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Operational Disturbances in Supply Management

Sources and Managerial Approaches

Master Thesis in International Logistics and Supply Chain Management

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Abstract

Nowadays global companies view the world as a single entity, sourcing materials from anywhere and performing operations to create the optimal supply chain for their products. This leads to an increasing complexity which is driving supply management to become a core capability of businesses. As supply chains are inherently vulnerable to disturbances, supply management will have to play a key role in the field of risk analysis and risk management. An increased awareness of sources of disturbances is essential to create significant improvements in the handling and prevention of disturbances.

The purpose of this thesis is to identify and classify sources of disturbance which can have a negative influence on a company's supply management. This is achieved by the investigation of theories available in literature, as well as identifying and analyzing the disturbances in the supply management of an international manufacturing company. Additionally, the theories on disturbance management are reviewed to create a foundation for managerial implications.

The company studied is Husqvarna, which currently is in a situation with several disturbances in its supply management. The performed case study aims at both, describing these phenomena, as well as testing of the theories. The chosen qualitative approach makes it possible to gain in-depth knowledge and investigate different aspects of sources of disturbances in this case study. The interviews performed are standardized open ended questionnaires in order to get in-depth knowledge of the situation.

The empirical findings are then analyzed in regard to the purpose of the thesis. The goal of this analysis is to compare the sources of disturbances of the classification scheme created in the literature review to the respondents' answers from the interviews. Moreover, inputs and opinions from the respondents on how to manage disturbances are connected with the theories provided in the literature review within this field.

Various sources of disturbance with a negative influence on the supply management of companies are identified. It was also possible to compare the classification scheme which was created based on the theoretical findings with the finding of the case study of Husqvarna. Consequently a holistic overview of potential and actual sources of disturbance in supply management has been created. Furthermore, it is possible to contribute to the body of knowledge on how to manage disturbances in supply management. The provided insights highlight implications that can help companies to successfully manage disturbances and hence improve their performance.

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List of Abbreviations

3PL	Third-Party Logistics Provider
CEO	Chief Executive Officer
EDI	Electronic Data Interchange
IT	Information Technology
JIT	Just-In-Time
PCP	Project Control Process
Q1	Quarter One
VMI	Vendor-Managed Inventory

1 Introduction

In the first chapter the reader is introduced to the broader context of this thesis. A brief introduction to supply management and its development over the years is given. This is important to create a basis for understanding the context of this thesis. Furthermore, the aim of this chapter is to generate a clear picture of the discussed problem and the purpose of the thesis. Based on this, the central concept of the thesis is explicitly defined and the scope of the thesis is delimited. After that the research questions are presented. The chapter ends with the presentation of the outline of the following chapters.

1.1 Background

In order to understand the importance of supply management it is helpful to be aware of the development of global trade. According to Langley, Coyle, Gibson, Novack and Bardi (2009) there have been three waves of international trade. The first wave occurred between 1400 and 1800, and was driven by countries seeking materials and goods not available in their own environment. The second wave took place between 1800 and 2000 and was mainly driven by companies seeking markets, labor, economies of scale, material, and goods – within this era many large international companies were created. The third and current era began around the year 2000 and is driven by smaller companies and individuals. This development became possible due to the emergence of new technologies, which have reduced the impact of distances and differences in time.

Comparable to this development in trade there has been a similar development in the management of supply. Even though the importance of purchasing has been debated in academic circles from the 1960s, only by the early 1980s had Western organizations begun to focus on their supply structures. Today most organizations see managing their supply base as a key strategic issue and supply management is seen as a facilitator to success. Due to current pressures like increased competition, improved time-to-market and cost reductions, supply management is still of growing importance to organizations. Companies have to respond constantly to the changes in strategic pressures and priorities by re-engineering their supply management structures (Cousins, Lamming, Lawson & Squire, 2008).

With its high impact on costs, supply management directly affects the results of an organization's bottom line. For every euro earned the supply management is accountable for spending over half of that. More is spent on purchasing materials and services than for all other expense items put together, which means wages, taxes, dividends and depreciations. For a typical manufacturing company the cost of materials is 2.5 times the value of labor and payroll costs (Burt, Petcavage & Pinkerton, 2010).

Moreover, with the arrival of globalization, the world's trading patterns have changed radically. For organizations there are numerous opportunities for global sourcing and with these opportunities comes not only the ability to decrease costs in sourcing, but also possibilities to find new markets for products. Nowadays a global company views the world as a single entity, sourcing materials from anywhere and performing operations to create the optimal supply chain for its products (Monczka, Handfield, Guinipero, Patterson & Waters, 2010). This situation leads to an increasing complexity which is driving supply management to become a core capability of businesses (Cavinato, Flynn & Kauffman, 2006).

1.2 Problem Discussion

The development of supply management presented in section 1.1 has many consequences. One which is important for this problem discussion is the new and changed interest in risk. The number and character of the risks and the total risk exposure change, as supply management becomes more complex. The various risks organizations are facing have been increasingly in focus during the last decade both in the media (Simons, 1999) and as a research topic (Paulsson, 2004).

As a result of the importance and the complexity of supply management, this function will have to play a key role in the field of risk analysis and risk management, and will consequently step to the forefront of business strategy. It is crucial for supply managers to uncover and identify potential risk areas. Concerning supply management, risk can be everything which affects the continuity and integrity of supply (Cavinato et al., 2006). Companies that actively analyze these risks, and proactively engage with them will be in a much better position to maintain competitiveness and profitable bottom lines (Cook, 2007).

Furthermore, Rasmussen and Svedung (2000) declare that it is an often heard opinion that in the future, organizations will need access to more knowledge about risk areas to handle them. Moreover, they will need to become more proactive, for which more knowledge about risks is needed as well.

Cook (2007) contributes by clarifying that risks always have to be taken in context – they exist and many cannot be controlled, but only influenced. Companies must be able to assess risks and how they will affect the management of the supply situation. According to Paulsson (2004), risk management within supply management is one of the most significant challenges companies are facing as new risk areas occur. For instance eliminating buffer stock might increase productivity, but it will also, if nothing else is done, decrease possibilities to handle disturbances.

Supply chains are inherently vulnerable to disturbances, but the vulnerability of modern supply chains seems to be increasing. Due to amplified competitive pressure and the globalization of markets, almost all industries have gone through a remarkable change in their business environment. This led to a massive pressure to make business processes and supply chains either more efficient or responsive. Many companies reacted to this development by various redesigns, outsourcing business parts, sourcing in low-cost countries, lowering inventories, or collaborating more intensively with other supply chain actors. However, all these developments resulted in an increased vulnerability of supply chains to the impact of disturbances (Wagner & Bode, 2009). Thus, an increased awareness of the existence of disturbances and their sources of origin in the supply chain will create significant improvements to handle or prevent them (Svensson, 2000).

1.3 Purpose

The purpose of this thesis is to identify and classify sources of disturbance which can have a negative influence on a company's supply management. This is achieved by the investigation of theories available in literature, as well as analyzing the disturbances in the supply management of an international manufacturing company. Additionally, the field of disturbance management will be reviewed to create a foundation for managerial implications. The findings of the literature and the case study will be scrutinized and compared. Having a holistic overview of possible sources of disturbance in supply man-

agement will make it possible to come up with managerial implications that can help companies to improve their performance. In the globalized world with its fierce competition, the question on how to optimize supply management is essential. This trend will not reverse, and professionals who become effective and comfortable in this situation will be in demand (Cavinato et al., 2006). This thesis aims to contribute to the body of knowledge on how to manage complex supply situations for manufacturing companies.

The company studied is Husqvarna, which is a manufacturing company with its core activities in Sweden, but with a presence in more than 100 countries worldwide. Currently the company is in a situation with several disturbances in its supply management. A contributor to this situation is the extensive redesign done at the assembly unit located in the city Huskvarna. There has been a huge increase in the efficiency of this unit and at the same time the suppliers are having problems to keep up with the new pace (B. Cannerborg, personal communication, 2012-01-19).

1.4 Delimitation / Definition

Due to the limited extent of this thesis, it becomes necessary to further delimit its scope. The overarching purpose of this thesis is to identify and classify possible sources of disturbance in the supply management of manufacturing companies. However, the focus of the case study is on one international company based in Sweden. It is important to note that the company Husqvarna is not viewed as being representative for all organizations.

Moreover, the term ‘source of disturbance’ has to be explained. Even though this term can be found in a variety of academic articles (for example Ritchie & Brindley, 2004; Paulsson, 2004), not many of the authors establish a definition to clarify the exact meaning of this term. In order to delimit the scope of this thesis, it becomes necessary to establish a definition of the term ‘disturbance’. The Merriam-Webster Online Dictionary (2012) states that a disturbance is ‘*an act or instance of the order of things being disturbed*’. In the context of supply management Svensson (2000) defines a disturbance as a deviation that causes negative consequences for an organization. Accordingly, a ‘source of disturbance’ specifies the origin of the disturbance within the supply chain.

Based on the definition of a disturbance, a suitable approach for a further delimitation of the scope of this thesis is Svensson (2000). According to him sources of disturbance can be divided into atomistic (i.e. direct) and holistic (i.e. indirect) sources of disturbance. The atomistic sources of disturbance signify that focus on a selected and limited part of the supply chain is required in order to analyze them. These direct sources of disturbance can for example occur between a company and its first-tier suppliers. The holistic sources of disturbance indicate that an overall analysis of the supply chain is required in order to analyze these sources. Indirect sources of disturbance may for example affect the supply chain between the first-tier sub-contractor and the supplier. Accordingly, the scope of this thesis is delimited to the identification and classification of atomistic sources of disturbance which deal with an organization’s direct problems with their suppliers or with their internal processes. Furthermore, it can be said that those disturbances have to be possible to control – which is not the case for example for natural disasters or changes in political situations. Atomistic sources of disturbance could for instance be external threats such as vendors, for example first-tier suppliers, performing poorly or suppliers which are not able to keep up with rising demand. On the other hand there could also exist internal problems such as communication problems between different departments (for example purchasing and production planning).

1.5 Nomenclature and Conceptual Framework

The terminology used relating to risk management and disturbances in the context of supply management is inconsistent – there is still no commonly agreed nomenclature (Wagner & Bode, 2009). Due to this reason, the purpose of this section is to clarify the nomenclature used in this thesis.

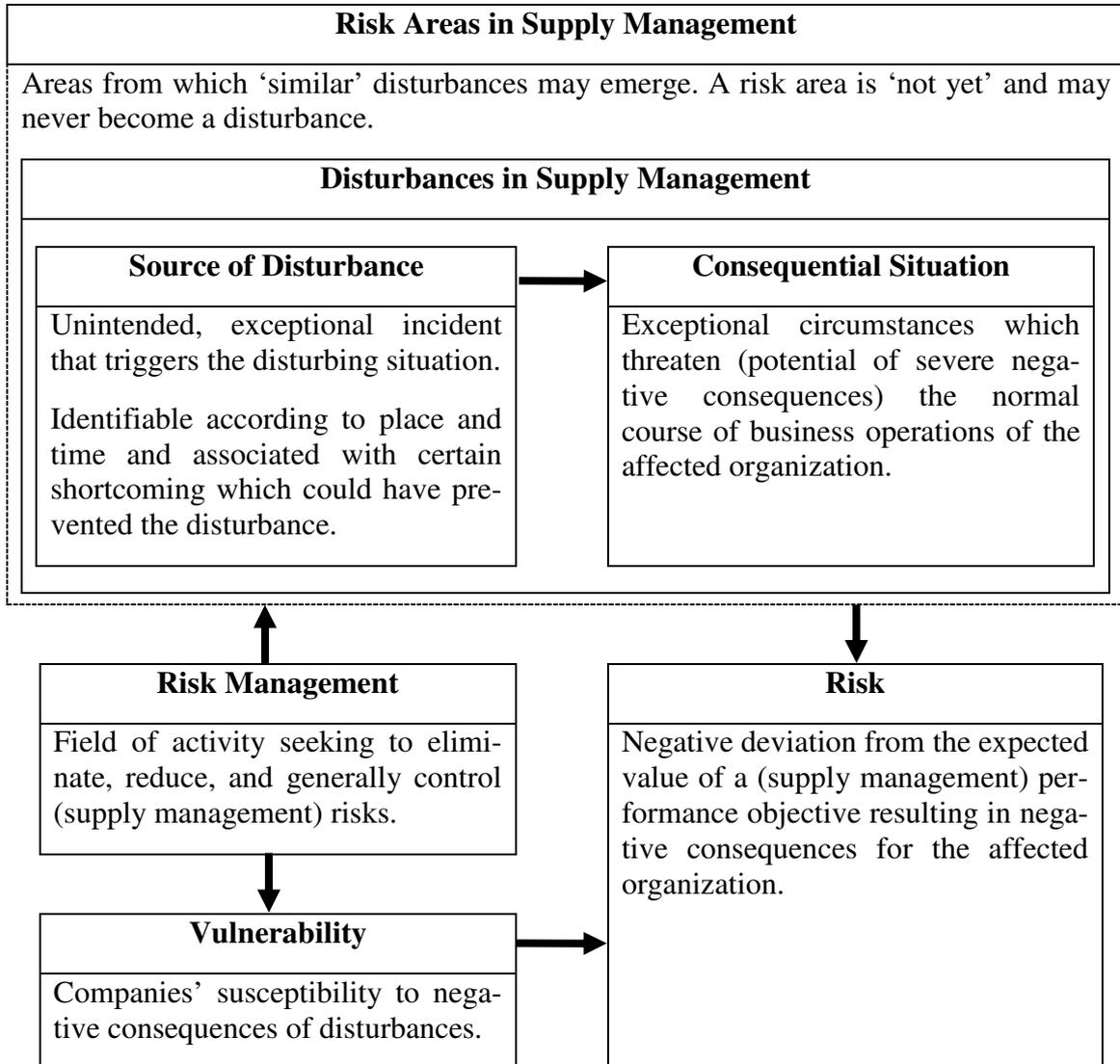


Figure 1.1 Nomenclature and conceptual framework (adapted from Wagner & Bode, 2009).

Figure 1.1 illustrates how these terms are interconnected with each other. In the following literature review all these terms will be covered and discussed.

1.6 Research Questions

The research questions for this thesis are listed below:

- What are potential atomistic (direct) sources of disturbance which can have a negative influence on the supply management of manufacturing companies?
- How could these sources of disturbance be classified?
- What are possible managerial approaches to manage disturbances?

1.7 Outline

The following figure is used to visualize the outline of the theoretical framework of this thesis. Furthermore, it shows how the focus is narrowed down in a funnel approach.

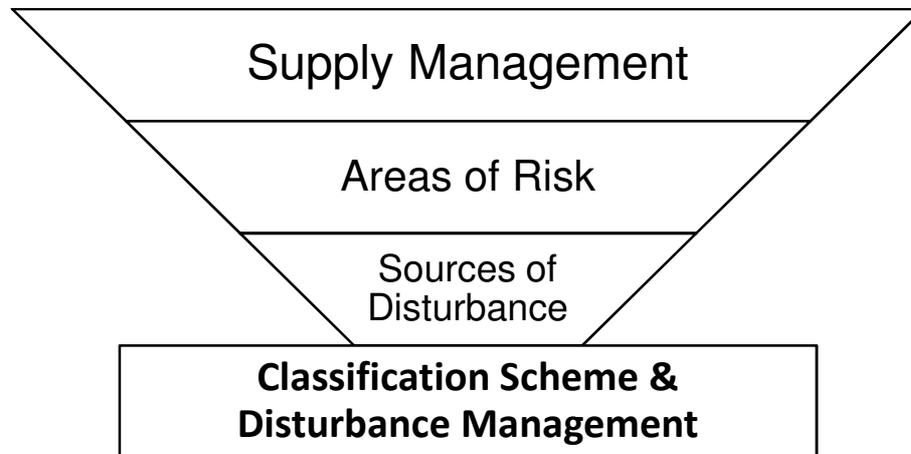


Figure 1.2 Structure of theoretical framework (compiled by the authors).

Chapter 2: After the reader is introduced to the broader context of the research problem, the term supply management is defined and discussed. Also, a typical supply management process is explained, followed by a discussion about its importance for companies.

Based on this background the thesis takes the reader from the broader context to the narrower issue of different areas of risk in supply management. Various sources regarding risk areas are analyzed to point out connections to the focus on sources of disturbance in supply management. This part is essential to convey an overview of this research field.

Since risk in supply management is a very extensive topic, the next step is the focus on investigating the possible sources of disturbance in supply management. This means to move one step forward by presenting the literature in an advanced and novel way. The outcome is a classification scheme for sources of disturbances, where possible atomistic sources of disturbance will be divided into external and internal sources (supply chain or company related). Moreover, the field of disturbance management will be analyzed in order to provide a background for the managerial implications that will be provided.

Chapter 3: Following the theoretical framework insights and reflections concerning the applied research method are provided. The chosen approach is presented and discussed. Moreover, relevant strengths and weaknesses are discussed. The method section comprises a straightforward description of how the empirical work has been carried out.

Chapter 4: In this chapter the empirical findings are presented. As the findings are analyzed in the following chapter, no deeper interpretation is carried out in this section. The interviews performed internally at Husqvarna and conducted externally are presented.

Chapter 5: After the presentation the empirical findings are analyzed in regard to the purpose of the thesis. The sources of disturbances identified in the literature review are compared to the respondents' answers. Moreover, inputs and opinions on disturbance management are connected with the theories provided in the literature review.

Chapter 6: The thesis ends with conclusions, which refer back to the research questions, depict ideas for future research, acknowledge deficits and give managerial implications.

2 Theoretical Framework

In this chapter different theories and previous studies that are related to the subject of this thesis are examined. From the findings a frame of reference is created, which will form the basis for both the design and the analysis of the empirical study.

2.1 Supply Management

During the first period of the 21st century, more changes are taking place in the areas of supply management, supply chain management, value network management, and virtual corporations than ever before. Supply management especially has a major impact on companies' bottom lines. It is the 'heart and soul' of supply chain interaction since 'the chain' starts with finding, selecting and managing effective and efficient suppliers. In today's complex global environment supply management has as much or even more impact on a company's return on assets than any other business function. It contributes to increases in profitable sales by enhancing the quality of products, ensuring on-time performance, reducing time to market, and giving sales and marketing freedom to maximize net revenue through the application of pricing elasticity (Burt et al., 2010).

2.1.1 Definitions

So far, the term *supply management* has been used without clearly defining it. As it is an important concept for this thesis, it is important to clarify and discuss its meaning. Leenders, Fearon, Flynn and Johnson (2006) point out the fact that terms like purchasing, procurement, materials management, sourcing, and supply management are used almost interchangeably. However, Leenders et al. (2006) also stress that it is commonly agreed that supply management includes more than the standard procurement process. According to Langley et al. (2009), the standard procurement process consists of needs analysis, make or buy decision, purchase type, vendor selection, product delivery and post-purchase performance evaluation.

Supply management also has responsibility for other parts of a supply chain, for example the company's customers and their customers and their suppliers' suppliers. The focus is to minimize cost and time across the supply chain for the benefit of the final customer in the chain. This view goes along with the prevailing idea that competition is changing from the company level to the supply chain level (Leenders et al., 2006).

Burt, Dobler and Starling (2003) support this observation and emphasize that already by the end of the 1980s managers started to see the fusion of the two resources, the team which managed the operational and tactical activities of purchasing, and supply managers who developed the strategic aspects, into a single entity. The integration of activities among actors in supply management is also recognized by Arnold, Chapman and Clive (2012) who add that there is no common manifestation of supply management in practice. Stolle (2008) argues that the term supply management keeps evolving with the practices of leading companies.

Generally, it can be said that supply management is seen as a comprehensive management concept, which is constantly evolving. Accordingly, supply management is defined as the dynamic vision of the practices performed by a strategic procurement function generating maximum value for the company (Stolle, 2008).

2.1.2 Importance to Organizations

In order to understand the dynamic vision and the increasing importance of supply management the following example from Burt et al. (2010) from the airplane industry is a good starting point. In 1945 40% of the total cost originated from materials, in 1955 it was about 50% and by the year 2000 it reached over 65%. Another good point is made by Leenders et al. (2006) who emphasize the importance supply management has on profit leverage – for a company with revenue of 100 million euro, purchase volume of 60 million euro and profit of 8 million euro, a reduction of the purchase volume by 10% would increase profit by 75%.

These figures show a substantial potential for gaining a competitive advantage, which is endorsed by Burt et al. (2003) through developing five value-adding benefits of supply management being: quality, cost, time, technology and continuity of supply.

- *Quality*: It is essential that the quality of purchased items is defect free, 75% of all quality flaws can be traced back to purchased materials.
- *Cost*: Supply management plays a key role in decreasing the cost for a company. Decreased supply costs have a direct effect on bottom line profit.
- *Time*: It is crucial for a company to get its new products to the market in the right time. Professionals estimate that it is possible to reduce the time for a product to reach the market by 20 to 40% through excellent supply management.
- *Technology*: Supply management has two main responsibilities concerning technology. It must ensure that appropriate technology is provided by suppliers, and that technology is carefully controlled when dealing with external suppliers.
- *Continuity of supply*: Supply management must monitor the supply and take the necessary precautions that are required to reduce the risk of supply disruptions.

At the same time supply managers are responsible for preventing unexpected threats or shocks from the supply world in the form of price increases and supply disruptions. A company's supply management has to take actions to minimize the impact of such threats by monitoring changes in its ever changing supply environment (Burt et al., 2003). In order to build up and sustain a competitive advantage, a leading organization has to constantly improve and innovate its supply management practices (Stolle, 2008).

However, most supply management initiatives are not possible without the support of executive and functional managers. A strategic supply management process has to be organizational and cross-functional. The support from other functional groups, like for example product development, is essential for supply managers to create sustainable sources of advantages (Trent, 2007).

2.1.3 Supply Management Process

Leading organizations work hard to make their supply management a strategic contributor to corporate success (Trent, 2007). It is certainly not enough to view the supply management process merely based on the day-to-day routine of a supply management professional. A typical process could start with the recognizing of the need, which is generated by a person or a system, and might end with the maintenance of records and relationships, concerning the storage of information about the purchase (Leenders et al., 2006).

Considering the importance to organizations (section 2.1.2) it is evident that the supply management process deserves particular attention. The relevance is further reinforced by the fact that leading companies have their own definitions of the supply management process, which is highlighted by Harrington (1995). Additionally, he defines the supply management process as a business process that aligns a company's business objectives within the supply base. The main focus of the supply management process has to be on customer satisfaction through continuous improvement. One of the main strategies to achieve this is to institute an effective, efficient and adaptable supply management approach and process with emphasis on total cost, cycle-time, quality, and especially *risk*.

Trent and Roberts (2009) go one step further by claiming that the merger of supply management and risk management is inevitable. They argue that those areas are not mutually exclusive topics, because every supply chain and supply management within it faces a multitude of risks. Supply management and risk management are becoming so intertwined that failing to recognize this interrelation can lead to serious problems.

Before coming back to risk management as a part of supply management in section 2.2.2 it is necessary to discuss and define the term *risk*.

2.2 Risk in Supply Management

Everybody knows about risk, thinking of it in terms of unpleasant things that might happen. For companies, risk is a threat that something might happen to disturb usual activities or stop proceedings happening as planned. Risks appear in a vast variety of different forms; their effects might be localized in one part of the company, or passed on to threaten the whole supply chain; different risks can be linked. On the one side, many risks are fairly minor and have only limited impact. On the other side, risks occasionally have enormous consequences (Waters, 2011).

2.2.1 Definitions

The aim of the following part is to make the concept of risk in supply management clear by comparing definitions from different authors. At a first glance it might be both hard and easy to define the word *risk* since it is a term so commonly used in everyday life. In the common human perception risk is seen as potential harm from unforeseen events. However, risk is a construct that has different interpretations (Waters, 2011).

In the field of supply management, several publications are addressing the question of how to define risk. Generally two different approaches can be distinguished. The first approach views risk as both danger and opportunity. This perspective is in line with common practice in many fields of business research such as finance, where risk is equated with variance and covers both a 'downside' and an 'upside' potential. In contrast, the second approach considers risk as being purely negative. Bearing in mind the possible impact of disturbances in supply management, the latter notion corresponds best to supply management business reality (Wagner & Bode, 2009). Consequently, risk is defined as a purely negative construct in this thesis.

According to this, Kogan and Tapiero (2007) claim that risk results from the direct and indirect adverse consequences of outcomes and events that were not accounted for or that were poorly prepared for, and concerns their effects on individuals, or companies. This definition is rather sophisticated, but provides a good basis for simplification.

A more practical interpretation that captures the concept well, defines risk as the probability or likelihood of realizing an unintended or unwanted consequence. At supply management level, companies face various risks, which can be associated with shifting currency values, suppliers failing to deliver on time, quality defects, price increases, material shortages, labor disputes, and countless more scenarios (Trent & Roberts, 2009).

2.2.2 Risk Management as a Part of Supply Management

Trent (2007) establishes *not to forget about risk* as a major principle underlying strategic supply management. As already pointed out in section 2.1.3, risk management and supply management are closely related. The interrelation is underlined by Russill (2010) through pointing out possible consequences of the failure to properly manage risks in supply management:

- *Decrease in profit*
- *Decreased ability to handle price increases from suppliers*
- *Poor supplier performance*
- *Less productive use of human resources*
- *Increased vulnerability to internal and external fraud*
- *Entering the market with new products too early or too late*

Chopra and Sodhi (2004) stress that in all situations there is a trade-off between lowering risk and the potential impact on profit. Every situation is unique which makes it hard to create an optimal action plan which is adaptable for any company in a similar situation. Kleindorfer and Saad (2005) provide a similar logic regarding the trade-off of decreasing risk and its impact on profit. Monczska et al. (2006) provide a check list with the intention to make it easier for companies to come up with an accurate plan to manage or mitigate risk. However, the authors make also clear that almost all situations are unique, so there is no 'magic list' on how to prepare or react if a risk situation occurs.

Hallikas, Karvonen, Pulkkinen, Tuominen and Virolainen (2004) establish a typical risk management process which contains identification, risk assessment, decision and implementation of risk management actions and risk monitoring. This is in line with Kleindorfer and Saad (2005), who emphasize that it is necessary to act on a strategic level to avoid risk. For instance that a company has to be well managed with respect to risk internally, before it can demand that other actors should be. The robustness towards risk is determined by the weakest link in the supply chain.

Consequently it can be said that it is crucial for companies to find out about possible areas of risk in supply management in order to be able to manage and mitigate them.

2.2.3 Risk Areas in Supply Management

While it is not possible in this thesis to give a complete discussion of all potential risk areas in supply management, the major ones will be highlighted. A good starting point for investigating risk in supply management is Leenders et al. (2006), who present seventeen potential risk areas:

1. *Source location and evaluation*
2. *Lead time and delivery*
3. *Expediting*

4. *Political and labor problems*
5. *Hidden costs*
6. *Currency fluctuations*
7. *Payment methods*
8. *Quality*
9. *Warranties and claims*
10. *Tariffs and duties*
11. *Administration costs*
12. *Legal issues*
13. *Logistics and transportation*
14. *Language*
15. *Communications*
16. *Cultural and social customs*
17. *Ethics*

This list illustrates the variety of potential risk areas in supply management. In order to point out the significance for companies, some of the examples used by Leenders et al. (2006) will be presented:

- Although enhanced transportation and communications have improved *lead time and delivery*, the risk for additional lead time is always present. This could for example concern establishing credit, delays from transportation, delays from customs, and the time goods are held in ports.
- *Political and labor problems* can, depending on the country in which a supplier is located, cause serious risks of supply interruptions.
- Due to the distances and lead times involved, misunderstandings of the *quality* specifications can be extremely costly.
- The current trend in *logistics* is to integrate the domestic and global supply. In this way supply chains often become very complex and vulnerable to risks.

An article that connects well to the example regarding *lead time and delivery* is from Holmström and Aaviko (1994). It provides an example of an automobile producer located in Finland: Most of its components arrive by ferry, and if a truck with components misses a ferry it has to wait a minimum of twelve hours for the next ferry. For a factory with a just-in-time (JIT) production such delays can cause severe disturbances.

Wagner and Bode (2009) divide supply chain risk sources into five distinct classes: *Supply side risk*, *demand side risk*, *regulatory, legal and bureaucratic risk*, *infrastructure risk*, and *catastrophic risk*. The first two categories of risk sources deal with supply-demand coordination risks that are internal to the supply chain. The focus of the latter three is on risk sources which are not necessarily internal to the chain.

Supply side risks exist in purchasing, supplier activities and supplier relationships. These risks can concern the threat of financial instability of suppliers, production capacity constraints on the supply market, quality problems, or inability of suppliers to adapt to product design changes.

Demand side risks result from problems emerging from downstream supply chain operations. This can include disruptions in the physical distribution of products, uncertainty of customer demand, or problems connected to the *bullwhip effect*.

Regulatory, legal, and bureaucratic risks refer to the environment concerning supply chain-relevant laws and policies (for example trade and transportation laws) as well as the degree and frequency of changes in these laws and policies.

Infrastructure risks include those disruptions that materialize from the infrastructure that a company maintains for its operations. As organizations have become increasingly technology-dependent, IT related problems are highly relevant to supply management.

Catastrophic risks sum up events that, when they occur, have severe impact in terms of magnitude in the area of their occurrence. This alludes to natural hazards (force majeure), socio-political instability, civil unrest, economic crises and terrorist attacks.

Discussing a variety of supply chain risks, Tang and Tomlin (2009) come up with a very similar categorization. The risks are *supply risks*, *process risks*, *demand risks*, *rare-but-severe disruption risks*, and *other risks* (*intellectual property risks*, *behavioral risks*, *political risks*, and *social risks*). Risk is also divided into categories by Christopher, Carlos, Omera and Ozgur (2011). Their five categories are *process risk*, *control risk*, *demand risk*, *supply risk*, and *environmental risk*. Process and control risk are internal to the organization, demand and supply risk are internal to the supply chain but external to the company and environmental risk is external to the supply chain.

Stecke and Sanjay (2009) classify four sources of risk in supply management:

1. *Number of exposure points* concerns the journey of raw material to final customer, and all the points where the material stops and is refined or changes from one mode of transportation to another which are potential points of exposure.
2. *Distance* is where, with global sourcing, the distance to suppliers has increased and from that an increased difficulty to control and manage the supply chain.
3. *Flexibility* concerns whether a company practices sole sourcing where there is an increase in vulnerability due to less flexibility in the chain.
4. *Redundancy* can concern a company that reduces its buffer and redundancy with a JIT approach, which in turn decreases the ability to manage disturbances.

Chopra and Sodhi (2004) propose nine categories to classify risks in supply management. They go one step further by combining the risks with the respective drivers:

Table 2.1 Categories of risk with respective drivers (Chopra & Sodhi, 2004)

<u>Category of risk</u>	<u>Drivers</u>
<i>Disruptions</i>	Natural disasters / Disputes with the labor force / Bankruptcy among suppliers / Acts of war and terrorism / ...
<i>Delays</i>	High utilization of capacity at the supplier / Low degree of flexibility at the supplier / Poor quality / Changes of transportation modes / ...
<i>Systems</i>	Collapse of IT infrastructure / Low degree of integration / ...

<i>Forecast</i>	Incorrect forecasts due to long lead times / Short product life cycles / Small customer base / Lack of supply chain visibility / The bullwhip effect / ...
<i>Intellectual property</i>	Vertical integration of the supply chain / Global sourcing / ...
<i>Procurement</i>	Exchange rates / Percentage of raw material from a single source / Long-run versus short-run contracts / ...
<i>Receivables</i>	Number of customers / Financial strength of the customers / ...
<i>Inventory</i>	Cost of holding inventory / Uncertainty in supply and demand / Value of the products / ...
<i>Capacity</i>	Flexibility in capacity / Cost of capacity / ...

Although risk is present at any point along the supply chain, this thesis focuses on a company's internal and external (in relation to first-tier suppliers) vulnerability. The following part will specifically focus on the related atomistic sources of disturbance.

2.3 Sources of Disturbance

2.3.1 Organizational Theory

In order to understand how internal and external sources of disturbances occur, it is useful to briefly investigate organizational theory to get a deeper understanding. Andersson (1994) states that an organization is built up from six different parts:

- *Administrative activities* such as planning, management and control
- *Technical operations* such as the production process
- *Economic and financial operations*
- *Accounting*
- *Commercial activity* such as marketing and procurement
- *Organizational safety*, different kinds of safety measures

Between all of these parts of an organization there is a dimension of conflict (Andersson, 1994). An example is provided by Melão and Pidd (2000) by explaining the difference between a production manager and a marketing manager regarding an order fulfillment. For the production manager the satisfaction comes from an order being manufactured on time, whereas for the marketing manager the satisfaction comes from fulfilling a customer's need.

Aldrich (2008) provides some examples of sources of internal conflicts:

- *Mutual task dependence*: If there is a strong interdependence between departments to achieve success – for example sales department and production department – an internal conflict arises when problems occur in one of these departments.
- *Task related asymmetries*: If one department is unilaterally dependent upon another department there is high probability for internal conflicts.

- *Department performance measurement*: As it is hard to measure the joint performance of two or more departments, performance criteria and rewards are usually measured based on the contribution from a single department. Consequently the different interdependent departments try to maximize internal performance without focusing on the big picture.
- *Other sources* of internal conflicts originate from lack of communication (which might come from faulty communication channels), absence of shared vocabulary and holding on to information as a tactical power gaining issue.

All potential internal conflicts can increase the vulnerability of a company. Asbjornslett (2009) discusses different factors – internally and externally – that contribute to vulnerability. Internal factors mentioned are: *staff factors, maintenance factors, human factors, management and organization factors, technical failures/hazards* and *system attributes*. Among the external factors are listed: *financial factors, market factors, legal factors, infrastructure factors, societal factors* and *environmental factors*.

Within an organization, as well as between an organization and its co-actors, there are many elements of conflict. Ultimately, conflicts are unavoidable in a relationship characterized by interaction and interdependence (Conrad, 1994). For every company it is essential to understand its internal conflicts to be able to isolate the most relevant and critical threats. Once a company has knowledge of its internal vulnerabilities, there is a possibility to monitor the external environment for signs of danger and start to mitigate them. Even if the company cannot prevent a disturbance, it is still possible to reduce the impact through the awareness of potential sources of disturbance (Christopher, 2005).

2.3.2 Atomistic Sources of Operational Disturbances

According to Ritchie and Brindley (2004), areas of risk within the supply chain can be categorized along a particular continuum (see figure 2.1). On this continuum the points operational disturbances, tactical disruptions and strategic uncertainty are identified.

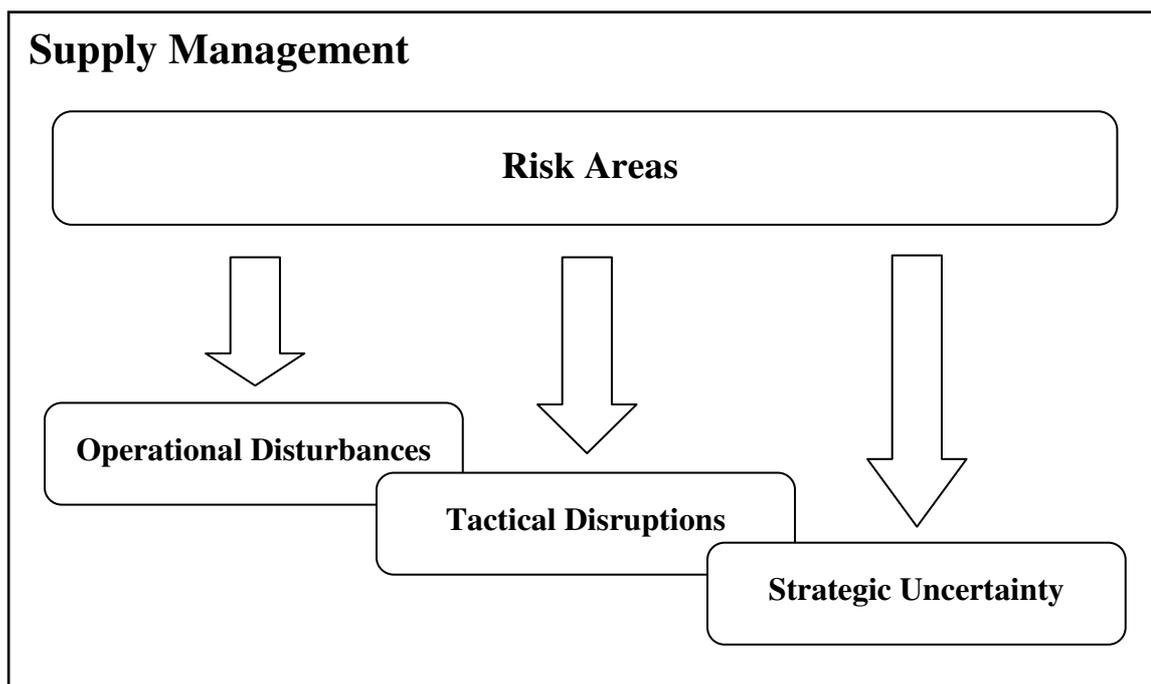


Figure 2.1 Different types of risk in supply management (adapted from Ritchie & Brindley, 2004).

The area of operational disturbances is consistent with the scope of this thesis. The sources of disturbances that will be examined in this thesis are the ones that occur up until entry of production. The focus will be on the sources of disturbances that can be managed and controlled, i.e. the disturbances caused by humans or actors in relationship between companies. Less emphasis will be on sources out of control by humans or actors in relationships of organizations, such as natural disasters and terrorist attacks.

As already discussed in the delimitation, this thesis investigates sources of disturbance in an atomistic view. This means that the source of disturbance lies either internally or in the direct relationship between a company and its first-tier suppliers. Svensson (2003) defines the resulting disturbances as quantitative, the received items are in the wrong quantity, qualitative, there are quality errors on the received items, or time constrained, the items did not arrive at the requested time.

2.3.3 Examples of Potential Sources of Disturbances

During the literature research for the contributions to the classification scheme a major difficulty was discovered, which is also mentioned by different authors and was already referred to in chapter 1. This is namely that there is no consistent terminology in the field of disturbances in supply management. In literature the terms disturbance, disruption and risk have been frequently used interchangeably, showing no consensus among authors about these concepts (Machado, Azevedo, Barroso, Tenera & Machado, 2009). According to Wagner and Bode (2009) this also holds true for terms such as disturbance, disruption, incident, accident, glitch, failure, hazard, or crisis. These are just two examples from literature where authors specifically emphasize that there is an inconsistency in terminology, but it can be observed in most of the investigated sources that the terms are used without much consistency. In the following part some examples will be given where the concept of sources of disturbance was explicitly dealt with.

According to Chopra and Sodhi (2004) disturbances are often caused by a *supplier's inability to respond to a change in demand due to high utilization or inflexibility*. Further common sources of disturbance are *inventory management* or *capacity issues* (Chopra & Sodhi, 2004). *Inventory management* as a potential source of disturbance is also mentioned by Tang (2006) who argues that in times of shorter product life cycles and the increasing product variety, inventories are decreased due to high inventory holding costs.

Poor forecasting as a potential source of disturbance is mentioned by Yi, Ngai and Moon (2011) in their investigation of supply chain flexibility in an uncertain environment. In the article, in which companies in the fashion industry are examined, it is stated that forecasting is especially difficult in developing markets since it is hard for agents and retailers to provide accurate information on customer demand (Yi et al., 2011). An error in the forecasting for demand can escalate to an error in the forecasting for the supply side.

Brandyberry (2010) highlights the danger arising from disturbances in supply management. Thus, it is crucial to have *well-documented policies and procedures* to be protected against disturbances. The lack of such policies is a potential source for disturbances.

Rishel, Scott and Stenger (2003) emphasize the importance of *sharing information* throughout the supply chain to make it more effective. Managers must share information among each other in the supply chain. For this to have a positive effect the information has to be accurate and relevant, therefore the *internal communication culture*

is crucial. The information may include inventory levels, shipments, production and demand projections. Within this information sharing there are several potential sources of disturbances, it has to be correct information that is communicated well among the concerned parties. Hong, Tran and Park (2010) investigate the *impact of electronic communication technologies*. Between companies, electronic data interchange (EDI) is used to transfer documents without any interference of humans. If such a system breaks down a substantial source for potential disturbance is created.

2.3.4 Derivation of Classification Scheme for Sources of Disturbances

Summarizing it can be said that in the investigated literature, there are only few papers that specifically focus on a definition and characterization of sources of disturbances in the context of supply management. Svensson (2000) introduce a conceptual definition, which is adopted in this thesis to introduce the concepts of atomistic sources of disturbance (in contrast to holistic sources, which will not be dealt with in this thesis). Due to the inconsistency in terminology and the time constraints of this thesis it proved difficult to find literature about sources of disturbance and their classification. For future research it would be necessary to look for a variety of identified terms which are used interchangeably (for instance: disturbance, disruption, risk, and vulnerability) and double-check them with the definition established in this thesis. Nevertheless, it was possible to derive a classification scheme, which will be presented in this section.

The classification of common sources of disturbance developed by Matson and McFarlane (1998) provides a good starting point. Their intention is to ensure a comprehensive understanding of the main issues companies are facing in the production environment. The classification contains three areas (Caputo, (1996) uses a corresponding scheme):

- *Upstream sources of disturbances*
- *Internal sources of disturbances*
- *Downstream sources of disturbances*

This classification shows that there is a need to investigate sources of disturbance, which are internal to a company as well as sources which are related to disturbances rooted upstream or downstream in the supply chain. These disturbance sources are external to the affected company (sources of disturbance located downstream in the supply chain are not investigated in this thesis). Nevertheless, this can only be a starting point as this classification is not profound enough for this thesis.

Vlajic, van der Vorst and Hajjema (2011) conducted an extensive literature review to create a list of sources of supply chain vulnerability. They define vulnerability sources as characteristics of the supply chain or its environment that lead to the occurrence of unexpected events and as such, they are direct or indirect causes of disturbances. For any occurring disturbance a set of vulnerability sources can be identified that represent a direct or indirect cause of the disturbance. This definition of sources of vulnerability provides an excellent foundation for the development of a classification scheme for atomistic sources of disturbance. The definition used for sources of vulnerability is very similar to the definition of sources of disturbance of this thesis.

Based on these assumptions the framework of Vlajic et al. (2011) is selected as the base for the classification scheme of this thesis. Adjustments are made concerning the focus on organizations' direct problems with their first-tier suppliers or with their internal

procedures and the concentration on the identification of atomistic sources of disturbance in supply management. Also the potential sources of disturbance identified in the previous sections are included. Table 2.2 presents the derived classification scheme:

Table 2.2 Sources of disturbance: Supply chain and company related (adapted from Vlajic et al., 2011)

Sources of disturbance: Supply chain and company related			
	Supply system	Information system	Organization structure
Supply chain related (external)	<ul style="list-style-type: none"> - Complexity of supply network - Lack of capacity - Inflexibility (for example due to high utilization) - Low reliability of chain partners - Lack of control in supply chain (for example of outsourced activities) - Lack of risk management and recovery planning initiatives along the chain 	<ul style="list-style-type: none"> - Lack of infrastructure to support information sharing - Lack of information visibility - Varying ICT standards used in supply chain 	<ul style="list-style-type: none"> - Loose contracts - Unclear coordination and cooperation - Insufficient collaboration - Lack of trust - Local optimization
Company related (internal)	<ul style="list-style-type: none"> - Limited control actions - Subjective decision making - Inaccurate forecasting - Lack of or insufficient attention to risks and disturbances management - Rigid planning (all levels) - Inventory related issues - Communication issues (sharing of accurate and relevant information) 	<ul style="list-style-type: none"> - Lack of or inadequate decision support system - Slow data transfer and processing - Late detection of disturbances - Lack of data about disturbances - Inaccuracy of data - Insufficient data analysis (disturbances) 	<ul style="list-style-type: none"> - Weak internal coordination and cooperation - No standardized working procedures - Poorly documented policies and procedures - Lack of communication culture - Lack of preparedness for disturbances

When sources of disturbance are classified it has to be taken into account that these sources are interconnected with each other. Hence, they make a chain of causes and consequences, which potentially cause disturbances in the realization of supply processes (Vlajic et al., 2011). Consequently, it becomes necessary for companies to develop methods for improving the management of disturbances in supply management.

2.3.5 Disturbance Management

According to Hinrichs, Rittscher, Laakmann and Hellingrath (2005), disturbance management deals with the planning and controlling of presumable events for which their time of appearance is not predictable. An example would be a disturbance in order processing, which is caused by a supplier's low reliability. It is obvious that such a disturbance can appear, but it is not predicable when it will happen. In this regard disturbance management is the active steering task to avoid the unpredictable situation by providing a structure in which disturbances can be managed in a controlled way. This disturbance management concept is not only short term oriented, but also enables companies to initiate changes towards an optimal solution for strategies to prevent disturbances.

Correspondingly, Vlajic et al. (2011) consider two groups of strategies: disturbance prevention and disturbance impact reduction. The goal of disturbance prevention is the reduction of disturbance frequency and scale; that means acting in advance to eliminate, avoid or control any direct source of disturbance. The use of the second group of strategies usually applies when disturbance prevention is impossible. This might be the case if, for instance, the prevention of a disturbance requires unreasonable investments.

According to Hinrichs et al. (2005), disturbance management consists of three elements in respect to create a stable process environment, which applies to both of the strategies:

- *Communication*
- *Knowledge*
- *Technology*

1. *Communication* defines organization, duties and responsibilities, and communication processes / rules in disturbance management. In the first step it has to be defined who is part of or affected by disturbance management. The crucial organization units have to be linked organizationally to avoid frictions in the communication flow. Furthermore, the duties and responsibilities describe the tasks which are part of the disturbance management. Communication processes / rules define how communication has to take place and how it is organized and designed.

2. *Knowledge* describes definitions of sources of disturbance and possible prevention strategies. This describes how threats can be avoided with the help of disturbance management. It also helps to assess the possible impact of a disturbance.

3. *Technology* deals with the IT support for disturbance management. For the needs of disturbance management workflows have to be flexible. The goal is to facilitate and improve the work within the disturbance management in supply management for critical decision making between different partners.

A very similar approach is presented by Matson and McFarlane (1998), who state that the extent and quality of information available concerning the occurrence and character of disturbances extensively affects responsiveness, since it has a major influence on the achievable quality of response decisions. They identify the following areas as being of importance for developing a better responsiveness towards disturbances:

- *Human / organizational*
- *Processes*
- *Decision, control and information systems*

Another interesting approach is provided by Oke and Gopalakrishnana (2009) who analyze the likelihood of a disturbance occurring and its business impact. Based on this, different mitigating strategies are developed which focus on improved planning, coordination of supply and demand, and flexibility. Melnyk, Rodrigues and Ragatz (2009) provide a simulation model with four mitigating policies:

Information related policies: The focus is on the flow of information within the supply chain. Important issues are lead time of information flows, quality of information and the sharing of information.

Buffer-related policies: The focus is on the three major types of buffers – inventory, lead times and capacity.

Alternate sourcing: This concerns developing and implementing alternative supply sources.

Component substitution: This relates to the identification and use of substitute components that have greater availability in case of a disturbance.

Concluding, it can be stated that active disturbance management can improve the process quality and reduce the costs related with disturbances. Companies benefit from an improved capability of disturbance management and are able to initiate changes towards an optimal solution and organization (Hinrichs et al., 2005).

3 Methodology

The structure of this chapter is based on the so-called ‘research onion’ provided by Saunders, Lewis and Thornhill (2009). The ‘research onion’ is used as support to work in a structured way and develop the research process. Within each step provided by Saunders et al. (2009) additional sources are added to support or supplement the information provided.

3.1 Research Philosophies

First of all, there are two ways to view the relationship between research philosophy and research method. One way is to view the research questions as the frame for the philosophical stance, the other way is where the philosophical stance guides the research questions (Neergaard & Ulhoi, 2007). The research questions were developed in the initial phase of this thesis. Consequently, they then guided the structure and the methodological approaches of this thesis.

With regard to the research philosophy, Saunders et al. (2009) introduce four different concepts – *positivism*, *realism*, *interpretivism* and *pragmatism*:

Positivism is an approach most common among natural scientists and the outcome is often law-like generalizations.

Realism has as its aim to describe the reality independently of the human mind.

Interpretivism takes into account the differences among human beings in their roles as social actors. There is a difference when making research upon humans and their interactions and research about for example machines. This difference is emphasized in the interpretivistic philosophy.

Pragmatism: If the research question does not aim in the direction of positivism or interpretivism, the philosophy is pragmatic.

The most appropriate philosophy for this thesis is interpretivism. As the study performed investigates sources of disturbances, it is not a plainly interpretivistic study, since it is not a study on humans per se. Yet, the human factor is still very important, as organizations are unambiguously affected by decisions made by humans.

3.2 Research Approaches

After the research philosophy, the next step is to look into the research approaches. In this thesis the theories on sources of disturbances are investigated and connected to the findings of the empirical study. The different research approaches are presented below.

Deductive and Inductive Approach

There are two different research approaches provided by Saunders et al. (2009), namely deductive and inductive. The difference can be shortly explained as deduction – testing theory, and induction – building theory. Hyde (2000) explains the difference as follows:

Inductive reasoning is a building process that starts with observations, then seeking for a pattern which leads to a tentative hypothesis and in the last phase it might be able to create a generalizing theory.

The *deductive reasoning* starts in the other end with an established theory, hypothesis and through observation the aim is to investigate if the theory can be applied.

The research approach of this thesis leans towards a deductive approach. There are established theories and known facts in the field of risks and sources of disturbances. However, any new findings aiming more in the direction of an inductive approach are also taken into consideration.

Exploratory, Descriptive and Explanatory Approach

According to Brannick (1997), research needs to be classified as *exploratory*, *descriptive* or *explanatory*:

An *exploratory* study answers the question ‘what’. This approach is used when searching for understanding regarding the nature of a problem. There is often little or no prior knowledge in the area.

The *descriptive* approach answers the questions ‘when, where, who’. There are plenty of studies in the research area and the purpose of a descriptive research is to provide a relevant description of a certain business environment.

The *explanatory* approach answers the questions ‘how and why’. It shows the relationship between different variables, one or more variables determine the value of other variables. The aim of the research is to develop, extend or disprove existing theories.

The performed study is a mixture of the descriptive and explanatory approach, yet leaning towards the descriptive approach. The ‘when, where, who’ questions are helpful in the research upon sources of disturbances. The explanatory approach is also valid since the ‘how and why’ questions are relevant for the study.

3.3 Research Strategy

In this section the different research strategies will be explained. There are seven different main strategies: *experiment*, *survey*, *case study*, *action research*, *grounded theory*, *ethnography* and *archival research* (Saunders et al., 2009).

In case study research multiple sources of evidence are used. The data collection techniques can include interviews, observation, questionnaires, and document analysis. Case study research can be used for the description of phenomena, as well as for the development and testing of theory. Case study research used for theory testing requires the specification of theoretical propositions derived from an existing theory or suggested by the outcomes from prior research. Based on the analysis of the case data, the findings of the case study can be compared with the expected outcomes predicted by the propositions. As a result, the theory can be validated or found to be invalid to some extent and, depending on the results, the theory may then be further refined (Patton, 2002).

Case study research is especially suitable and has its strengths in situations in which the examination and understanding of the context is essential. This applies particularly to areas where the experience of individuals and the context of actions are critical (Williamson, 2002). As this is very much the case in this thesis, a case study is performed with the aim of both describing phenomena as well as testing of theories. Based on this case study the investigated sources of disturbances are classified, but also tested against the theories.

Quantitative versus Qualitative Research

It is important to make a distinction between quantitative and qualitative research, Brannick (1997) gives the following explanation. Quantitative research is focused on the connections between a number of well-defined and measured attributes, including many cases. On the other hand, qualitative research is focused on the connections between many contextualized attributes including, in comparison to quantitative research, few cases. According to Patton (2002), outcomes of qualitative studies are in depth and detailed, in contrast to the outcome of quantitative studies, which comes from standardized measures that make it possible for varying perspectives and experiences to be built into a restricted number of prearranged response categories.

For this thesis a qualitative study is performed. The qualitative study suits the purpose of this thesis better compared to the quantitative. As stated above, the quantitative approach comes from standardized measures where perspectives can be built in prearranged response categories. It would be difficult to create prearranged response categories for a quantitative study for sources of disturbances and the outcome would probably not be constructive. The qualitative approach on the other hand makes it possible to gain in-depth knowledge and investigate sources of disturbances.

3.4 Method Choices

To perform a qualitative case study there are three different methods, *mono method*, *multiple method* and *mixed method*. The mono method is a single data collection technique and analysis procedure. The multiple method uses more than one data collection technique and analysis procedure. The mixed methods approach applies when both qualitative and quantitative data collection techniques and analysis procedures are used (Saunders et al., 2009).

The multiple method is used in this thesis since different techniques are applied for gathering and analyzing data. A more thorough explanation on how the data is collected is provided in the next section.

3.4.1 Data Collection

First of all, there is a need to make a distinction between primary and secondary data. Primary data is collected directly from the source for example through interviews. Secondary comes from sources such as written documents, books and journals (Neergaard & Ulhoi, 2007). In this thesis the secondary data for the theoretical framework is collected from books and journals. The primary data collection is explained in this section.

Since there is a qualitative case study performed in this thesis, there is a need for a more thorough explanation of qualitative data collection. According to Patton (2002) qualitative findings can be gathered from three kinds of data collections: *written documents*, *direct observations* and *open-ended in-depth interviews*.

From interviews come direct quotations from respondents regarding their knowledge, opinions, feelings and experience. With interviews, observations can also be made from detailed descriptions of peoples' activities, actions, behaviors, processes within companies and interactions between people (Patton, 2002).

Since the purpose of this thesis is to investigate and analyze sources of disturbances, the most appropriate way to collect data is through interviews. Written documentation and

direct observations are not suitable for the purpose of this thesis as there are no documents available on sources of disturbances at Husqvarna. Directly observing sources of disturbances is more or less impossible for an observer external to the company.

There are no rules for the size of the sample in a qualitative inquiry – instead the sample size depends on what the investigator wants to know, what will have credibility and what will be useful. There is a trade-off between depth and breadth. If the cases are rich in information, in-depth interviews from a small number of respondents can be very valuable. On the other hand, when trying to explore a phenomenon, a broad investigation with several respondents is the most appropriate approach (Patton, 2002).

For this thesis eight respondents are interviewed. At an initial meeting with Husqvarna it was decided that, to get sufficient information, respondents from the different purchasing and planning departments should be interviewed. Based on that, an interview schedule was developed. It contains the chosen respondents together with possible interview dates. The schedule was then approved by all respondents. This was done to ensure that an adequate amount of in-depth interview data can be generated for this thesis.

In addition to the respondents suggested by Husqvarna, the benefits from consulting a supplier of Husqvarna were discussed. Together with Husqvarna a suitable supplier, with direct connection to almost all of the respondents at Husqvarna, was identified. Husqvarna has been experiencing disturbances in the collaboration with this supplier for an extended period of time and thus the information obtained from the supplier would function as a complement to the information from the respondents within Husqvarna.

3.4.2 Interviews

The reason for an interview is to obtain information which cannot be directly observed. The quality of the information is to a large extent dependent on the interviewer. To gather appropriate qualitative data, three approaches are presented by Patton (2002):

The *informal conversational* approach generates questions and answers from the natural flow of interactions. Often the respondent is not aware of the fact that there is an interview taking place. The information collected from informal conversational interviews can be hard to summarize and analyze.

For the *general interview guide* approach there are a set of predetermined issues prepared before the interview, which the investigator wants to explore through the respondent. The interviewer is free to explore a conversation within a specific area from the predetermined issues.

In the *standardized open ended* interview there is a set of thoroughly prepared questions with the aim of transporting the respondents through the same questions in the same order. The outcome from the standardized open-ended interviews can easily be summarized and analyzed.

The interviews conducted in this thesis are standardized open ended questionnaires with the aim of getting an in-depth knowledge of the situation. The questions for the interviews are developed based on the theoretical framework and ideas are also gathered in cooperation with Husqvarna. All the conducted interviews are recorded and transcribed.

3.5 Time Horizons

There are two different time horizons according to Saunders et al. (2009): *Cross-sectional*, which is explained as a snapshot taken at a particular time, and *longitudinal*, which covers a longer period of time.

In this thesis a cross-sectional study is performed to investigate the sources of disturbances 'now'. Since the data is collected through interviews it would be difficult to perform a longitudinal study. This is due to the fact that there are no records of history for disturbances. Moreover, employees change their positions, which also makes it hard to collect appropriate data for a longitudinal study.

3.6 Reliability and Validity

In this last section of the methodology threats to reliability, validity and possible weaknesses of a case study approach are examined.

Participant bias can occur when respondents answer in a way that they believe their managers would like them to respond (Saunders et al., 2009). In this study the respondents are not believed to answer according to the wishes of management, but there is a risk that the respondents answer biased in favor of their own departments or in favor of Husqvarna.

The second threat to reliability is *observer bias*. The given answers should not be subject to different interpretations depending on the person analyzing them (Saunders et al., 2009). A main weakness of case studies are the data collection and data analysis processes, which can be influenced by the researchers' backgrounds and interpretations of the interview material. This bias may limit the validity of the findings, although it has to be mentioned that bias also can find its way into the design and conduct of other types of research (Williamson, 2002).

Moreover, the use of qualitative data in case study research can make data analysis complicated. The reason is that qualitative data analysis methods are not as well-established as quantitative methods. Furthermore, the analysis may be time-consuming, depending on the volume and variety of the collected data. Another weakness of case study research is difficulties in generalizing research results (Williamson, 2002). As this thesis does not aim at generalizability of results, this potential weakness is negligible.

4 Empirical findings

In this chapter the empirical findings are presented. Intentionally, the style is concise and directed towards pure description. Due to the fact that the findings are analyzed in a separate chapter, no deeper interpretation is carried out in the following section. Firstly, a short description of the involved companies (Husqvarna and the consulted supplier) will be given. After that the six interviews performed internally at Husqvarna and the two conducted externally at the supplier are presented.

4.1 Background Husqvarna and External Supplier

In this section a brief introduction of the two companies taking part in the interview sessions is given. In place of the names of the internal respondents at Husqvarna, as well as the respondents at the supplier, the respondents' positions are mentioned. This is due to confidentiality reasons. The same applies to the name of the supplier itself, which is referred to as 'supplier A'.

Husqvarna, which has already been mentioned in the course of the thesis, is among the oldest companies in Sweden. It was founded in 1689 as a rifle barrel producer. To this day Husqvarna has produced a wide variety of products such as rifles, stoves, motorcycles and refrigerators. Today, many former divisions of the company have been sold or discontinued. Some of them still exist under the name Husqvarna (for example Husqvarna motorcycles now owned by BMW). Today the company is a manufacturer of chain saws, trimmers and lawn mowers among other 'professional outdoor products' as the company often refers to (Husqvarna AB, 2012).

The case study location of Husqvarna is situated in Huskvarna city. Recently, Husqvarna made some major changes for example to their chain saw production. As a result, the productivity improved. Additionally, the company has managed to reduce the time to change the production from one model to another. Unfortunately, two problems arose from these improvements. Firstly some suppliers are currently having a hard time in keeping up with the faster production pace, and secondly it became harder for some suppliers to adjust and react to the short time Husqvarna now can change from one model to another. As a result of that, Husqvarna is frequently short of components, which regularly makes it impossible to run normal production during the weekdays. When components finally arrive, production has to run on the weekends to catch up (Commodity manager, personal communication, 2012-01-19).

Supplier A has been a regional supplier of Husqvarna for a long period and is located about an hour away from Huskvarna city. The company is a manufacturer of plastic components – among its customers are for example Scania and Volvo. The prerequisites of supplier A are quite different to those of Husqvarna, because the manufacturing is more process based and the set up times (to switch from producing one component to another one) are between 24 to 30 hours. Additionally, supplier A has a lead time of 12 weeks for raw material, so unplanned changes in demand can cause severe internal disturbances at supplier A (Managing director at supplier A, personal communication, 2012-02-29).

All the information presented in the following interview summaries is based on personal communication with the respective respondents. In order to make it easier to follow the summaries, the interviews are separated into different parts through headlines in the be-

gining of each section (*in italics*). These headlines are not directly connected to the terms in the classification scheme of the theoretical framework. Moreover, they differ in all of the summaries, because different answers were given by the respondents. In both of the sections (Husqvarna and Supplier) the interviews are summarized in the order they were conducted.

The interview schedule, which was developed together with Husqvarna, is placed in Appendix 1. There information such as dates and durations of the interviews, which are presented in the following sections, can be found.

4.2 Interview Data – Employees of Husqvarna

All of the interviews with the employees of Husqvarna were conducted through personal communication at the respective departments of Husqvarna.

4.2.1 Project Purchaser

The first respondent at Husqvarna is working for project purchasing, which is collaborating with research and development. As project purchaser he is involved in searching for and investigating suppliers for new products that are being developed. Project purchasing is not involved in day-to-day business – the focus is on finding and developing potential suppliers.

Communication: The respondent explained the so-called Project Control Process (PCP) as a way to improve communication between departments. The PCP advocates meetings of project purchasing and local purchasing in which the two departments can discuss for example if a certain supplier should be discontinued. Sometimes local purchasing wants to discontinue a supplier that project purchasing wants to start a new project with. Through the PCP such situations can be avoided. However, the respondent highlights the lack of regular meetings of different departments to share relevant information. As a result, operations of different departments are often not synchronized.

Processes: The respondent believes that the start-up phase with a new supplier is crucial for success. However, he sees no direct connection between the degree of integration and the amount of disturbances.

Moreover, the respondent mentioned the so-called ‘risk list’. It is sent from the planning department and contains components with a high probability for delays. As suboptimal he identified that no proactive work is done once a supplier is removed from the list.

In case of delays it is the responsibility of the planning department to contact the supplier and investigate the reasons for the delays. If the problem turns into a strategic issue the planning department has to contact the purchasing department for support.

Moreover, the respondent highlighted that Husqvarna works with a kanban system for suppliers located close by. For offshore suppliers Husqvarna has a vendor-managed inventory (VMI) stock in Torsvik managed by a third-party logistics provider (3PL). The respondent sees this as a good way for the company to increase its flexibility.

He sees a potential from dual sourcing, but there is no clear strategy on how to apply it. There are back up suppliers appointed, but these are never used. Consequently, these suppliers cannot be used in cases of delays.

Contracts: The respondent stresses clarity as a way of avoiding disturbances. According to his experience, any possible misunderstanding in direct communication or in the contracts is going to take place. Moreover, he experiences big differences in culture. To minimize disturbance arising from cultural differences it is very helpful to require Swedish staff at offshore production units.

The responsibility for contracts lies within the planning department. A penalty clause exists in the contracts, but it is not stated in a way to be executed efficiently.

Products: The distance and complexity of the product is a contributing factor to disturbances. As a 'rule of thumb' he states that the further away a supplier is located the more likely disturbances occur. The complexity of a product also contributes to the likelihood of disturbances.

Knowledge/software system: The respondent has no knowledge concerning the availability of data to compare the performance of suppliers. There is some data available on alternative suppliers but there could be a lot more. These are areas where the respondent wishes Husqvarna had better knowledge and more data.

Forecasting: The respondent believes that more stable forecasts would decrease sources of disturbances at suppliers. For professional products stable forecasts are achievable, but this becomes much harder for consumer products where the demand varies much more.

Furthermore, seasonal demand makes it hard to make accurate forecasts. In addition to the seasonality the weather is an important factor.

4.2.2 Manager Internal Logistics

The second interview at Husqvarna was conducted with a manager of internal logistics. His department works at the intersection of the purchasing, production and marketing departments. The respondent has been working for Husqvarna for a long time and has had several different positions in which he gained a lot of relevant knowledge.

Communication: The respondent also mentioned the 'risk list' (as described in the first interview). Additional to the list, direct communication between planners and purchasers takes place. According to the respondent, an area for improvement is that purchasing focuses too much on the price of an item, but not on the total cost.

Moreover, he highlighted the need to inform and integrate the suppliers on Husqvarna's working procedures and the recent changes made in production.

Processes: Regarding follow ups and investigations of delays, it is the responsibility of the planning department. Additionally, there is a weekly meeting where the purchasing, planning, production and quality departments meet and discuss the four suppliers that are performing the worst.

With the new and reduced local purchasing organization, the planning department performs some of the tasks that should be performed by local purchasing. The local purchasing organization has been decreased too much.

The respondent believes that owning tools at the suppliers is a source of disturbances. According to him this harms the suppliers' will to invest, since Husqvarna can remove the tool from the supplier at any time.

Moreover, the respondent believes that the stock at the 3PL is too low and consequently a cause of disturbances.

Software systems: Due to the fact that the software system cannot measure the amount of delays from a particular supplier, the possibilities for proactive work are limited.

4.2.3 Local Purchaser

The third interview conducted at Husqvarna was with a local purchaser. The respondent has been employed at Husqvarna more than ten years. This gives him good insights and knowledge about the company.

Communication: The respondent criticizes the lack of long term communication management. Purchasing and planning only meet in case of emergencies. The respondent believes that there is a need for more cooperation between these departments, but he does not know who is responsible for measures.

Furthermore, the respondent believes that there is a connection between the degree of communication and the performance of a supplier. However, this is just a feeling, since there is no data available to support this statement.

The level of integration with the supplier is less important since internal suppliers at Husqvarna are often performing much worse than external suppliers.

Husqvarna's size relative to other customers of a supplier decides how prioritized the company will be as a customer.

Processes: Investigations and follow ups of delays are only performed in emergency situations. Husqvarna is only aiming at the symptoms of disturbances, not the actual sources. There is also a lack of data since the software system cannot record and save statistics about disturbances.

Husqvarna should start to measure the performance of the suppliers to be able to work proactively. In addition, the respondent believes that Husqvarna's policy of being restrictive in supporting suppliers with investments is a problem.

However, the respondent believes that Husqvarna generally needs to be stricter in its relation to its suppliers. If the supplier feels that Husqvarna does not care about occurring disturbances, it is less likely that the supplier will try to improve.

Flexibility/complexity: The respondent is of the opinion that a supplier with high flexibility (who can supply a wide variety of components) should be located close to Husqvarna. To ensure flexibility of suppliers located far away, a 3PL is the right way.

The respondent sees a connection between the complexity of components and the likelihood of disturbances. This is due to the fact that lead times of second- and third-tier suppliers become more crucial for on time delivery.

4.2.4 Planner I

The fourth interviewed employee of Husqvarna is a planner. He has been working for Husqvarna for several years and in different departments. This gives the respondent a relevant view on the problems of sources of disturbances.

Processes: The kanban system in production is a source of disturbances since it is working out of control of the planning department and also parallel to the forecasts sent by the planning department. No long-term solution is available for this problem. This worked better at another division of Husqvarna where all employees sat under the same roof and informal information sharing was possible.

The respondent has no knowledge of the delivery time of supplier A's raw materials. For him this is crucial since it is planning who enters information about delivery times into the software system. Generally, a lot of this information is missing in the system.

There is no time to handle any problems or long term planning outside the day-to-day tasks assigned to the planner.

Communication: There is not enough communication between the production and planning departments. Also no clear rules are established regarding when the planning department has to turn to the purchasing department for help.

During the meetings between different departments only the day-to-day issues are handled – there is no discussion about the sources of the problems.

To start visiting the suppliers and vice versa is essential. Every time a supplier is visited, things to improve can be found. Even the smallest thing can change a lot.

Forecasting: Even if the yearly demand of Husqvarna is well known by the supplier it does not help since 70% is needed between January and May. This is not recognized by many suppliers.

The planning horizon for supplier A is too short. If a prognosis is sent, showing a demand of 1000 units for the coming four weeks, Husqvarna frequently needs those 1000 units in the first week.

Moreover, the planning department sends forecasts to its suppliers where the coming four weeks are supposed to be locked. The disturbances arise because there are constant changes within these four weeks.

One reason Husqvarna deviates from the forecasts could for example be that the delivery from an offshore supplier is late. Consequently Husqvarna has to change its production plan and as a result a rapid change in the demand for supplier A's products occurs.

4.2.5 Planner II

The fifth interview within Husqvarna was also conducted with a planner. She has been working for Husqvarna for a couple of years and is well aware of the current situation regarding disturbances. Her responsibilities include sending forecasts to suppliers and putting parameters regarding the suppliers' prerequisites into the software system.

Forecasting: The main problem at Husqvarna is the variance between the forecast and the actually produced products. This is due to the fact that the demand is affected both

by seasonality and weather. However, both of these aspects are taken into consideration when making the yearly forecasts. It is the changes made in the shorter run, to what is forecasted and what is ordered, that cause disturbances.

The planning department sends forecasts to its suppliers where the coming four weeks are supposed to be locked. The disturbances arise because there are constant changes within these four weeks.

Moreover, it is not clearly stated how much flexibility is needed for different products. This makes it hard to determine how much flexibility/security stock the suppliers should have. If there is a variance between the forecasts and what is ordered, too low security stock at the suppliers becomes a source of disturbance.

Problems with the stock levels occur mostly in the end of the seasons, after the summer holiday there are either too many products built or there is a shortage.

Communication: In general the information flow is good within Husqvarna. Direct communication with offshore suppliers can be complicated due to time differences. Moreover, misunderstandings can sometimes arise from cultural differences. The respondent emphasized that visits and close contact is a good mitigating strategy, but can also be difficult with suppliers located far away.

Processes: Every week updated orders, with the coming four weeks locked, are sent to the suppliers. Some suppliers have to manually type the orders into their system which can be very time-consuming and there is also a risk for mistyping. When orders are changed just after a couple of days these suppliers might not have the time to put the updated order into their system. EDI is a way to prevent this, but it is also a large investment, so especially for smaller suppliers EDI often is no option.

Husqvarna has a tendency to increase its purchases from suppliers. Such increases are often made without any in-depth knowledge regarding the capacity of the suppliers. If the capacity is close to maximum it is a potential source of disturbance.

Even if Husqvarna has knowledge regarding a supplier's lead time they sometimes just ignore it and place orders that the supplier will not be able to fulfill.

The kanban system in Husqvarna's production is not automated. Pallets are scanned in production whenever they are empty. The respective orders go directly to the suppliers causing overlaps with the orders sent from the planning department. This can easily create disorder at the suppliers.

Software system: It is not possible to measure supplier performance in the current software system. With the knowledge on how suppliers are performing it would be easier to work proactively with them. However, it is important that the rules on how and what to measure are developed together with the suppliers.

4.2.6 Global Purchaser

The sixth interview at Husqvarna was conducted with a global purchaser. Among his responsibilities is the purchasing of plastic parts. He has been working for Husqvarna since November 2011, so his internal knowledge cannot be considered extensive. However, his experience in purchasing is very comprehensive, as he has worked in several different countries for different companies (for example General Motors).

Sources of disturbances concerning global purchasing are changes in demand, changes in forecasting, security stock at suppliers and suppliers' capacities.

An example of lacking capacity is suppliers that are already running their production 24/7. These suppliers cannot fulfill the ever rising demand of Husqvarna.

Problems are also caused by increasing oil prices. As the plastic industry is directly dependent on the oil price, during periods of high oil prices the producers of plastic pellets might be reluctant to purchase and thus produce enough.

Mitigating strategies: There is an internal system showing when the amount of components drops below a security level. Forecasts are sent to the suppliers every week. Based on this, suppliers can buy raw material. Even if Husqvarna does not purchase according to the forecasts the suppliers are still getting paid for the raw material. Every week suppliers world-wide have to approve if they can deliver according to forecasts.

The respondents highlights that lean manufacturing is a good strategy. Moreover, it is necessary to work together with the suppliers from the very beginning and also to track problems for example back to third-tier suppliers – this is an ongoing process right now.

Forecasting: Often there are increases in Husqvarna's production in quarter one (Q1), correct purchase orders are then essential. There is flexibility of +/- 15% to the forecasts. Husqvarna might only use 70% of the supplier's capacity on a yearly basis but the demand can change dramatically during periods. For trimmers there can be a high seasonal demand, still forecasts and information from Husqvarna should be able to mitigate the impact of such changes.

The yearly demand of a plastic part might be 20.000 items, which should all be delivered within four months. This information is given in the forecasts. Even if there is a sudden extraordinary demand, this should not have too much impact, since plastic parts are relatively easy to produce. There is not so much difference between 20.000 and 100.000 items. For critical parts Husqvarna has an extra buffer stock.

Software systems: Husqvarna has a very flexible and transparent system. Suppliers can view forecasts through a web site. Husqvarna regularly benchmarks their software system together with their suppliers, who are generally content with the system.

Currently, Husqvarna also works on a software system to enable supplier performance measurement. Based on this a scorecard on supplier performance will be developed.

4.3 Interview Data – Supplier of Husqvarna

Two interviews were conducted with the selected supplier. The first interview was through a personal meeting. The necessary follow up interview was conducted via telephone, but was also recorded and transcribed.

4.3.1 Supplier A – First Session

This is the first interview, which was conducted at supplier A. In this session the managing director and the production manager were present.

Flexibility: Sometimes Husqvarna changes its orders once or even twice a week. It gets complicated since the lead time of raw material is 12 weeks and the set-up time for changing production from one component to another is 24 to 30 hours.

Moreover, it is not possible to have any alternative suppliers due to the high demands on the raw material from Husqvarna. In addition, supplier A wants to run four weeks production cycles to optimize production in respect to the time consuming set-up times.

Forecasting: According to the written contract that became obsolete in 2006, supplier A is supposed to deliver according to the forecasts of Husqvarna and with a flexibility of +/- 30% in the volume for four weeks. The problem is that this contract is still to be renewed and the forecasts for four weeks are only followed by 44% currently. Sometimes Husqvarna orders 300-400% more than planned.

Communication: Supplier A believes that the communication with Husqvarna works well in general. The forecasts that are sent every Thursday through EDI are locked for the upcoming four weeks and also contain the current production plans of the whole year ahead. Furthermore, the companies communicate via telephone every Friday to discuss any deviation from the forecasts.

Processes: The orders from the kanban system arrive parallel to the orders sent from planning department. This causes deliveries which do not fit Husqvarna's needs. This problem is difficult to solve since the planning department at Husqvarna does not have control over these kanban orders. Supplier A also believes that there is an over-ordering via the kanban system due to subjective feeling that parts are often delayed.

4.3.2 Supplier A – Additional Interview

As the information gathered from the interviews with supplier A on February 29 was mainly about sources of disturbance there was a need for a follow up session. The intention of this additional interview was to get more insights regarding aspects of successful disturbance management being practiced with Husqvarna. Moreover, the information and findings from the other interviews were evaluated. Another goal was to investigate if changes in the performance occurred since the first meeting. This time the respondent was the production manager who also took part in the first interview session. Even though the two interviews were conducted in the time frame of only two months, it was possible to gain new insights compared to the last interview session.

Communication: According to the respondent's opinion, the communication between the companies works well. There are no direct barriers to the information flow. Even if something has to be discussed outside the regular communication flow of the companies this can easily be done via telephone or email.

Processes: As found out in the first interview session Husqvarna sends forecasts for the coming four weeks every Thursday and that is always followed up with communication by telephone on the following Friday. The forecasts are supposed to be locked for these four weeks and from the first interview session it was understood that Husqvarna regularly made changes within those four weeks. This has improved after meetings between the companies, which resulted in fewer changes within the locked four week forecast period.

Supplier A keeps track of their level of order fulfillment. This data is also stored and helps to improve performance. However, the company does not keep track of the causes of not fulfilling orders, because it is often hard to determine where the actual cause of the problem was rooted.

Knowledge: Since the first interview session the two companies have met. According to the respondent Husqvarna now has a better understanding of the prerequisites of supplier A. In addition, the problems arising from the kanban system at Husqvarna have been discussed.

Software system: The systems of the two companies communicate through EDI, the forecasts of Husqvarna are sent directly into the system of supplier A. This is the only way their software systems communicate and no problems arise from that. The respondent does not feel any need for additional communication between the companies' software systems.

Changes: As a last point the respondent wanted to stress the improvements that had been accomplished since the last interview session. At that time Husqvarna ordered only 44% according to the forecasts, now this number has increased to 60%.

5 Analysis

In this chapter the empirical findings are analyzed regarding the purpose of the thesis. The goal of this analysis is to compare the sources of disturbances of the classification scheme created in the literature review to the respondents' answers from the interviews. Moreover, inputs and opinions from the respondents on how to manage disturbances are connected with the theories provided in the literature review within this field.

5.1 Classification Scheme

In this section the results from the interviews are analyzed and compared to the sources of disturbances in the classification scheme from the literature review. The results of the following detailed analysis will be summarized in section 5.2 on pages 40 and 41.

5.1.1 Supply Chain Related (External) and Supply System

Complexity of supply network

In connection to this term the findings can be summarized as complexity arising from the distance to the supplier, combined with the complexity of the actual component (Project purchaser, personal communication, 2012-02-15). The complexity of components is a contributing factor to disturbances since with a more complex component the lead times of the second- and third-tier suppliers are more crucial for the lead times of the finished components (Purchaser, personal communication, 2012-02-23).

An example why Husqvarna deviates from the forecasts could be a late delivery from an offshore supplier. Consequently, Husqvarna has to reschedule its production scheme and therefore also quickly change the orders to its suppliers. How fast the suppliers can react to these changes determines how severe the disturbance will be (Planner I, personal communication, 2012-03-05).

Lack of capacity

Lack of capacity is a source of disturbance. An example is suppliers who are already running their production at full capacity. In such situations the source of disturbance is either that even with full utilization of its capacity the supplier cannot supply enough parts according to the demand, or Husqvarna wants to increase the quantity it buys from a supplier that is already close to full utilization of its capacity (Global purchaser, personal communication, 2012-03-22).

As the demand for Husqvarna's products increases over time, the demand for components from suppliers increases. If suppliers are already producing at full capacity they cannot handle an increased volume (Planner II, personal communication, 2012-03-21).

Inflexibility (for example due to high utilization)

For plastic parts, which are categorized as an easy component to produce, it is important that a supplier can ramp up the production when needed. If the supplier cannot easily go from 20.000 items to 100.000 it is a potential source of disturbance. This is valid only for plastic components where the increased production time going from 20.000 items to 100.000 items is negligible (Global purchaser, personal communication, 2012-03-22).

It is hard for supplier A to be flexible when there is a lead time of 12 weeks for raw material. Having an alternative supplier for the raw material would be too expensive since supplier A is buying raw material from the same sub-supplier for all its production. Purchasing only the raw material used for the production of Husqvarna at another supplier would then be too expensive due to the lower volume. The raw material bought for Husqvarna's products cannot be used to produce anything else. Therefore supplier A is reluctant to purchase any quantity over what is exactly needed for the production for Husqvarna. Another factor affecting the flexibility is that to change a machine from one type of component to another takes 30 hours (Production manager at supplier A, personal communication, 2012-02-29).

It is not clearly stated how much flexibility stock the suppliers should have – for example a certain volume of each component stored at the supplier. Without such clear rules and instructions it is hard for the suppliers to adjust and achieve the right level of flexibility stock (Planner II, personal communication, 2012-03-21).

Low reliability of chain partners

The forecasts that are sent to supplier A from Husqvarna are often only correct to 44%. If this continues over time, the credibility of the forecasts decreases and there is a risk that the attention to the forecasts decreases in the future (Production manager at supplier A, personal communication, 2012-02-29).

Supplier A sometimes experiences one or even two changes per week of the components they produce for Husqvarna. Such frequent changes of the production decreases the reliability to the supply chain partner (Production manager at supplier A, personal communication, 2012-02-29).

Lack of control in supply chain (for example of outsourced activities)

Increases in the oil price cannot be affected by any of the partners in the supply chain. The plastic industry is directly dependent on the oil price, so under periods of high oil prices the producers of plastic pellets are reluctant to purchase and thus produce enough (Global purchaser, personal communication, 2012-03-22).

Lack of risk management and recovery planning initiatives along the chain

None of the respondents answered anything that could be related to this term.

5.1.2 Supply Chain Related (External) and Information System

Lack of infrastructure to support information sharing

None of the respondents answered anything that could be related to this term.

Lack of information visibility

The planners often lack the knowledge of the suppliers' prerequisites which leads to incorrect parameters in the system. This will in turn result in inadequate planning, which is a potential source of disturbance (Planner I, personal communication, 2012-05-03).

There is a lack of knowledge at some suppliers about the seasonal demand of Husqvarna's products. This seasonality in turn directly affects the quantities and when those quantities of components are needed (Planner I, personal communication, 2012-05-03).

Varying ICT standards used in supply chain

Some suppliers have to manually type Husqvarna's orders into their system which is very time consuming and there is a risk for mistyping. If Husqvarna sends an updated version of an order within the same week there is a risk that the supplier will not have the time to put the new forecasts into the system, because it might be too time consuming (Planner II, personal communication, 2012-03-21).

5.1.3 Supply Chain Related (External) and Organizational Structure

Loose contracts

There are misunderstandings between Husqvarna and some of its suppliers due to the formulation of the contracts. If there is any possibility for a misunderstanding in a contract it is likely to occur. Therefore, it is essential that the contracts are as clear and as easy to understand as possible to avoid any misinterpretations (Project purchaser, personal communication, 2012-02-15).

There is a penalty clause in the contracts but it is not stated in a way that can be executed efficiently (Project purchaser, personal communication, 2012-02-15).

The contract between supplier A and Husqvarna should have been renewed in 2006, but there is still no new contract. A new contract is ready but the parties have not been able to reach an agreement over the terms regarding flexibility and delivery times. If there is a dispute over problems concerning these issues, it cannot be solved based on the contract (Production manager at supplier A, personal communication, 2012-02-29).

Unclear coordination and cooperation

Suppliers will not give their best to supply on time if there is no risk of repercussions. If penalties are not clearly communicated, the suppliers are less likely to supply without delays (Purchaser, personal communication, 2012-02-23).

Insufficient collaboration

The low knowledge among suppliers of the changes made to Husqvarna's assemble unit in Huskvarna city (Manager internal logistics, personal communication, 2012-02-17), and low knowledge among some suppliers on how the seasonal demand of Husqvarna is spread throughout a year, are examples of lack of collaboration among supply chain partners. Husqvarna's low knowledge on the prerequisites of some suppliers is also one (Planner I, personal communication, 2012-03-05).

The policy of being restrictive with helping suppliers with investments is a problem. If Husqvarna would support its suppliers, the productivity could be increased and disturbances could be avoided (Purchaser, personal communication, 2012-02-23).

Lack of trust

None of the respondents answered anything that could be related to this term.

Local optimization

Husqvarna sometimes places orders knowing that the suppliers will have troubles, but ignore this and order anyway (Planner II, personal communication, 2012-03-21).

On the other side, supplier A wants to run four weeks production cycles to optimize his production in respect to the extensive set-up times. These production cycles are best for supplier A, but the requirements of Husqvarna's production is not taken into consideration (Production manager at supplier A, personal communication, 2012-02-29).

5.1.4 Company Related (Internal) and Supply System

Limited control actions

Except for the start-up phase, there is no direct connection between the degree of integration between Husqvarna and its suppliers, and the frequency and severity of the occurring disturbances (Project purchaser, personal communication, 2012-02-15).

Husqvarna's own internal suppliers often perform worse than the external suppliers. There is a lack of control of these internal suppliers and therefore a lack of ability to improve their performance (Purchaser, personal communication, 2012-02-23).

Subjective decision making

Purchasing and planning department have different perspectives on what is most important, for example, the focus of the purchase department is too much on the price of the components, not on total cost (Manager internal logistics, personal communication, 2012-02-17).

Inaccurate forecasting

For products for professional use, for example chain saws or trimmers, it is a lot easier to make stable forecasts than it is for consumer products. The demand for consumer products varies much more, because these are products that consumers buy more or less the instant moment they need them. A good example is the arrival of spring which can vary quite a lot between the years. Seasonal demand in combination with the weather makes it hard to make accurate forecasts for Husqvarna's consumer products (Project purchaser, personal communication, 2012-02-15).

The forecasts sent to supplier A are only followed by 44% which makes it hard for supplier A to plan its production. In addition to the poorly followed forecasts, Husqvarna sometimes orders 300-400% more than planned. Supplier A does not have the capacity to supply 300-400% over what is scheduled for production (Production manager at supplier A, personal communication, 2012-02-29).

The main problem arising from forecasting is that the considerable variance between what is forecasted and what is actually produced. Due to this variance the production plans of Husqvarna quickly become obsolete and have to be changed. When Husqvarna's production plans becomes obsolete, the orders sent to suppliers also become obsolete and rapid changes at the suppliers' production plans are likely to cause disturbances (Planner II, personal communication, 2012-03-21).

The planning department sends forecasts to the suppliers where the coming four weeks are supposed to be locked. The disturbances arise because there are constant changes within these four weeks (Planner I, personal communication, 2012-03-05).

The forecasts sent to supplier A are supposed to be locked for the following four weeks. However, there might be an estimated demand for the coming four weeks of 1000 com-

ponents, but often those 1000 components are needed already in the first week due to inaccurate forecasting (Planner I, personal communication, 2012-03-05).

The main problem is that there are too many changes between what is forecasted and what is actually ordered (Planner II, personal communication, 2012-03-21).

Lack of or insufficient attention to risks and disturbances management

There is no clear strategy for dual sourcing. Back-up suppliers are appointed, but they are never used. Consequently, these suppliers cannot be used in case of delays. The same applies to alternative suppliers in general. There is some data available but it could be a lot more (Project purchaser, personal communication, 2012-02-15).

During the meetings between different departments only the day-to-day issues are handled, there is no discussion about the sources of the problems (Planner I, personal communication, 2012-03-05).

Once a supplier is removed from the risk list, no proactive work is done to get the supplier off the list permanently (Project purchaser, personal communication, 2012-02-15).

There has been too much focus on the price of the components and not on the total cost, including lead times and so on. This affects the lead time negatively (Manager internal logistics, personal communication, 2012-02-17).

Husqvarna's size relative to other customers of a supplier decides how prioritized the company becomes as a customer. If Husqvarna is the largest customer of a supplier, the supplier often prioritizes them. If Husqvarna is among the smaller customers, the supplier often does not prioritize them. There is no attention to the situations where Husqvarna is a small customer of a supplier and the associated problems such as delays in deliveries (Purchaser, personal communication, 2012-02-23).

There is no time to handle any problems or long term planning outside the day-to-day tasks assigned to the planner (Planner I, personal communication, 2012-03-05).

Husqvarna only aims at the symptoms of disturbances not the actual sources (Purchaser, personal communication, 2012-02-23).

Rigid planning (all levels)

The interviews have shown that rigid planning is not a problem at Husqvarna, instead the company adjusts and changes its forecasts and orders continuously (Planner I, personal communication, 2012-05-03, Planner II, personal communication, 2012-03-21 & Production manager at supplier A, personal communication, 2012-02-29).

Inventory related issues

The stock level at the 3PL is too low and consequently causing disturbances. The 3PL manages some of the components from offshore suppliers. Husqvarna orders components from the 3PL on a day-to-day basis. There is a need to increase the amount of each component that the 3PL stores to avoid disturbances (Manager internal logistics, personal communication, 2012-02-17).

Inadequate and low levels of security stock at suppliers are a source of disturbance (Global purchaser, personal communication, 2012-03-22).

If there is a variance between the forecasts and what is actually ordered, too low flexibility stock at the suppliers becomes a source of disturbance (Planner II, personal communication, 2012-03-21).

Problems with the stock levels occur mostly at the end of the season, which is after the summer holiday in fall. The demand in fall highly depends on the demand in spring and summer. In fall there is often the situation that there is either a too large stock or a too small stock available (Planner II, personal communication, 2012-03-21).

Communication issues

There is no strategy or plan on how to organize regular meetings to share information and solve problems between purchasing and planning department. Instead the two departments only meet in case of emergency situations (Purchaser, personal communication, 2012-02-23).

There is too little communication between production and planning department (Planner I, personal communication, 2012-03-05).

There is a difference in culture between employees located in Huskvarna city and employees located in China. Communication between employees located in Sweden and China can lead to misunderstandings due to the cultural differences, which can result in disturbances (Project purchaser, personal communication, 2012-02-15).

Direct communication with offshore suppliers is difficult due to the time difference. Moreover, the cultural differences often cause misunderstandings. An example is if the two parties think they have reached an agreement, but instead both parties just misinterpret what the other party wanted (Planner II, personal communication, 2012-03-21).

5.1.5 Company Related (Internal) and Information System

Lack of or inadequate decision support system

Husqvarna's software system cannot measure the amount of delays caused by a particular supplier. Consequently, the possibilities for proactive work are minimal (Manager internal logistics, personal communication, 2012-02-17).

There is a lack of data since the software system cannot record and save statistics about disturbances (Purchaser, personal communication, 2012-02-23).

It is not possible to measure the performance of the suppliers in the current software system (Planner II, personal communication, 2012-03-21).

No data is available to compare the performance of suppliers (Project purchaser, personal communication, 2012-02-15).

In the software system at Husqvarna there is a lack of warning indicators. For example, Husqvarna sent a prognosis to supplier A for 1000 items. If the order instead becomes 1400 items, there is no warning shown in the system that this is an over ordering (Production manager at supplier A, personal communication, 2012-02-29).

Slow data transfer and processing

None of the respondents answered anything that could be related to this term.

Late detection of disturbances

None of the respondents answered anything that could be related to this term.

Lack of data about disturbances

There is no data available to investigate direct connections between the degree of communication with a supplier and the performance of the supplier. If such data was available, and the data proved the connection, a proactive strategy could be directed towards suppliers performing poorly and some of the disturbances occurring today could be avoided (Purchaser, personal communication, 2012-02-23).

The software system cannot measure precision in delivery from suppliers, there is no ability record and save statistics on how suppliers that are performing (Manager internal logistics, personal communication, 2012-02-17).

Inaccuracy of data

There is incorrect data for some suppliers in the software system of Husqvarna regarding lead times and other essential prerequisites of the suppliers. It is impossible for Husqvarna to make correct planning for those suppliers. Even if Husqvarna believes that the planning is done correctly, it turns out incorrect due to the incorrect data (Planner I, personal communication, 2012-03-05).

Insufficient data analysis (disturbances)

There are no investigations performed on the companies that show up frequently on the risk list: Why they are frequently present on the list, and what can be done to remove them permanent from the list (Project purchaser, personal communication, 2012-02-15).

5.1.6 Company Related (Internal) and Organization Structure

Weak internal coordination and cooperation

The orders coming from the kanban system are not connected to the orders sent from planning department. Supplier A believes that this results in over-ordering (Production manager at supplier A, personal communication, 2012-02-29).

The kanban system is out of control of the planning department and it works parallel to the forecasts (Planner I, personal communication, 2012-03-05).

With the new and reduced local purchase organization, the planning department performs some of the tasks that should be performed by local purchase. Consequently, the local purchase organization has been decreased too much (Manager internal logistics, personal communication, 2012-02-17).

No standardized working procedures

There is a lack of regular meetings between different departments to share relevant information (Project purchaser, personal communication, 2012-02-15).

The operations performed by project purchasing, local purchasing, planning and production department are dependent on each other, but not synchronized (Project purchaser, personal communication, 2012-02-15).

There are no clear rules when planning department shall turn to purchase department for help (Planner I, personal communication, 2012-03-05).

Poorly documented policies and procedures

None of the respondents answered anything that could be related to this term.

Lack of communication culture

None of the respondents answered anything that could be related to this term.

Lack of preparedness for disturbances

None of the respondents answered anything that could be related to this term.

5.2 Results of Analysis of Classification Scheme

In table 5.1 all the sources of disturbance that were mentioned in the interviews show the number of their nominations in brackets. The ones that were not mentioned are crossed out and the five most named ones are highlighted in italics.

Top 5 Sources of Disturbance:

1. *Lack of or insufficient attention to risks and disturbances management (7)*
2. *Inaccurate forecasting (6)*
3. *Lack of or inadequate decision support system (5)*
4. *Communication issues (sharing of accurate and relevant information) (4)*
5. *Inventory related issues (4)*

Results:

- The entire top five sources of disturbance are ‘company related’ (internal – Husqvarna). In total, the ‘company related’ sources make up almost two thirds of all the answers (39 out of 61).
- Also four of the top five sources of disturbance can be found in the combination of ‘Supply system’ and ‘company related’. These four alone make up more than one third of all the answers (21 out of 61).
- The category ‘Supply system’ contains most answers combined with the ‘supply chain related’ (external) as well as combined with ‘company related’ (internal). In total, the category comprises more than half of all the named sources of disturbance (34 out of 61).
- In the combination ‘Organization structure’ and ‘company related’ only two of the five possible sources of disturbance were named by the respondents and make up less than ten percent (10 out of 61).
- The category ‘Organization structure’ is rather an external than internal problem (nine compared to six answers).
- The category ‘Information system’ is more an internal than an external problem (nine compared to three answers). In combination with ‘supply chain related’ (external) only three answers could be assigned to this category, this is the least named area.

Table 5.1 Results of analysis (compiled by the authors)

Sources of disturbance: Supply chain and company related			
Σ 61	Supply system Σ 34	Information system Σ 12	Organization structure Σ 15
Supply chain related (external) – Σ 22	<p style="text-align: center;">Σ 10</p> <ul style="list-style-type: none"> - Complexity of supply network (3) - Lack of capacity (2) - Inflexibility (for example due to high utilization) (2) - Low reliability of chain partners (2) - Lack of control in supply chain (for example of outsourced activities) (1) - Lack of risk management and recovery planning initiatives along the chain 	<p style="text-align: center;">Σ 3</p> <ul style="list-style-type: none"> - Lack of infrastructure to support information sharing - Lack of information visibility (2) - Varying ICT standards used in supply chain (1) 	<p style="text-align: center;">Σ 9</p> <ul style="list-style-type: none"> - Loose contracts (3) - Unclear coordination and cooperation (1) - Insufficient collaboration (3) - Lack of trust - Local optimization (2)
Company related (internal) – Σ 39	<p style="text-align: center;">Σ 24</p> <ul style="list-style-type: none"> - Limited control actions (2) - Subjective decision making (1) - <i>Inaccurate forecasting (6)</i> - <i>Lack of or insufficient attention to risks and disturbances management (7)</i> - Rigid planning (all levels) - <i>Inventory related issues (4)</i> - <i>Communication issues (sharing of accurate and relevant information) (4)</i> 	<p style="text-align: center;">Σ 9</p> <ul style="list-style-type: none"> - <i>Lack of or inadequate decision support system (5)</i> - Slow data transfer and processing - Late detection of disturbances - Lack of data about disturbances (2) - Inaccuracy of data (1) - Insufficient data analysis (disturbances) (1) 	<p style="text-align: center;">Σ 6</p> <ul style="list-style-type: none"> - Weak internal coordination and cooperation (3) - No standardized working procedures (3) - Poorly documented policies and procedures - Lack of communication culture - Lack of preparedness for disturbances

Italics – Top 5 Sources of Disturbance | Crossed out – not mentioned by respondents

5.3 Disturbance Management

In this section the results from the interviews are grouped and compared to the theories on disturbance management. The chosen categories are highlighted in italics. Moreover, the follow up session with supplier A is covered in this section, as its main topic was management of disturbances.

5.3.1 Opinions on Possible Approaches by Employees of Husqvarna

Communication and information flow (internal)

According to one of the planners and the global purchaser, the general information flow and communication is good within the company (Planner II, personal communication, 2012-03-21; Global purchaser, personal communication, 2012-03-22). However, the other interviewed planners states that the communication works better at another division of Husqvarna where all the staff sits under the same roof and informal information sharing is possible (Planner I, personal communication, 2012-03-05). Also the interviewed project purchaser emphasized that there is still potential for improvements. He highlights that the PCP is a good way to further improve communication between departments. Through the PCP project purchasing gets to meet local purchasing. Then the two departments discuss for example if a supplier should be discontinued. This is very important, because in the current situation it can happen that local purchasing wants to discontinue a supplier that project purchasing wants to start a new project with. Through the PCP similar situations could also be avoided in other departments (Project purchaser, personal communication, 2012-02-15).

Working proactively with suppliers

The interviewed project purchaser also states that the work with the 'risk list' sent from the planning department could be improved. This list contains components which have a high probability for delays. Once the suppliers causing the delays are removed from the list, there is no proactive work done. According to this respondent, working proactively in these cases would create a lot of potential improvements (Project purchaser, personal communication, 2012-02-15). The manager of internal logistics also mentioned the 'risk list' as an instrument with a lot of potential, but for him the problem is more general. He believes that the biggest possible improvements can be realized by the purchasing department, which puts too much focus on the price of an item, instead of total cost. Concerning the investigation of delays he highlights that if the current software system could measure the amount of delays from a particular supplier, the possibilities for proactive work could be increased. He thinks that planning should start to work on these issues. Moreover, he sees a general need to inform and integrate the suppliers on how Husqvarna is working and the recent changes made to production (Manager internal logistics, personal communication, 2012-02-17). The project purchaser agrees that it is the responsibility of the planning department to investigate the suppliers regarding delays. Additionally, he emphasizes that if the problem turns into a strategic issue the planning department should contact the purchasing department for support. Strategically he sees a potential in dual sourcing. Currently there are back up suppliers appointed (even though there could be more data available on alternative suppliers), but these are never used, which makes it very unlikely that they can be used just in case of delays. Moreover, he thinks that it is important for Husqvarna to introduce a penalty fee for suppliers that cause a stop in production (Project purchaser, personal communication, 2012-02-15).

Supplier performance measurement

A new point of view is provided by the local purchaser who believes that Husqvarna needs to be stricter in its relations to its suppliers in general. He highlights that if the supplier feels that Husqvarna does not care about disturbances, there it is less likely that the suppliers will care and try to improve. The strategy he suggests is that Husqvarna should start to measure the performance of the suppliers. In that way Husqvarna would be able to work proactively (Purchaser, personal communication, 2012-02-23). The planner absolutely agrees that knowledge about the suppliers' performance is necessary to act proactively. Consequently, he also agrees that Husqvarna needs to measure how well suppliers are performing. Additionally, he suggests that 'how' and 'what' to measure needs to be regulated together with the suppliers. Yet, he brings to attention that it is not possible to measure supplier performance in the current software system (Planner II, personal communication, 2012-03-21). The project purchaser agrees that data should be available which makes it possible to compare the performance of different suppliers (Project purchaser, personal communication, 2012-02-15). It has to be mentioned that Husqvarna is currently working on its software system to make it possible to measure the performance of suppliers. Based on this, a scorecard showing the supplier's performance is developed (Global purchaser, personal communication, 2012-03-22).

Cultural differences

An interesting fact brought up by the interviewed project purchaser is the existence of large cultural differences, for example in regard to the mitigation of disturbances. In view of that, he highlighted that it is essential to have Swedish staff for example at off-shore production units (Project purchaser, personal communication, 2012-02-15).

Supplier relationships

In general, the project purchaser emphasized that the start-up phase with a new supplier is crucial for success (Project purchaser, personal communication, 2012-02-15). The global purchaser agreed about the need to work together with the supplier from the very beginning. Furthermore, he states that the starting phase should be tracked back further to the third-tier supplier for example – which is an ongoing process right now (Global purchaser, personal communication, 2012-03-22). A planner added that in the beginning it is essential to visit the suppliers and vice versa. Every time a supplier is visited, things to improve can be found and sometimes even the smallest thing can mean a lot (Planner I, personal communication, 2012-03-05). Another planner voiced his concern stating that visiting and close contact are probably good mitigating strategies, but it has to be kept in mind that this is time-consuming and expensive to practice with suppliers located far away (Planner II, personal communication, 2012-03-21).

5.3.2 Current Measures of Husqvarna (According to Employees)

Increasing flexibility

The project purchaser explained that Husqvarna works with a kanban system for closely located suppliers, whereas for offshore suppliers Husqvarna has a VMI stock in Torsvik managed by a 3PL. According to him this is a great way for the company to increase its flexibility (Project purchaser, personal communication, 2012-02-15). It also has to be mentioned that according to one of the planners the kanban system can also be a source of disturbance since it is working out of control of the planning department and parallel

to the forecasts sent by them. He also emphasized that a long-term solution for this problem is very important (Planner I, personal communication, 2012-03-05). However, it is also believed by the local purchaser that a supplier with high flexibility (who is able to supply a wide variety of components) should be located close to Husqvarna. He also agrees to the fact that using a 3PL is the right way to achieve flexibility regarding suppliers located further away (Purchaser, personal communication, 2012-02-23).

Suitable IT-systems

The global purchaser explains that there is an internal system showing when the amount of components drops below a certain security level. Moreover, forecasts are sent to the suppliers every week. The suppliers can then buy raw material according to these forecasts, and if Husqvarna does not purchase accordingly the supplier is still getting paid for the additional raw material bought. Moreover, suppliers world-wide have to respond if they can deliver according to forecasts every week. Husqvarna has a very flexible and transparent system, on which suppliers can view forecasts through a website. Husqvarna also does benchmarking of their software system with their suppliers and the suppliers are very happy with the system (Global purchaser, personal communication, 2012-03-22). Nevertheless, some suppliers are still typing the orders manually into their system which creates a risk for mistyping. Also this procedure is very time consuming which means that if there are frequent changes the suppliers might not have the time to put the updated orders into the system every time. EDI should be used to improve this situation, but an EDI system is also a considerable investment – so especially for smaller suppliers this might be not an option (Planner II, personal communication, 2012-03-21).

5.3.3 Current Measures of Husqvarna (According to Supplier A)

First of all it has to be mentioned that since the first interview session the two companies have had an information meeting, and according to the respondent this led to a better understanding of the prerequisites of supplier A. As already revealed in earlier interviews, Husqvarna sends forecasts for the upcoming four weeks every Thursday. This is always followed up by communication through telephone on the following Friday. The forecasts are supposed to be locked for the following four weeks, but from the first interview session with supplier A it became obvious that Husqvarna often made changes within those four weeks. The meeting between the companies has resulted in fewer changes in the 'locked' four week forecasts. As a result, the respondent presented the archived improvements. Before Husqvarna ordered only 44% according to the forecasts, now this has increased to 60%. This emphasizes the importance of regular meetings.

In general, the respondent believes that the communication between the companies is working well. He sees no direct barriers to the information flow; problems can be discussed outside the regular communication flow via telephone or email. Moreover, the systems of the two companies communicate well through EDI. The forecasts from Husqvarna are transferred directly into the system of supplier A. This is the only way their software systems are communicating and no problems are related to that. The respondent does not feel any need for additional communication between the software systems. Within its system supplier A keeps track of the level of order fulfillment. This data is also stored and helps to improve performance. The causes of poor order fulfillment are not tracked. This is due to the fact that it is often impossible to determine who and what actually caused the problem. This would be a potential area for improvements (Production manager at supplier A, personal communication, 2012-04-18).

5.4 Results of Analysis and Excluded Interviews

It is possible to divide the collected interview data into seven categories. All of these categories correspond with the findings of the theoretical framework (see section 2.3.5). The results of the analysis are presented in the following part.

Communication and information flow (internal)

The answers in this category are consistent with Hinrichs et al. (2005). There, internal communication is the first step to successful disturbance management. It is crucial that frictions in the communication flow are avoided.

Working proactively with suppliers

According to Hinrichs et al. (2005), disturbance management is the active steering task to avoid unpredictable situations together with suppliers.

Supplier performance measurement

Matson and McFarlane (1998) highlight that the extent and quality of information available, concerning the occurrence of disturbances, has a major influence on the achievable quality of the response decisions.

Cultural differences

According to Matson and McFarlane (1998), human and organizational aspects are of great importance to manage disturbances. This also applies to cultural differences.

Supplier relationships

This category can be connected to Melnyk et al. (2009), who specially focus on managing disturbance in regard to a company's interactions with its suppliers.

Increasing flexibility

Oke and Gopalakrishnana (2009) provide different strategies to manage disturbances. One main aspect handled is the improvement of flexibility.

Suitable IT-systems

According to Hinrichs et al. (2005) and Matson and McFarlane (1998), IT is a crucial part of disturbance management, as it can facilitate and improve the efforts made.

The results of the second additional interview with supplier A provide further helpful insights regarding very similar aspects. Moreover, it has to be mentioned that, in the course of gathering data, some additional interviews were conducted. As the thesis developed, it became more and more obvious that this data is not really suitable, although it brings in supporting and valuable insights to the topic. This concerns two external respondents with no connection to Husqvarna or to its suppliers. They were interviewed due to their experience in disturbance management, in order to provide additional external insights on the successful management of disturbances as an input for managerial implications. However, it was decided not to include the outcomes, as they do not fit into the case study of Husqvarna. The results of these additional interviews are included in this thesis in appendix 2. They provide a good starting point for possible further research approaches, which will be, inter alia, discussed in the following chapter.

6 Conclusions

The thesis ends with the conclusions, which refer back to the research questions, present ideas for future research, acknowledge shortcomings and give managerial implications.

The purpose of this thesis was to identify and classify sources of disturbance which can have a negative influence on organizations' supply management. This was achieved by investigating theories available in literature, as well as the analysis of the disturbances occurring in an international manufacturing company.

To begin with, various sources of disturbance with a negative influence on the supply management of companies were identified. It was also possible to compare the classification scheme which was created based on the theory with the findings of the case study at Husqvarna. Consequently, a holistic overview of potential and actual sources of disturbance in supply management has been created.

Additionally, theories on disturbance management were reviewed to create a foundation for managerial implications. Albeit that the theoretical findings proved to be rather abstract, it was possible to formulate thorough and relevant connections through the interviews. Consequently, it was possible to contribute to the body of knowledge on how to manage disturbances in supply management. The provided insights highlight implications that can help companies to successfully manage disturbances and hence improve their performance.

It has to be acknowledged that the inconsistency in terminology made it difficult to carry out the literature review on sources of disturbance. For future research it would be necessary to look for a variety of identified terms which are used interchangeably (for instance: disturbance, disruption, risk, and vulnerability) and double-check them with the other recognized definitions.

Concerning the method, one main weakness has to be mentioned. In the data collection and data analysis processes, the researchers realized that one can be easily influenced by personal background and knowledge. This led to various discussions during the interpretation of the interview material. In order to optimize the validity of the findings, all possible effort was employed to minimize this personal bias.

Moreover, it would be useful to investigate a bigger sample of companies to be able to create results which can be more generalized. In addition, it would be worth the effort to investigate companies outside Sweden or even outside the area of Western Europe. It can be assumed that the identified sources of disturbances are mainly relevant for companies located in areas with similar characteristics to Western Europe, as opposed to a company in another geographic area which might – for various reasons – face different disturbances in supply management.

For future research it would also make sense to investigate holistic (indirect) sources of disturbance, which would require an overall analysis of the supply chain in order to analyze these sources. This is highly relevant, since indirect sources of disturbance affect for example the supply chain between the first-tier sub-contractor and the supplier. This would assist managers in fully identifying, classifying and managing the sources of disturbance which could negatively impact on their organizations supply management.

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Appendices

Appendix 1 Interview schedule

Company	Position	Interview – Type	Interview – Duration	Date
Husqvarna	Project purchaser	Personal	1h 40min	2012-02-15
Husqvarna	Manager internal logistics	Personal	1h 10min	2012-02-17
Husqvarna	Local purchaser	Personal	1h 15min	2012-02-23
Supplier A	Production manager and Managing director	Personal	1h 35min	2012-02-29
Husqvarna	Planner I	Personal	55min	2012-03-05
Husqvarna	Planner II	Personal	1h	2012-03-21
Husqvarna	Global purchaser	Personal	1h 10min	2012-03-22
Supplier A	Production manager	Telephone	45min	2012-04-18

Additional Interviews performed (see Appendix 2)

Company	Position	Interview – Type	Interview – Duration	Date
-	Gunnar Meijer	Personal	1h 10min	2012-04-02
Fredriksons	Åke Franzen	Personal	1h 40min	2012-04-11

Appendix 2 Other input on possible approaches to disturbance management

The two excluded, but mentioned, interviews are the ones of two external respondents with no connection to Husqvarna or to its suppliers. In the course of the thesis it was decided not to include the outcomes, as they do not really fit into the case study of Husqvarna. Nevertheless, these interesting insights are included in this appendix. The names of the respondents are provided as they saw no special need for confidentiality.

Gunnar Meijer

Gunnar Meijer was chief executive officer (CEO) at a company that supplied for example Ericsson. Also, he was a senior manager at Electrolux when they owned Husqvarna. Gunnar Meijer's views on disturbances and sources of disturbances are based on his experiences from international manufacturing companies. His views are not related to the specific situation at Husqvarna, but due to his long and thorough experience they are still relevant.

According to Gunnar Meijer a common source of disturbance is sudden increases in demand. If for example a demand of 10.000 units is forecasted and negotiated for a year and the manufacturer then needs to increase it to 15.000 there are often disturbances arising from that. Therefore, it is crucial that the possibility for increases in the demand is handled in the contracts between a manufacturer and a supplier. Information on the intensity of the deliveries is also crucial. It has to be clearly stated in which frequency deliveries have to take place – for example two times a day, or every second day.

Another important point made is that all changes in a product need to be communicated to the supplier as soon as possible before the change occurs. Moreover, it has to be clarified in the contracts how many of the old components the manufacturer is still going to purchase. Generally, it is also important for the supplier to have information about their products in the manufacturer's production – for example how many have been used, or where they are in the production. Visibility is crucial. Every manufacturer that was a customer of the company where he was CEO was given full insight in the production (G. Meijer, personal communication, 2012-04-02).

Åke Franzen

Åke Franzen is a business area manager at the company Fredriksons. The company has three different business areas, it is a: (1) contract manufacturer to Tetra Pak, (2) manufacturer of x-ray machines and (3) a supplier to other manufacturing companies. Fredriksons experienced a lot of disturbances from suppliers before they started an extensive reorganization about two years ago. The company has no connection to Husqvarna. Nevertheless it is interesting, because it has suffered from delays from suppliers and Åke Franzen provided examples how the company solved their problems with the disturbances.

Before the reorganization there was a low degree of integration between the purchasing, planning, production, order and marketing departments. At this time the company had several problems with disturbances from suppliers. To solve this situation a new organization was created where the purchasing, planning and order departments were united into a single logistics unit. The head of this unit was a strategic manager who was not

allowed to be operative and thus could be exempt from the day-to-day struggle with deliveries.

In order to create a high transparency and an ability to discover potential sources of disturbances before their occurrence, several measures were taken. A good example is that the logistics department meets with the production department every morning at 09:30 to discuss potential problems. Moreover, the logistics department measures the performance of suppliers. If suppliers are not performing well this automatically becomes an issue for the strategic purchase department (Å. Franzen, personal communication, 2012-04-11).