaneously (Cranfield Centre for Logistics and Transportation, 2003). It is vital for managers to consider that if they take actions for reducing risks, they are also changing the risk profile for the company. Meaning that in the future they need to look for something else that can disrupt their supply chain, which also applies for other firms in their network. Furthermore, often a disconnection can be seen between managing the supply chain and changing the organizational structure. Far from all firms have a specialist on supply chain management in their boardrooms, which implies that risk aversion is not taken until the very end (Peck, 2005).

We will now look at the difference between internal and external risks, since the origin of risks appear either outside or inside the company.

3.3.2 Internal and External risks

There are several different kinds of risk, but the two most obvious are external and internal risks. External risks are risks that the company can do nothing about, like for example natural disasters, war, legal restrictions, terrorism and so on. They pose a greater threat to the company since they are not controllable (Cranfield Centre for Logistics and Transportation, 2003). Internal risks in supply chains however, are something that can be managed. They are a result of how the supply chain is structured and managed (Christopher, 2005).

3.3.2.1 Internal risks

Brindley and Ritchie (2004) also recognize the presence of internal risks, but choose to call these *unsystematic risks,* and can be compared to Christopher's (2005) view on internal risks. Companies that seek to expand, use new technology or seek to gain competitive advantage are more likely to be exposed to unsystematic, or internal risks, than others. Norrman and Lindroth (cited in Brindley, 2004) argue in a similar way and also add that internal risks that

an organization can be influenced by are strategic, financial, operational, commercial and technical.

According to the Cranfield Centre for Logistics and Transportation (2003) there are two drivers of internal risk; *process risk* and *control risk*. These drivers are not that easy to spot since they are too obvious to notice for the managers' and are not considered as threats. Process risk refers to disruptions in the activities that add value to products in a company. A good infrastructure is vital for these processes to be executed correctly. Examples of the consequences of these risks are quality issues and products that have to be reworked, as well as failure of business and supply chain systems. This seriously damages the company's utilization of resources and can be very time consuming. One of the largest process risks occurs when there is a change of location and the way the company operates (Cranfield Centre for Logistics and Transportation, 2003). Norrman and Lindroth (cited in Brindley, 2004) also identified this internally-driven process risk. According to them, this risk is a result of certain objectives regarding the internal processes not being entirely fulfilled due to operations, empowerment or information processing. They also distinguish between different kinds of risk, but also emphasize that there is a considerable difference between risk sources and risk consequences, where risk consequences could be factors such as costs and quality issues.

Process risk occurs every time a company changes the way it performs things, i.e. the internal processes. The consequences of this type of risk are financial losses and/or harm to the company's reputation. There are some different forms that process risk can take; *"performance dips, project frights, process fumbles and process failures"*. Performance dips are, just as the name implies, a decrease in the production. Project frights on the other hand, means that partners in a project can get worried and leave or cancel the project as a consequence. Furthermore, process fumbles are problems that occur while for example implementing a new system, which in turn leads to even larger problems than before. Finally, process failures mean that once a new system is implemented you might discover that it does not work at all, which causes more trouble. These different kinds of risk can in turn be divided into two classes: *people-* and *operational risk* (Buchanan & Connor, 2001).

The people risk is connected to how the people in the organization react to the process changes. The question is whether the employees are resistant to change and whether the company itself is taking the so called learning curve into consideration. That is, if they have different incentives to make different groups of people change their attitude (Buchanan & Connor, 2001).

The operational process risk on the other hand, deals with the operations within the company. A good example is a process that cuts across several functional groups in the company. This can be different departments that all should be included in the change, but rarely know anything about each others tasks. Another example of an operational risk is the performance dip where almost all risks come together, and the dip often occurs when new systems are introduced (Buchanan & Connor, 2001).

Whereas process risk is more concerned with execution, control risk deals with planning and is used to manage the processes. There are rules and procedures that are assumed to be used when managing processes. Control risk means risk in the managerial procedures of a company, decision making and how the processes are controlled. It can be various things, from how big orders a company gets to which policy that is used for safety stock. The risks that stem from control can thus be said to have its origin in these rules and procedures if

they are not correctly interpreted. There is little doubt that control risks are almost always self-inflicted (Cranfield Centre for Logistics and Transportation, 2003).

3.3.3 Outline of risks

To make it easier for the reader to get an overview and see the links between the theories presented in this chapter, as well as get a better view of the parts that are interesting to analyze more thoroughly, the authors of this thesis have summarized them in this table.

Levels		**Categories of risk**	**Internal risks**
Level 1	Value/Product Process -Information flow risk -Material flow risk *Jönköping*	Delays Disruptions Systems Inventory Capacity Procurement	Process risk: -Infrastructure -Quality -Utilization of resources -Location -People risk -Operational risk
Level 2	Assets and Infrastructure dependencies *Jönköping - Poland*		
Level 3	Inter-Organizational Networks *Thule Trailers*	Intellectual property Forecasts	
Level 4	The Environment	Disruptions Receivables	

Control risk

Table 3 - Outline of risks

3.4 Managing supply chain risks

"*Supply Chain Risk Management is the management of external risks and supply chain risks through a coordinated approach among the supply chain members to reduce supply chain vulnerability as a whole*" (Cranfield Centre for Logistics and Transportation, 2002, p.38).

The risks must not necessarily be risks between members in a supply chain. Supply chain risk management can also be about managing supply chain risks inside a single company. The purpose with supply chain risk management is of course to prevent disruptions in the supply chain that could lead to ripple effects that are noticeable throughout the entire supply chain. The investigated perspective should according to Norrman and Lindroth (cited in Brindley, 2004) be either the dyad relationship between buyer and seller or involve three or more firms.

To find and to analyze risks is the core of the risk management process. Giunipero and Eltantawy (2003) argue that in order to get a well functioning competitive supply chain that is able to extensively avoid risk, managers need to focus on improving and coordinating the relationship between the supply chain members and facilitate the flow of information and communication. The authors emphasize the importance of interpersonal communication, teamwork and the ability to negotiate (Giunipero & Eltantawy, 2003).

Another theory connected to the way of mitigating risk presented by Giunipero and Eltantawy (2003) above, are a number of basic approaches presented by Tang (2006). These four basic management approaches can be used in a coordinated fashion to manage supply chain risk.

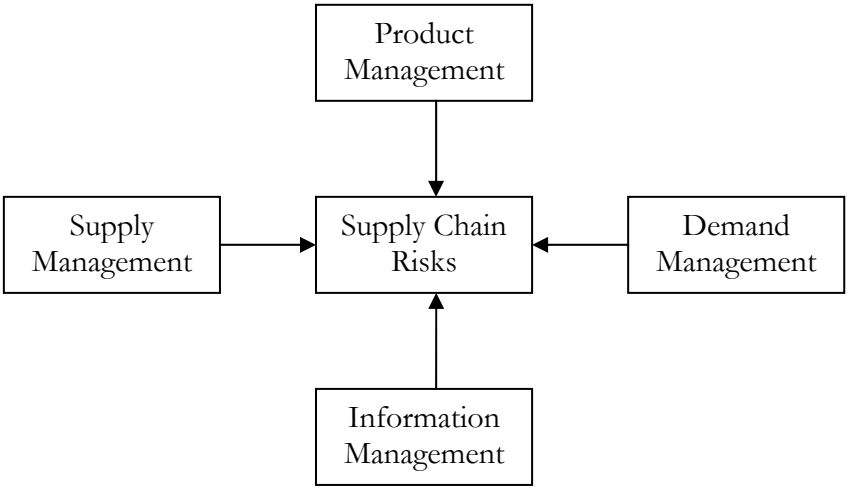

Figure 5 - Four basic approaches to mitigate risk (Tang, 2006)

First, a strategy to use is to collaborate with upstream members of the supply chain to secure the supply of material in the supply chain, supply management. Secondly, a firm can look down in the supply chain to coordinate demand in a way that would benefit them, demand management. Furthermore, the design of products and processes can be modified to make supply meet demand easier, product management. Finally, the information management among the members of the supply chain can be opened up, so that information is easier to access (Tang, 2006).

The question is how to best manage risks to get as low impact as possible to the company operations. In addition to what has already been mentioned, Chopra and Sodhi (2004) identifies eight mitigation strategies for this purpose.

Categories of Risk / Mitigation Strategies	Disruptions	Delays	Forecast risk	Procurement risk	Receivables risk	Capacity risk	Inventory risk
Add capacity		▼		↓		▲	↓
Add inventory	↓	▼		↓		↓	▲
Have redundant suppliers	▼			↓		↑	↓
Increase responsiveness		▼	▼				▼
Increase flexibility		↓		↓		▼	↓
Aggregate or pool demand			▼			▼	▼
Increase capability		↓					↓
Have more customer accounts					↓		

Greatly Increases Risk ▲	↓ Decreases Risk
Increases Risk ↑	▼ Greatly Decreases Risk

Table 4 - Mitigation strategies (Chopra & Sodhi, 2004)

In this table, Chopra and Sodhi (2004) show that for example in order to prevent the risk of delays, the best strategy would be to add capacity and inventory and increase the responsiveness. The problem with forecasts can best be managed if demand is aggregated. Capacity risks are also decreased with pooled demand, as well as with increased flexibility. Added capacity does on the other hand however add to the capacity risk. If managers are to successfully implement a supply chain risk management strategy, it is vital that the entire organization fully comprehend the meaning of supply chain risk and understand the impact that one decision might have on other areas in the organization. Only then can a strategy adapted to the organizations specific situation be successfully implemented (Chopra & Sodhi, 2004).

Another way to manage supply chain risk is according to Christopher (2004) to improve supply chain confidence. He argues that a lack of confidence among the supply chain members lead to an increased supply chain risk, which in turn leads to a decrease in supply chain efficiency.

Furthermore, as a final theory input on the management of supply chain risk that provides a good summary of the other theories presented so far, you can either have to avoid, reduce, transfer or share the supply chain risk. To avoid risks, it is necessary to remove the causes that could give rise to them. Reducing the risk mean that you for example keep safety stock, use several sources for supply and use back-ups. Insurances can be a way of transferring the risks or transfer the risks to the other actors in the supply chain network by for example introducing Just-In-Time deliveries, make-to-order manufacturing and pool inventory as close to the end-customer as possible. Sharing risks could be another solution,

by for example extended collaboration with supply chain partners or liability contracts (Norrman & Lindroth, cited in Brindley, 2004).

Like Giunipero and Eltantawy (2003) say, a way to mitigate the supply chain risk is to coordinate relationships, as well as information in the supply chain. Tang (2006) mentions the same in his model. From Norrman and Lindroth's (cited in Brindley, 2004) four approaches presented previously, at least two of these can be connected to the framework by Tang (2006). To transfer and to share risk can be interpreted as being similar to coordinating relationships between the actors regarding supply and demand in the supply chain. Furthermore, the mitigation strategies presented by Chopra and Sodhi (2004) can be connected to Tang's (2006) model. To aggregate or pool demand as well as to have more customer accounts can be linked to demand management and to have redundant suppliers can be linked to supply management. In addition, to increase the responsiveness can be related to information management.

4 Empirical findings at Thule Trailers in Jönköping

The empirical findings are presented here, such as material gathered from personal interviews with company personnel, and information about the company gathered from other sources.

4.1 Thule Trailers supply chain

The external supply chain of Thule Trailers Jönköping includes, as all supply chains, several companies both upstream and downstream. There are however a couple of larger ones worth mentioning. Suppliers like Autoflex provides axles for the trailers, Otto Just GmbH & Co. KG delivers wheels and Koskisen Skandinavia supply plywood for the trailers. The company's customers are mainly retailers like Silvan, Granngården and Bauhaus. Other large customers are outside the Do-It-Yourself sector such as companies that are specialized in trailers. The company has also divided their operation under direct sales to retailers, for example the ones mentioned above, and rental to gas stations like Shell, Statoil and Preem. Thule Rental operates in Sweden, Denmark, Norway, Finland, Poland, Germany and there has also been a recent start-up of Thule Rental in France.

The external suppliers to the Polish factory should also be included in the external supply chain. The largest supplier they have is the Danish manufacturer of sheet metal, Jørgensen & Utoft A/S. The Polish factory also delivers to external customer throughout Europe.

4.1.1 Mapping of the internal supply chain

Thule Trailers AB had their entire production split up on all locations in the Trailer division until 2003 when it was decided to offshore the production to Poland, this added to the further expansion of Thule Trailers AB internal supply chain.

"Thule's strategy is to grow both through acquisitions and by themselves."
(Local manager)

When the production plant was established three years ago the initial idea was to only produce some of the components for Sweden and Denmark. But very soon the management realized that an increase of operations was needed. At the start up there were 80 employees in the Polish plant. Today they employ 360 people. The amount of components produced has increased from 80 per month in the beginning, to approximately 3 000 per month during the high season this year.

The Polish factory now acts as an internal supplier for most of the components for the other units in the division. They are today the largest unit within the trailer division with a production of over 1000 different versions of trailers that they supply the different trailer divisions with, seen in figure 6. The production plant in Jönköping receives about 60 of these since most of the trailers are sent directly to the retailers.

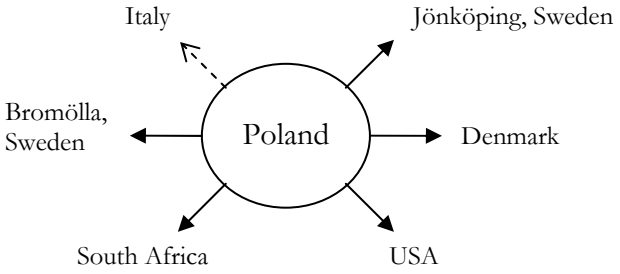

Figure 6 - Thule Trailers Internal Supply Chain with supplier as focal point

Thule Trailers Jönköping also procures a small amount from the Danish plant, which makes the Danish plant another internal supplier to Jönköping. The Italian unit still has its own production, but in the near future they will also move the main part of it to Poland.

4.2 Risks in Thule Trailers Jönköping

The reason for moving to Poland was not primarily financial, instead it was to gain more capacity. Furthermore, the motive for choosing Poland in particular was their open labor market rules. Labor is easier to employ and give notice in Poland, something that enables them to manage labor resources easier depending on the current market situation. The off-shoring to Poland meant that the production plant in Jönköping had to redesign the way they worked. Before the move they had a lot of welders, who after the move had to learn how to assemble trailers from premanufactured components. No one in the Jönköping production plant was given notice, but some chose to leave anyway.

There are a number of other sources that drive risk in Jönköping. To get a better overview we have decided to divide the sources under individual headings. Each heading will present a major source of internal risk to their internal supply chain. Three main issues are especially pointed out by the assistant production manager in Jönköping. These have to do with the internal supplier in Poland and mainly concern galvanization capacity, transportation and external supplier issues. There are however more sources of risk present that we will also elaborate on below.

4.2.1 Quality

A major risk source is the existence of poor quality in some of the trailers or the incapability of the internal supplier, Poland, to sometimes deliver the right quality on time. Last year was according to the assistant production manager, not a very good year seen from a quality perspective. A lot of time was spent on moving materials back and forth, which in turn lead to delays in the deliveries to their customers. The issues still remain, but not to the same extent as before. The largest quality issue according to him is problems in the galvanization process, which mainly is a result of insufficient information sharing between the different galvanization companies used in Poland. If something is discovered that does not correspond to the quality expectations, the information regarding this only goes to the galvanization company that is currently responsible. Next time though, when one of the other galvanization companies are used, this information has not reached them and the same

problem occurs again. According to the assistant production manager, at least one truck a month returns goods that do not satisfy the quality standards demanded.

The local manager's perception of quality is to have a product that corresponds to customer expectations as well as the demands postulated by government authorities. The product should also match the company's own specifications. Quality is also about delivering in time and in the right quantity. The assistant production manager emphasizes that quality can have different meanings, but defines quality as the durability and trustworthiness of a product. Compared to the competitors the company has, according to him, excellent quality.

4.2.2 Business system

A big difference between the division units is that they use different business- and planning systems. The Danish unit in comparison has the same system as Poland, and they can see or place their orders directly into the Polish system. They also have the opportunity to see the delivery status of their components. This would be the main advantage for Jönköping if they changed system, but according to the local manager, as it is today the company sees more drawbacks than advantages. The issue has been discussed, but it is perceived as too costly and time consuming. Since part of the business strategy is to grow through acquisitions, all the acquired companies would have to implement new business systems. The divisions' strategy has been to let everyone keep their own systems. The local manager does however realize that there would be some advantages since the heart of their operation lies in the Polish factory, orders would be much easier to place and track.

In Poland they receive the orders manually and an employee registers the order in the system and sends back a confirmation with a delivery date. This is the solution they have come to since Jönköping does not have the same system when it comes to placing orders.

Furthermore, an issue that also can be disturbing for the production at the supplier plant is according to the operations manager in Poland that information about orders are not placed in time. What is considered as most disturbing are changes in delivery time and general changes in the orders. The assistant production manager in Jönköping does however claim that orders are placed every day and are seldom altered after they have been placed, a view that is shared by the local manager.

4.2.3 Information flows

Information risk is the risk of a disturbance in the information flow within and between companies. These disturbances are in Jönköpings case for example differences in the business culture between the units in the division. The organizational structure differs from unit to unit, where some are more hierarchical than others and some are flatter. The overall organizational goal is set in advance by the headquarters, but how the individual divisions and units reach the goal is up to them. It is however perceived that few are willing to take responsibility and that the communication between the levels in the hierarchy is better in some departments than in others.

> "*A classical issue is between the production and sales departments who sometimes have different opinions. But the goal is still the same, that the customer gets the product in time, the right quality, and the right price*"
> (Local manager)

Polish business culture is traditionally fairly strict. The communication between the different hierarchy levels in Poland is perceived by the assistant production manager in Jönköping to be insufficient. There is no noticeable communication between departments, no one takes responsibility for the entire flow, just for their own part.

"*People are not very good at taking responsibility at all*"
(Logistics planner)

Decisions cannot be made individually, there are rules and procedures that need to be followed. The decision-process gets held up when lower management have to wait for instructions from higher hierarchy levels.

Furthermore, differences between Sweden and Poland is the way of thinking of the end customer. Sometimes the communication is distorted by misunderstandings, according to the Polish operations manager, which mostly is a result of different attitudes towards quality and delays. There is also a difference in culture which also contributes to misunderstandings.

"*One thing is that we are working much more here [in Poland] than our Swedish colleagues, but maybe they are better organized*"
(Operations manager)

The logistics planner at Thule Trailers Jönköping sees the greatest problem with the delivered products from Poland to be that parts are missing or have been assembled incorrectly. The cause for this might be different attitudes to for example quality, and that the internal supplier does not recognize that an end customer stands behind every delivery order. It is important for them to understand that the end customer, like for example the construction companies, cannot perform their tasks and loose a lot of money if they do not have the equipment to transport their machines in time.

"The attitudes are so different, they don't think like that, that there is an end customer behind the product"
(Logistics planner)

There are a number of other risk sources connected to the production in the Polish plant. First of all, the problems with galvanization mentioned in the beginning of this chapter were also mentioned by the local manager in Jönköping. The problem that they have is that the galvanization companies used do not all receive the same information, or do not share information between themselves. Secondly, information about delayed orders as a result of this, are not always shared with Jönköping.

4.2.4 Capacity

The next risk has to do with the risk of a lack in capacity. At the supplier plant in Poland production has increased from 80 pieces per month in 2003 till 3000 pieces per month this year during the peak season. With the rapid expansion of Thule Trailers AB, the assistant production manager means that the Polish factory might reach their capacity limit soon.

"*They probably can't handle much more considering the growth rate of Thule Trailers*"
(Assistant production manager)

An example of how the Polish capacity effects the production in Jönköping is that the assistant production manager visits Poland approximately a week per month just to locate material. This shows that the production plant in Poland is often overloaded with work and can therefore not deliver on time, a view that is shared by the logistics planner. Another occurring issue is that goods can get held up at the different galvanization companies used during the peak season because they have accepted more work than they can finish on time. This also results in delays in the production at the plant in Jönköping since the material does not arrive in time.

The capacity in Jönköping has on the other hand increased since the core of the production was moved to Poland. Production has increased from 13 000 trailers a year to over 18 000 trailers this year. This would not have been possible before, and was also one of the main reasons for moving the production in the first place. According to the assistant production manager, if needed, they could easily run two or even three shifts instead of just one.

4.2.5 Flexibility

There is a difference of opinion inside the Jönköping unit whether or not the greatest threats are external or internal. An example given of perceived external risks are changes in the market, price of commodities, price of energy and changes of interests. The internal risk mentioned is mainly capacity but another issue also mentioned is flexibility. The Polish operations manager believes that they are flexible and efficient, and considers this to be a very crucial, but difficult point in the production.

"I must say, this is the main point in production for me,
to be efficient and flexible, it is sometimes tough to be both"
(Operations manager)

Flexibility is something that is crucial to achieve a smooth and efficient flow of the operations. The assistant production manager in Jönköping does however not find the flexibility of the internal supplier to be as good as the Polish operations manager would like us to believe.

"In reality they are not flexible at all, only after pressure,
then they become enormously flexible"
(Assistant production manager)

The local manager in Jönköping points to the Polish factory's external suppliers, and claims that the larger the supplier is, the less flexible they become. This in turn affects the Polish production, and makes it seem like they are not flexible.

The plant in Jönköping in turn is considered to be quite flexible since they do not have large production lines and long setup times. Some of the external suppliers are however not particularly flexible, for example the supplier of plywood has a lead time of over 10 weeks which is not very flexible.

4.2.6 Delivery security from suppliers

There are also some risks connected to the external suppliers to the Polish production plant. They do not always deliver with a 100% certainty. According to the Polish opera-

tions manager, the average delivery security is 70%. Only 10% of the external suppliers to the Polish unit have a 100% security. Some are however far worse with only 30-35% delivery security. A reason for this is that the supply of sheet metal from the Danish supplier has not been fully reliable. This is believed by the local manager in Jönköping to be a result of the present business cycle and rising demand, as well as interest rates. They are in the process of looking for alternative suppliers. About 20% of all deliveries from Poland to Jönköping are delayed each year as a result of this. This number depends on if it is during the peak season or not.

The delivery security of the external suppliers to Jönköping differ, some have almost 100% while others vary from time to time. It is believed by the local production manager that it is a result of the growing economy, that they cannot handle all orders due to a lack of capacity. He also states that the delivery security from the Polish internal supplier is good. This view is however not shared with the logistics planner and the assistant production manager who due to delays from the Polish unit's supplier have to get involved in the process of getting the material to Poland. If the Polish production plant cannot produce components because of material shortages, Jönköping obviously does not receive the ordered goods in time. In turn these delays affect the deliveries to the external customer.

4.2.7 Transportation from supplier plant

The transportation risk mainly concerns the risk of damages to the goods during the transportation. The damage risk occurs when the trucks are being loaded in Poland, which is not always done correctly. The trailers are loaded on top of each other, sometimes as many as ten on top of each other. The only packaging used is wooden blocks and metal sticks that are used for stacking, in addition ropes to secure the cargo. Thule Trailers Jönköping is in possession of one truck that they use to transport goods to Finland. For other destinations and additional transports to Finland, they use third-party logistics providers like TransCargo and LKW Walter. Some issues with the third-party logistic providers have been that they have not fully secured the cargo, i.e. the ropes used to secure have not been tightened every 100 km, which is vital when you transport goods on roads in for example the Baltic States where the road quality is not the best. There have also been occasions where the third-party logistics providers have not provided the promised trucks in time or have been standing still in Sweden waiting for return-goods.

The goods get transported with trucks, from Poland to Jönköping and from Jönköping to the retailers, as well as directly from Poland to the retailers. The company has chosen not to change the way of transport along the way. As the local manager says, they have learnt from their mistakes not to reload the goods. If a company chooses to reload to a different means of transport, it increases the risk of damage. Before, Jönköping transported the goods by railroad, which was very convenient since they have tracks running all the way up to the Jönköping production plant. This was however seen as too costly with all the damage and reloading.

A consequence of delays and damaged goods that cannot enter the assembly, is that part of the production plant in Jönköping has suffered production line stops. When it occurs it mostly lasts for a couple of hours.

4.2.8 Forecasts

To make forecasts, every seller reports to his or her manager what the forecasted sales numbers are, this is then aggregated into a sales forecast. The sales forecast is used as the base for the production forecast. To minimize material shortage risks, an additional 15 % is added to the sales forecast. The production forecast in Jönköping is then broken down into individual components and then used as a forecast sent to all suppliers, internally and externally, so that they in turn can make their forecasts. This forecast is updated every month and stretches over three months.

There is little make-to-order production on the more advanced trailers since some components have up to 12 weeks lead time, but standard trailers are kept in the warehouse for instant delivery. The marginal error in the forecasts is believed by the local manager to be substantial.

The forecasts sent to Poland are not used as Jönköping would like them to. Jönköping demands a buffer on high-frequency articles but the Polish management is resistant to keep too many articles in inventory.

"*Inventories are capital binding, and it's something they've learned to keep down as much as possible"*
(Assistant production manager)

4.2.9 Experience

This quote from the logistics planner points to another reason to why production is not running as smoothly as wished at the plant in Poland.

"They [Poland] have no experience of trailer production, we [in Jönköping] have 50 years of experience. The operations are rapidly increasing there so they have difficulties to cope, and a huge demand for leadership from us. They have difficulties working independently and taking own initiatives. All directives must come from above or from us who works with them."
(Logistics planner)

4.3 Managing risks at Thule Trailers Jönköping

The local manager at Thule Trailers Jönköping is not of the opinion that the internal supplier is worse than the external suppliers when it comes to causing risks for them. They do not according to him incur any more problems.

"*We had some disruptions in the beginning [with the internal supplier], but this year I think it has worked out well"*
(Local manager)

The solution is, according to the local manager, to provide the supplier, both external and internal, with as accurate forecasts as possible and have a good relationship with them that you can rely on to manage risks. Another way to increase safety is to secure other suppliers that you can turn to in need. Problems that occur with the internal supplier can be easiest solved together, at sight. Therefore, a quality group has been established with representatives from various levels of management from every production site in Europe. The goal is according to the Polish operations manager to solve current problems and to work out a strategy on how to address them in the future. Examples of problems could be for instance

quality issues, delivery issues and so on. If, for example, a complaint regarding quality is filed, Poland has to investigate it and give an answer to Jönköping within seven days. After the introduction of the quality group, things have become much better.

Thule Trailers in Jönköping work with quality in the sense that before the trailer reaches the end customer there are some quality controls regarding electricity, lighting and so on. On the other hand the quality control regarding goods from the internal supplier in Poland is not sufficient.

"Towards the end customer the quality control is good, however internally it could be better."
(Assistant production manager)

In order to check quality, there are some standard routines, like checking electricity and lights. The internal quality routines are however not very extensive.

"We don't have any good routines regarding internal quality controls, that is when it [components] arrives from our suppliers…often we discover quality flaws when the components have already entered the production. If we're lucky we haven't gotten very far, but if we're unlucky we have to tear apart a half-finished trailer"
(Assistant production manager)

Some of the assembly lines in Jönköping have at times been at a stand still because of quality flaws. Internally, the quality routines might not be the best, but as regards to the customer, the quality control lies on an acceptable level. Some of the trailers are however delivered directly to the retailers from Poland, which eliminates the opportunity for the unit in Jönköping to control its quality.

In addition, Thule Trailers in Jönköping deals with issues concerning damages by having small things like lights and reflectors stored. The reason for this is that these articles easily gets damaged and therefore are important to have at hand. Jönköping also has a few trailers in store, but only the smaller most basic ones. The more advanced trailers are however not kept in store and have a lead time of approximately five weeks, sometimes even more. Even a few of the retailers keep safety inventory. This is though only possible for the larger retailers, since the costs connected to safety inventories are too large for the smaller ones.

When dealing with delays internally, Poland has recently introduced a new resource planning system according to the Polish operations manager, and that it can be of enormous help to speed up the production and increase the capacity. They check the needed resources for the next period and then they plan the resources and add extra forces if it is needed. The assistant production manager in Jönköping however says that Poland have almost reached their limit and are therefore not able to increase the production when needed. The local manager on the other hand explains that investments in the Polish factory are made continuously in new machines and buildings.

The objective is to get Poland to start working with having safety stocks of articles that are frequently demanded. This is though according to the assistant production manager in Jönköping not easy, since Poland is not used to working that way. If Poland had safety stocks it is thought by the assistant production manager that the issues with capacity would decrease.

The local manager says in addition that there are enormous costs connected to the inability to deliver in time, if for example the goods arrived in time but can not be used. If they do not know when the goods will be delivered with the expected quality, there are huge costs that might not be instantaneously discovered. He adds that if this happens, there is nothing else to do than to call and say that they are sorry that they cannot deliver in time. It sometimes happen that there is a reduction in price, but in that case the supplier gets reprimanded and a request to do better next time, or else they will have to pay a compensation for the reduced price.

If damaged goods arrive to Jönköping it is either adjusted at the local production plant or sent back for adjustment in Poland. If the goods are reworked in Jönköping an invoice is sent to Poland to cover the costs. The decision about how to handle damaged goods lie on either the local manager in Jönköping or the operations manager in Poland. The production manager in Jönköping can also be involved.

In order for the reader to get a better view of how the internal risks are managed at Thule Trailers in Jönköping the authors of this thesis have chosen to summarize the techniques in a table (table 5) showing what is being done right now, what they are planning to do and finally what they are resistant to do.

	Action	
What are they doing presently?	• Forecasts • Good relationship with suppliers • Securing other suppliers • The quality group	• Quality controls • Buffer inventories • Resource planning system • Increasing capacity
What are they planning to do?	• Other suppliers to the Polish factory • Improve quality control in Poland • Invest in new buildings to increase Polish capacity	
What are they resistant to do?	• The Polish factory is resistant to a safety buffer. • Introduce the same business system within the division.	

Table 5 - Summary of how Thule Trailers Jönköping manages risk

5 Assessment of internal risk impact on the internal supply chain

In this chapter our analysis of the internal risks impact on the internal supply chain of Thule Trailers in Jönköping will be presented.

Much of the research done in the area of risks in supply chains is focused on external supply chains and external risks, and many of the theories and models found have an external orientation. The authors of this thesis are however convinced that the main part of these also can be applied internally.

5.1 Internal supply chain mapping

To map the supply chain has been shown by Gardner and Cooper (2003) to be an important tool for organizations to get a clear picture of where potential risks might occur and also to facilitate the flow of information between members of the organization. Thule Trailers Jönköping does not possess a physical supply chain map of their internal members, even though a mental map of the internal members does exist. Thule Trailers AB as a division has grown considerably during the last decade through internal growth as well as through acquisitions as mentioned before. There are similar perceptions throughout the unit in Jönköping about what the internal network looks like and a physical map of all the units inside the company would in practice most likely not be of considerable help to them. The perspectives may however differ, since not all members in the internal supply chain are in direct contact with the external customer. It has also become evident during the interviews that there are many different views on problems. With a map these differences would certainly still show, since they are more, according to the authors of this thesis, depending on different levels in the company. Even if the hierarchy in the company is flat, the employees at certain levels have different opinions due to their different positions and work tasks. Having a map in this case would in theory better facilitate the understanding of the correlation and the ripple effect that affects everyone, the authors of this thesis are though doubtful of its practical value.

Indications were however found that instead of a supply chain map, something like an information flow chart would better facilitate the information flow in the company, since it is now sometimes insufficient. All employees in the organization do not always receive the correct and the same information. It is though not the authors of this thesis' belief that a physical map would improve this, since a map in this case would not be able to increase the information level in the company.

It has though been a tremendous help for the authors of this thesis to map the internal supply chain since it has greatly facilitated the understanding of the internal synergies, not only between Jönköping and Poland, but within the entire division. It has also clarified the huge influence that the Polish production site has on the other Trailer units and where improvements can be made to make the process in the company easier to handle.

Despite this it has become obvious that the internal customer, i.e. Jönköping, is deeply dependent on their internal supplier in Poland since this is their major source of procurement. This is one of the greatest risks there are in supply chains and there is clear evidence that Thule Trailers in Jönköping has suffered due to this fact.

A overview of the internal actors is given in the figure below that shows the internal supply chain, with Jönköping as focal point.

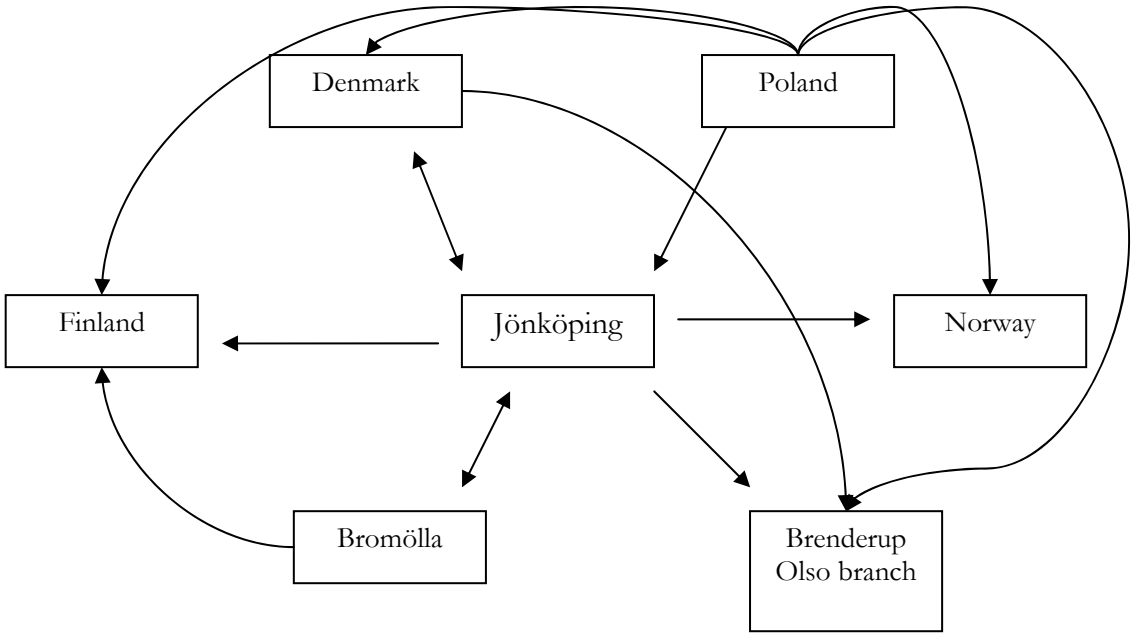

Figure 7 - Internal supply chain from Jönköpings perspective

If the external actors would have been included as well, we would have seen how complicated and intricate a supply network really is. But since the purpose of this thesis is to look deeper into the interactions between Jönköping and their internal supplier in Poland the authors of this thesis chose to visualize the immediate supply chain map for Jönköping in the figure below.

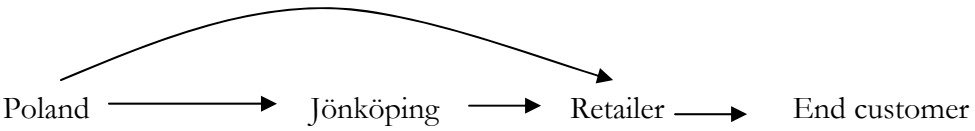

Figure 8 - Immediate supply chain

However, even if not visualized, a map can help the understanding of internal as well as external supply chains. This would also relieve the task of error proofing and risk management. If a supply chain map would exists it could enlighten the problem areas in the supply chain and according to the authors of this thesis, would give management a hint of where to place new investments. It would show Thule Trailers Jönköping the so called bottle necks and problem areas, as well as where added capacity would be most beneficial. A map would in theory therefore be a good source for decision-making concerning operations and make the flows of material and information run smoother.

Hill (2000) says that it is important to integrate the external supply chain with the internal. In Jönköpings case this would mean to also put focus on the external suppliers and customers. The authors of this thesis have discovered that for example the external suppliers that the Polish factory uses disrupt the flow in the internal supply chain, suggesting that an

internal mapping of the supply chain might not be as relevant as an external mapping. Therefore, if more attention was pointed towards integrating and managing the external supply chain Thule Trailers AB would solve some of their disruptions. As it is today, the production plant in Poland has large problems with their external suppliers of for example sheet metal. A consequence of delays to Poland also gives delays from Poland to Jönköping and in turn also to the retailers and in the end to the end customer. The issue of integrating the external supply chain with the internal becomes even clearer after looking at the different kinds of disruptions that Krajewski and Ritzman (2002) presents. One example is shortage of internally produced parts. This is something that Thule Trailers Jönköping also experience quite a lot of. As mentioned in chapter 4, those disruptions are connected to the internal suppliers' external suppliers and transportation from supplier plant. Another thing that contributes to further delays is if there is damage to the goods when it arrives.

Other disruptions that occur in Thule Trailers internal supply chain between Jönköping and Poland are mostly connected to a lack of parts needed for production. This has an internal source and these problems mainly appear due to errors in the information between the units.

5.2 Internal risks in the internal supply chain

As can be seen in the overview of the risks presented earlier in table 3, the first and the second levels of risks from Peck's (2005) theory are the focus of interest since it represents Jönköping and the internal relationship between Jönköping and Poland. The table shows how this relates to the categories of risk by Chopra and Sodhi (2004), as well as the theories on internal risks by the Cranfield Centre of Logistics and Transport (2003). Here it can be argued that the first two levels as well as some of the categories are the same as internal risks, or unsystematic risks. Furthermore the authors of this thesis assume that the internal risks can be seen both inside the company – level 1, as well as within the internal supply chain - level 2. As seen in the empirical framework, several of these internal risks have been identified as present in Thule Trailers Jönköping's internal supply chain. The following sections will make an assessment of what it means for the company, and the following discussion about the levels refers to the table found in chapter 3.3.3.

5.2.1 Level 1

The result of the risk impact in *level one* are mainly galvanization quality issues, internal delays and delays in delivery to retailers as well as communication differences between the departments at the production plant in Jönköping. The consequences according to Peck (2005) are mainly financial and commercial. In the majority of the literature read, these consequences of risks in supply chains are believed to be negative variations in business results, performance and reputation. No evident negative business result has been found in Thule Trailers Jönköping. On the contrary, since the start of the production in Poland, the business results have significantly increased. The increased capacity and production volume are likely contributors to this fact. On the other hand, without a doubt there are several hidden costs present as a result of the supply chain risks found. The authors of this thesis have no data on these presumed hidden costs, the authors of this thesis can however speculate that there are a lot of additional costs related to the transportation of returning goods to Poland, the extra labor costs related to this and all the extra working hours needed to solve the issues with both transportation and quality. There is also likely to be an opportunity cost related to the customers who might switch to an alternative supplier of

trailers. How this has affected their reputation we cannot say since the external actors have not been included in this thesis.

5.2.2 Level 2

The *second level* is the most relevant one since it mainly concerns the dyad relationship between Jönköping and Poland, i.e. the internal supply chain. The greatest risk here has to do with the distance between the production site in Poland and the assembly site in Jönköping. If the supply process does not run smoothly between the two, there are grave consequences for Jönköping since they cannot deliver to their customers on time. Faults similar to this is something that we have seen several cases of in the organizational processes. There are several elements contributing to late deliveries. The use of different information systems, as well as the use of third-party logistic providers, lead to delays and disruptions as well as quality flaws due to a lack of information or transportation damages. One main reason for the information asymmetry is that Jönköping do not use the same business system as Poland. As described before Jönköping sends their orders manually and thereafter Polish staff have to enter the orders in to the Polish business system. The Poles do not usually give Jönköping notice when orders are delayed, which complicates things when deliveries are due to Jönköping's customers.

The local manager in Jönköping does however not feel that the unit in Jönköping would benefit from a change of business systems. His belief is that the benefits would not cover the costs. The authors of this thesis are of the opposite opinion, that all the opportunity costs and hidden costs are not taken into consideration. All events have correlated impacts throughout the organization and an improvement in the information flow between the Polish factory and Jönköping would have positive effects throughout the entire organization. Therefore the same business system would benefit all departments at Thule Trailers Jönköping in the long run, even if everyone evidently does not see the advantages at the moment.

Furthermore, also related to level two is the issue of inventory. Thule Trailers Jönköping's goal is to have a buffer inventory of frequently used parts. This is also something they are trying to implement at the Polish production site, but so far without success. If a buffer inventory would exist at the Polish production plant as well the authors of this thesis believe that this would decrease the risk of quality defects and delays to the end customer.

It is certain that Thule Trailers Jönköping are aware of many of these internal risks, but they do not seem to work with the real source that give rise to most of these risks. There is a lack of responsibility outside the own work-area which complicates things further.

5.2.3 Level 3

The categories of risk connected to *level three* are intellectual property and forecasts, however when regarding these risks we are forced to look outside the immediate supply chain, using a perspective with Thule Trailers AB as a focal point. It was pointed out multiple times during the interviews, that Thule Trailers AB's mission is to grow both through acquisitions and by themselves. The authors of this thesis believe that the move of the main component production for the division to Poland was a strategically correct move, although now they are in the phase of realizing that they have to increase the production plants' size even more. It also widened the market span and made Thule Trailers AB even more globalized.

The forecasts for the Trailer division are done at each plant individually and sent to the production plant in Poland in order to give them a hint of how many components to produce. Again this part is related back to the issue with different business systems brought up previously. The forecasting would be better utilized if the same system was used in the entire Trailer division. Having an aggregation of the individual forecasts would help decrease the risk of forecast errors.

5.2.4 Level 4

Level four in the model is related to disruptions connected to the company's surrounding environment. As mentioned by the local manager in Jönköping, this can for example be peoples' incomes and the interest rates. The business cycle in Sweden and around in the world is also something that effects it, which shows in the numbers of trailers sold and in the end, in the results in the annual report.

A great advantage for dividing up the risk sources into levels is that it is easier to see what sources of risk that can be eliminated through a company's own efforts and where some cooperation would improve things. This is where the supply chain map in theory would come in handy since it would facilitate the risk source identification and elimination process.

The internal supply chain is not optimally managed and the company does therefore not have a perfect internal supply chain. They are however to a large extent aware of the weaknesses, but might not yet have found the optimal solution to solve them.

5.3 Managing risks in the internal supply chain

After observing the company through interviews the authors of this thesis have come to the realization that there are quite a few risks in the company. The risks and their consequences are often correlated and influencing and triggering each other. These have been presented earlier in chapter 4. The company has taken some action to manage risks, like the establishing of a quality group. One point to make here though is that risks are viewed differently at the different levels in the company and therefore the management vary along with the awareness.

5.3.1 Risk management presently

The local manager of Thule Trailers Jönköping believe that they are a risk aware company, but that they choose to not expose themselves to too much risk. The authors of this thesis believe that this is true to some extent, when it comes to exposing the company to risk. However, regarding the risk awareness there are a lot of risks that are being ignored by Thule Trailers Jönköping, or that are unidentified.

Since the most common risks that occur in the internal supply chain are issues with quality and delivery, these are the risks that need to be focused on in first hand. The company's way to manage risks in quality has been to establish a quality control group. The authors of this thesis believe that the quality group is a good initiative that in the long run can contribute to solving quality problems easier. However, as quality only is one of the risks touched upon in this thesis, something similar to the quality group could be done to handle the other risks.

Furthermore, the company manages risks by using a forecast to pre-determine sales and by maintaining a good relationship with Poland. A good relationship with the Polish factory is vital as Jönköping and Poland work so closely together. Even though some issues have been found that might be disruptive, mainly information errors, the authors of this thesis believe that these are solved quite easy as the relationship is good, with a fairly open and friendly communication. When it comes to the forecasts a possible risk is the way they are performed at the Jönköping plant. When doing the sales forecast they add 15% to minimize the risk of material shortages and by doing so set up a buffer of inventories. This might not have been necessary if the Polish plant kept a buffer on high-frequency articles.

After presenting some of Thule Trailers Jönköpings' ways of managing internal risks in their internal supply chain at the moment, the following sections will further develop and analyze the concept of supply chain risk management connected to the theories presented in chapter 3.

5.3.2 Risk management theories applied to Thule Trailers Jönköping

The theory combining all ways to manage risks presented earlier was to either avoid, share, transfer or reduce risk. The authors of this thesis believe that depending on the issue and the perspective, all four can somehow be applied to Thule Trailers Jönköping. The management of Thule Trailers in Jönköping currently are at the state, and has been for the last three years, of transferring some of the risks at their own plant to the plant in Poland, especially regarding capacity. This however also gives rise to new risks, since the problem in itself is not solved but only moved to another unit in the division. Since all units have transferred their production to Poland, with the exception of Italy, the risk at the Polish plant of under capacity increases and can result in delays and quality issues. In one way, it can be argued that the attempt to *transfer* risk has resulted in a *reduction* of risk at the Jönköping plant, but the remaining risk is *shared* since Jönköping is dependent on Poland – implying that it cannot be completely *avoided*. One way to ensure timely deliveries to the customers could be for Jönköping to keep a safety stock of trailers to be able to guarantee the customers delivery on time. It is according to the authors of this thesis, also crucial for the company to increase the number of supply sources in order to reduce risks further, especially for Poland, to have backup suppliers in case of emergency.

Another view of risk management is to divide the management into four different parts; supply, demand, information and product management. Thule Trailers Jönköping are doing a good job managing all of these different parts. The one thing that they could put more focus on is the information management. It could be opened up more than it is so that everyone in the company has the same perspective when issues are being viewed. The issue of information differences has already been addressed in 4.2.3. When it comes to the management of supply, they are trying to build up their own buffer to foresee delays from different suppliers. However, also have some secondary suppliers which they would use if needed. As discussed before, an improvement here that they also are aware of is a buffer of material in Poland as well. Management of demand is well done in Jönköping according to the authors of this thesis. Some of the trailers are made only when an order is placed and the customers are well aware of the time it takes to produce a trailer for them. The management of products is seen in Jönköping as a way of working with the suppliers in order to satisfy the customers, to get the customers the right product, of right quality on time.

According to Norrman and Lindroth (cited in Brindley, 2004) supply chain risk management can also regard risks in a single company's supply chain. Our interpretation of this is

that it can be connected to conflicts within the company regarding lack of information. When the decision to move the production to Poland was carried out, none of the employees were fired, though some chose to leave voluntarily. So, even if there were no known conflicts the authors of this thesis believe that the workers in the production at least had a different opinion than the management when they got the information about the change of work tasks.

From table 4 by Chopra and Sodhi (2004) the best way to manage risk is to add capacity and inventory as well as increase responsiveness. The management at Thule Trailers Jönköping is doing their best to add capacity and inventory. The main reason for moving the production to Poland was to gain more capacity, even though the assistant production manager is of the opinion that Poland does not have any more capacity, that they are using all of it already. Furthermore, according to Chopra and Sodhi (2004) it is important to manage risks correctly to be able to decrease disruptions in the supply chain flow. When doing this it is, according to Giunipero and Eltantawy (2003), important for managers to focus on developing the relationship between the members in the supply chain to increase the flow of information and the communication. The communication in the company is at times not sufficient and the process of managing the supply chain suffers accordingly. To increase the positive work process they need to work as an intact company with the same goal and not as separate parts.

5.3.3 Managerial implications

The information about the capacity levels gave an idea about what could be a better solution, since the assistant production manager also mentioned that the production plant in Jönköping could double their capacity without any trouble at all. In addition, when it comes to the inventory part, the Jönköping office is trying to introduce a concept of having an inventory of frequently used parts in Poland, a buffer. However, this is not always appreciated by the Polish office. The authors of this thesis believe that this is a good idea so if it worked better, it would benefit Thule Trailers Jönköping more, in the way that it would decrease the delays and increase the quality.

The risk management could most definitely be developed further. As stated before, more focus could be put on capacity at the Polish plant and also to look for root causes to why it is that products are delayed from Poland. Communication issues seems to be one of the major sources. Another reason for this is that they are weighted down by orders and also because they seem to have difficulties with their own suppliers.

Since communication is a problem, and therefore a risk, when managing the supply chain it would also be significant for the different units to introduce the same business systems, to save time and coordinate the demand. An alternative to changing business system completely would be to implement a so called EDI system, that 'translates' data between two different business systems so that they can work together. This would be a cheaper alternative for Thule Trailers. If this change was done the units would be able to have a better control of what is being done and would not have to chase materials needed in the production. These changes would reduce the disruptions that occur at times and make them less vulnerable to risks.

6 Conclusion

In this section the conclusions as a results of the findings will be presented and the purpose will finally be answered.

The conclusions are that the internal risks identified, i.e. communication risks, quality risks etc, have as great an influence on the company as would external risks. The internal risks can however be managed if they are realized and accepted as potential problems. In Thule Trailers Jönköpings case, a lot of work still remain to get the internal supplier to cooperate and function in a way that does not affect their own operations negatively. There is potential to solve most of the problems if both parties are prepared to put some real effort into reducing the risk sources. The risks are manageable and need to be managed to reduce the impact it has for the customer and end customer in turn. The authors of this thesis believe that for a company to be successful, the end customer has to be prioritized in almost every situation, and this goes for all of the members in the supply chain, especially the internal ones.

One suggested solution to find risks in supply chains, according to theory, is to map it. As stated in the analysis, Thule Trailers Jönköping would not be in a better situation if they had used mapping to analyze their supply chain. The authors of this thesis draw the conclusion that mapping facilitates the risk identification externally, though see no advantage internally, and therefore no reason can be found why Thule Trailers Jönköping should put an effort into doing this.

A common denominator in all the risks found can be concluded to be a lack of communication. There does not seem to be enough commitment from the Polish side to share information, and in addition there is an insufficient integration of external suppliers to Poland, as well as a full capacity utilization. All in all it comes down to integrating the external supply chain with the internal, and communication improvement.

Another conclusion is that Jönköping cannot stand alone in the process of identifying, reducing and managing internal risks. This is a process that needs to be coordinated internally within the entire Trailer Division, that would require a higher level of communication than the authors of this thesis have found in this research.

The subject with external supply chains is wider than our purpose, but the conclusion drawn here is that the internal supply chain will always be affected by the external. This fact becomes obvious when observing the internal risks within Thule Trailers Jönköpings internal supply chain. Almost every risk that we have found can be linked back to an external source, even if it is very far back.

A final remark would be that despite all of the different internal risks the authors of this thesis have found in the internal supply chain, Thule Trailers AB manages to grow rapidly and reap increased profits each year, meaning that the impact of the internal risks are at the moment just a thorn in the eye, but could eventually develop into a serious problem.

7 Discussion

Finally some concluding remarks about criticism that can be found for the chosen method of conducting this thesis and some suggestions for areas that could be further researched

Thule Trailers is most certainly not the only company that daily deals with issues arising within their internal supply chain. Since it nowadays is common that companies offshore and outsource more and more of their production processes, this is an issue that the authors of this thesis find highly relevant for many companies today. The risks and the risk consequences found in this research are not thought to be unique to Thule Trailers AB. The authors of this thesis are convinced that similar findings and conclusions can be drawn to other companies with similar supply chains, which is supported by Christer Alfredsson, CEO of K.A. Wiking AB – TVAB Group (Personal communication 2007-01-13)

> *"Risk analysis in Thule's internal supply chain was spot on the experience I have from a similar supply chain setup within the TVAB Group, the interview answers could be an echo of opinions in my own company."*
> (Christer Alfredson, CEO, K.A. Wiking AB – TVAB Group, Personal communication 2007-01-13)

7.1 Recommendations for further research

The subject of supply chains and supply chain risks have been discussed thoroughly by researchers for many years now. During the process of writing this thesis though, it was discovered that not much attention has been given to the internal aspects. As should be clear by now, the internal supply chain is just as important to manage as the external and the internal risks maybe not as vital as the external ones, but still a serious threat if not managed. These issues deserve much more research and attention.

In this case in particular it would have been of interest to include the external supply chain to get a macro perspective. It is very likely that the bullwhip effect, i.e. the information asymmetry ripple effects, can be observed in the external supply chain and it would be interesting to look where it originates in this particular supply chain. Chances are that the same causes can be observed in any other similar supply chain and would have enabled generalizations to other companies.

7.2 Critique of study

The thesis was conducted by using a qualitative method with semi-structured interviews. This technique was used since the authors of this thesis found it the best suited to gain the information and insight in the field of the research. For instance if a quantitative method with for example questioners would have been used, the authors might not have gotten the in-depth answers needed to be able to fully understand all aspects of the problem. There are however always the possibility of interpretation errors when you conduct a qualitative research method.

The interviews conducted might also have been extended to interview the blue collars at the plant in Jönköping and at the plant in Poland. They might have been able to give an even broader picture of the risks in Jönköping, but since the representatives that the authors talked to are in higher positions within the company they also have more knowledge of the company as a whole. The time constraint also made it impossible to interview all the

people we would have wished to interview. Furthermore, more representatives from the Polish factory would have increased the depth and reliability of the thesis.

Another potential problem with the research is the language barrier with the Polish representative. Some questions might have been interpreted in another way than was originally intended by the authors. This is because the study included terms that might have different meanings to different people, which can lead to misunderstandings. The process of translating the empirical data gathered from the interviews conducted in Swedish might also have influenced the descriptions depicted in the empirical chapter. The authors of this thesis are all Swedish native speakers, though fluent in English, the possibility of translation errors are always present.

References

Andel, T. (2001). Are your material and data flows in synch? *Material handling management, Volume 56, No.* 4, pp. 4-10.

Ballou, R. H. (2004). *Business Logistics/Supply Chain Management.* (5th Ed.) New Jersey: Pearson.

Barry, J. (2004). Supply Chain Risk in an Uncertain Global Supply Chain Environment. *International Journal of Physical Distribution & Logistics Management, 34(9), 695-713.*

Brindley, C. (Ed.). (2004). *Supply chain risk.* Cornwall: MPG Books Ltd.

Bryman, A., & Burgess, R. (Eds.). (1999). *Qualitative research - Volume 1.* London: Sage Publications.

Buchanan, D., & Connor, M. (2001). Managing process risk: planning for the booby traps ahead. *Strategy & Leadership, 29*(3), 23-28.

Cranfield Centre for Logistics and Transportation. (2002). *Supply Chain Vulnerability.* Retrieved 2006-12-04 from http://www.dcmt.cranfield.ac.uk/ddmsa/resilience/scvreport.pdf

Cranfield Centre for Logistics and Transportation. (2003). *Creating Resiliant Supply Chains: A practical guide.* Cranfield: Cranfield University.

Chopra, S., & Meindl, P. (2004). *Supply Chain Management – Strategy, Planning, and Operations.* (2nd Ed.) Upper Sadle River: Pearson.

Chopra, S., & Sodhi, M. S. (2004). Managing Risk to Avoid Supply Chain Breakdown. *MIT Sloan Management Review, Vol. 46 No. 1,* pp. 52-61.

Christopher, M. (2005, September 16). Title. *Financial Times,* p. 2.

Council of Supply Chain Management Professionals (2005). *Supply Chain and Logistics Terms and Glossary.* Retrieved September 11, 2006 from http://www.cscmp.org/Downloads/Resources/glossary03.pdf

Deloitte Enterprise Risk Services (2004). *Supply Chain Risk Management: Better control of your business environment.* Retrieved October 31, 2006 from http://www.deloitte.com/dtt/article/0,1002,cid%253D53681,00.html

Fishkin, C. A. (2006). *The Shape of Risk – A New Look at Risk Management.* New York: Palgrave Macmillan.

Gardner, J. T., & Cooper, M. C. (2003). Strategic supply chain mapping approaches. *Journal of Business Logistics, 24*(2), pp. 37-64.

Giunipero, L. C., & Eltantawy, R. A. (2003). Securing the upstream supply chain: a risk management approach. *International Journal of Physical Distribution & Logistics Management, Volume 34, No. 9,* pp. 698-713.

Hauser, J., Simester, D., & Wernefelt, B. (1996). Internal Customers and Internal Suppliers. *Journal of Marketing Research, Volume 33, No. 3,* pp. 268-280.

Hill, T. (2000). *Operations management, strategic context and managerial analysis*. London: Macmillian Press Ltd.

Johansson, J. (2006, November 18). Rekordår för Thule Trailers. *Jönköpings Posten,* p.15.

Kirk, J., & Miller, M. L. (1986). *Reliability and validity in qualitative research*. USA: Sage Publications.

Koster de, R., & Delfmann, W. (Eds.). (2005). *Supply Chain Management – European Perspectives*. Copenhagen: Copenhagen Business School Press.

Kotzab, H., Seuring, S., Müller, M., & Reiner, G. (2005). ***Research methodologies in supply chain management***, New York: Physica-Verlag Heidelberg.

Krajewski, L. J., & Ritzman, L. P. (2002). *Operations management, Strategy and analysis* (6th ed.). New Jersey: Pearson Education Inc.

Marshall, C., & Rossman, G. B. (1999). *Designing qualitative research* (3rd Ed). Thousand Oaks, California: SAGE cop.

McCracken, G. (1988). *The Long Interview*. Newbury Park: Sage.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass.

Miller, K. D. (1992). A Framework for Integrated Risk Management in International Business. *Journal of International Business Studies, 23(2), pp. 311-331.*

Peck, H. (2005) Drivers of supply chain vulnerability: an integrated framework. *International journal of physical distribution & logistics management, 35* (4), 210-232.

Pfohl, H.-C. (2004). *Logistiksysteme – Betriebswirtschaftliche Grundlagen.* (7th Ed.) Berlin, Heidelberg, New York: Springer

Quinn Patton, M. (1990). *Qualitative evaluation and research methods*. London: Sage.

Ryen, A. (2004). *Kvantitativ intervju – från vetenskapsteori till fältstudier*. Malmö: Liber.

Saunders, M., Lewis, P., & Thornhill, A. (2003). *Research Methods for Business Students.* (3rd Ed.) Essex: Pearson Education Limited.

Shah, J., & Singh, N. (2001). Benchmarking internal supply chain performance: development of a framework. *The journal of Supply Chain Management: A Global Review of Purchasing and Supply, February*, pp. 37-47.

Steel, P. (2006, June 29). *Managing supply chain risks*. Retrieved October 9, 2006, from http://www.consafelogistics.com/Our_Company/News_Pressreleases/Managing_supply_chain_risks.aspx

Tan, K. C. (2001). A framework of supply chain management literature. *European Journal of Purchasing & Supply Management. Volume 7,* pp. 39-48.

Tang, C. S. (2006). Perspectives in supply chain risk management. *International journal of production economics, 103*. 451-488.

Thule Sweden (2005). *Annual report 2005* [Brochure].

(Available from Thule Trailers AB, Industrig. 16, SE - 55302 Jönköping, Sweden)

Thule Group. (2006). *Company facts*. Retrieved 2006-12-11 from http://www.thulegroup.com/en/Thule-Facts/This-is-Thule2/

Appendix 1

Interview guide

This interview guide was used when conducting the interviews. The questions are rather general, but they were more guidelines that directed us through the interview and led to smaller more detailed follow-up questions to deepen our understanding of the company's situation.

- Tell us generally about your work and your position in the organization
- Tell us generally about the organization's
  - structure
  - development
  - growth
  - production
  - products
- Have there been large changes recently?
  - regarding the organization
  - regarding the industry
  - regarding consumer behavior
- Who are your customers/suppliers?
- How do you perceive the cooperation/relationship with your
  - Suppliers?
  - Customers?
  - Internal suppliers?
- How do you perceive the communication between you and your
  - Suppliers?
  - Customers?
  - Internal suppliers?
- Tell us about the interaction between yourself and your internal suppliers/customers regarding
  - Production (capacity, quality, lead times, efficiency, flexibility etc.)
  - Communication (information system, order processes etc.)
  - business culture
  - logistics
- Have you perceived any disturbances in the supply chain, and if so, what?
  - Externally
  - Internally
- What are the consequences in that case?
- What is your perception about risks in the supply chain?
  - Externally
  - Internally