



# SCANIA

## **The art of securing supply when facing a natural disaster**

– A risk and crisis management study at Scania CV AB

A master's thesis by:

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*Södertälje, 2013-05-31*



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# Executive summary

Title The art of securing supply when facing a natural disaster.  
*A risk and crisis management study at Scania CV AB*

Background Natural disasters can happen anywhere in the world with no warning at all. When it happens, it is a tragedy mainly for the affected people but also for the supply chains in which affected firms belong. Scania CV AB produces both trucks, buses, engines and provide services to these segments and therefore sources a lot of components from all around the world. A natural disaster could consequently result in stoppage of Scania's production line that would lead to huge economic consequences.

Purpose The purpose of the study is to *improve* the *proactive* and *reactive work* at the purchasing department within Scania CV AB in order to reduce the *risks* and the *economic consequences* that occurs due to *natural disasters* affecting their suppliers.

Methodology Mainly, a normative study was made to answer and fulfill the purpose of the study. Theories from the literature, Scania's existing working methods and mindset to avoid risks were investigated. Even the outcome of three previously executed cases regarding natural disasters were assessed by interviews. On top of that did a benchmark interview, with a company in a totally different industry, improve an already detailed data collection.

Conclusion A company must have both a well developed proactive work as well as a reactive plan for reducing risks and economic consequences to be the most successful when avoiding and handling natural disasters. The conclusions of the study came therefore, among other, out in four suggestions for proactive improvements which are:

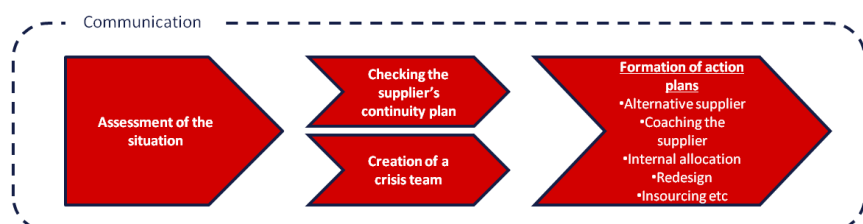
- Improvement of risk awareness among employees
- Location of supplier's production sites
- Improvement of *first assessment* and *audit*
- Standardize the business continuity plan

The study also contributed with a reactive framework that will be used as a tool to reduce the economic consequences when facing a natural disaster and is shown below.



## Sammanfattning

Titel	Konsten att säkra leverans vid drabbande av en naturkatastrof. <i>En risk -och krishanteringsstudie på Scania CV AB</i>
Bakgrund	Naturkatastrofer kan hända var som helst runt om i världen utan någon förhandsvarning. När en naturkatastrof väl bryter ut är det ofta en enorm tragedi, framförallt för de människor som drabbas men också för de försörjningskedjor där drabbade företag ingår. Scania CV AB producerar bland annat lastbilar, bussar, motorer och erbjuder service för dessa produkter varför komponenter köps in från hela världen. En naturkatastrof kan därmed resultera i ett stopp i Scantias produktionslina vilket skulle kunna leda till stora ekonomiska konsekvenser.
Syfte	Studiens syfte är att förbättra Scania inköps proaktiva och reaktiva arbets sätt genom att reducera risk och ekonomiska konsekvenser som uppstår då en naturkatastrof drabbar deras leverantörer.
Metod	I huvudsak gjordes en normativ studie för att svara och uppfylla studiens syfte. Teorier från litteraturen, Scantias nuvarande arbetsmetoder och tankesätt för att undvika risker undersöktes. Med hjälp av intervjuer samlades information kring tre tidigare fall in vilka alla berörde naturkatastrofer. Utöver det gjordes en benchmark-intervju, med ett företag i en helt annan bransch, för att förbättra en redan detaljerad datainsamling
Slutsatser	Företag måste såväl ha ett välutvecklat proaktivt arbete som en reaktiv plan för att reducera risker och ekonomiska konsekvenser och bli framgångsrik i att undvika och behandla naturkatastrofer. Studiens slutsatser är därför bland annat fyra proaktiva förslag till förbättringar, vilka följer nedan. <ul style="list-style-type: none"><li>• Förbättring av medvetenheten hos anställda kring risker</li><li>• Lokalisering av produktionssiter</li><li>• Förbättring av <i>first assessment</i> och <i>audit</i></li><li>• Standardisera kontinuitetsplanen</li></ul> Studien ledde också fram till ett reaktivt ramverk som kan användas som ett verktyg för att reducera ekonomiska konsekvenser vid drabbandet av en naturkatastrof och skildras nedan.



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## **1. Introduction**

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*The introduction chapter initially presents a background to the problem which culminates to the main purpose of the study, with an associated clarification in order to eliminate any ambiguities. The authors then briefly describes the structure of the study to make the reader aware of the study's course of action. The chapter concludes with a presentation of which directives that have been set to the study by the company, but also the delimitations set by the authors. This is presented early to clearly show the reader what is included in the study and what is left out. For a better understanding is a glossary of Scania specific words presented in appendix A*

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## 1.1 Background

Purchasing has become a more important part in many companies because of the large amounts of money generally involved and therefore the large saving opportunities. One other reason for the increasing interest is the need for closer relationships with the suppliers. (Van Weele, 2010) Cost is a key driver in many companies when it comes to sourcing, but what easily can be forgot in sourcing is the importance of risk management. Cost is not the only factor, but to be able to satisfy your customer's needs it is essential to get the components in the right condition and when you need them. Many delays and deficiencies can be a result of different events in the world, where one example is natural disasters. (Johansson, 2013)

Natural disasters can happen anywhere in the world at any point of time, with no warning at all (Barton, 2008). This is of course a tragedy for all the affected people and the surrounding environment at the moment, but also during the recovery time (Musa, 2012). In addition to the people and the environment, local companies will suffer during these times, which indirectly affects the entire supply chain where the company is presented. One company that has experienced these kind of problems in their supply chain is Scania CV AB. (Johansson, 2013)

Scania CV AB (hereinafter referred to as Scania) is a company with headquarter in Södertälje, Sweden. They produce heavy trucks, buses and engines and provide service to these three segments. All these products contain many different components whose suppliers can be found all over the world. Some of these components are technically advanced and are often developed in a close cooperation with the supplier which make the components unique and therefore it is difficult to find a substitute in case of delivery or quality problems. Scania are for that reason very dependent of these suppliers to secure good quality and normal production rate, especially because Scania focuses on producing high-quality products and working towards becoming a more Lean organization with lower stock levels and elimination of non-value adding activities. A delay in the delivery or deficient quality of an important product can therefore result in stopping the production line or revocation of products, which leads to economic consequences. (Johansson, 2013)

Some of Scania's strategic suppliers are located in areas with a higher risk for natural disasters and a few of those have been strongly affected by such disasters in the last couple of years. These situations have caused problems for Scania which has led to an awakening in the interest of eliminating these problems. The purchasing and R&D departments are today working closely together with the suppliers to get the production and delivery up and running as fast as possible when a disaster occurs. The main challenge in these situations is to reduce the delay in delivering components and still maintain accepted quality and price, but they are also working proactively to get both themselves and the supplier better prepared if a disaster occurs. (Johansson, 2013)

However, the effects of a natural disaster are never the same and different companies and individuals work differently with proactive as well as reactive risk reducing activities. Sourcing managers at Scania, responsible for these exposed products, are convinced that they can improve the risk profile when it comes to these problems. (Johansson, 2013)

## 1.2 Purpose

The purpose of the study is to *improve* the *proactive* and *reactive work* at the purchasing department within Scania CV AB in order to reduce the *risks* and the *economic consequences* that occurs due to *natural disasters* affecting their suppliers.

## 1.3 Clarification of purpose

In this section, the reader will get a clarification of the purpose. This is made to reduce the risk of misreading the purpose, but also to make it more clear for the reader to understand the content of the study. Below is an explanation of some words from section 1.2 Purpose that can be misleading or misread.

*Improve* = Means that the authors will identify improvement possibilities but will not be a part of any kind of implementation

*Proactive work* = All risk reducing activities that can be done *before* a disaster happens.

*Reactive work* = All activities that can be done *after* a disaster happens in order to reduce the economic consequences.

*Risks* = The probability of a natural disaster to happen and/or affect the economic consequences negatively. To reduce the risks is only related to the proactive work.

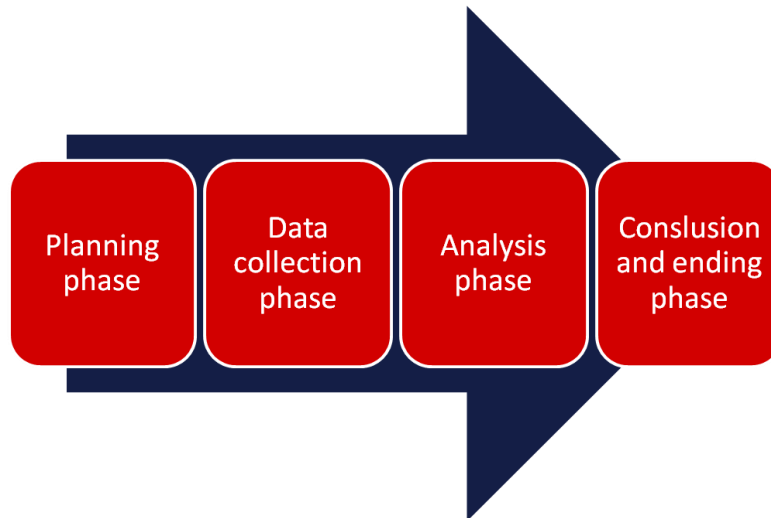
*Economic consequences* = These consequences occur when a natural disaster has happened and the effects are quality defects and/or production stops due to delays in delivering the product. The economic consequences can then occur both by lost revenue and non-value adding costs due to stops in the production caused by non-delivery from the suffering supplier, but also costs related to lack of quality e.g. revocation. One other important thing to clarify is that the study will not include any quantification of these economic consequences.

*Natural disasters* = A natural disaster is defined as “being created by a hazardous fleeting event (e.g., tornado, hurricane, earthquake) that disrupts routines.” (Baker, 2009 p.115) In this study, the term natural disasters will also include fire disasters.

Scania has a very detailed proactive working plan, while the reactive plan is not fully developed. In the problem definition, it was stated that to find and understand the deficiencies in the reactive work it is essential to understand the proactive work. The results of this study will therefore be presented partly as recommendations for how improvements can be done in the proactive activities and partly as a framework for how to work reactively. The framework will be presented as a model that describes how Scania and their suppliers should act reactively to minimize the economic consequences in case of a natural disaster.

## 1.4 Initial method of work

For the benefit of the reader, the authors will begin with introducing the course of actions and the arrangement of the thesis to make the reader more familiar with the procedure of the study. Figure 1 below shows the four phases the study will face. The study begins with the planning phase in order to understand the problem and how it should be solved. Then all information needed is collected in the data collection phase. Afterwards the authors begin to



**Figure 1: The four phases of the study**

analyze the collected information in the analysis phase and the study ends in the conclusion and ending phase, where the results and recommendations will be presented.

The study will outset in a pre-study where the authors are planning the entire project. The goal is to cover everything linked to the study so anyone can continue with the project where the pre-study stops. The phase will include chapters such as introduction to the study, business description, frame of reference, specification of task and methodology.

The data collection phase follows and will include empirical information, collected using different kinds of methods which are described in chapter 5 Methodology. The following analysis phase will use the collected information to find results and recommendations by using the specific questions and the analysis model presented in chapter 4 Specification of task. The authors will present their reactive crisis management framework and the specific recommendations for proactive risk management in the last phase, called the conclusion and ending phase.

In addition to the above described course of action, a detailed arrangement of the thesis will be described below. The reader will here be introduced to a short summary of every chapter and will thereby be informed about which chapters that are more relevant for his or her research. An overview picture of the chapters in the study is seen in figure 2 below. A glossary of Scania specific words are presented in appendix A

Chapter 1: Tells the reader the background to why the thesis is made which culminates in the purpose of the study. The directives from the case company and the author's delimitations gives the reader a summary in which system the study will take place.

Chapter 2: In this chapter an organization description of Scania CV AB will be presented to the reader with focus on details that the study will cover and analyze.

Chapter 3: The frame of reference will introduce the reader to purchasing and supplier relationship management in theory and then focus on both proactive as well as reactive theories about risk management strategies in the supply chain. Comparison between theories and empirical data can be seen as one of the tools, together with cases and a benchmark analysis, to answer the purpose of the study.

Chapter 4: The chapter will begin by introducing the authors about what view the authors are having on the study. It then focuses on the specific questions that need to be answered by different respondents to fulfill the purpose. The chapter also describes the theoretical and empirical background to why the questions need to be asked, why reading this chapter will give the reader a more clear view of the study. At the end of the chapter the authors will introduce the analysis model used in this study and describe how the model helps to get credible conclusions.

Chapter 5: This chapter will tell the reader what methods the authors used in the course of action to collect the desired information and theories, but also the methods used to answer the questions presented in chapter 4 Specification of task and the methods used to conclude the study. This chapter also contain reasoning about the validity and reliability of the study.

Chapter 6: Collection of empirical information is the name of the chapter where all information gained during interviews and lecture presentations are presented. The chapter will just cover the respondent's thoughts and not the authors'.

Chapter 7: It is the chapter when the theories gained in chapter 3 Frame of reference links with information from chapter 6 Collection of empirical data. The authors personal opinions are here presented for the first time. Both a proactively and a reactively analysis are made to cover the purpose of the study

Chapter 8: The conclusions are results of the argumentation in chapter 7 Analysis. This chapter will contain suggestions that will fulfill the purpose of the study.

Chapter 9: This chapter will include a reasoning on generalization of the study, how and where the suggestions can be used. Another reasoning about the feasibility will also be presented in the discussion chapter



Figure 2: Overview of the chapters in the study

**1.5 Directives and delimitations**

The purpose often cover more than just what the study is expected to embrace and that is why delimitations and directives are used. Björklund and Paulsson (2003) means that it is important to have distinct delimitations in the initial chapters of the study to frame the task as precise as possible. At the same time Björklund and Paulsson (2003) also points at the difference between a delimitation set by the authors and a directive set by the study initiator.

As a complement to the theoretical framework on the subject, three internal cases will be covered to contribute with relevant empirical information. The three cases covers Scania's earlier experience regarding crises due to natural disasters. As a complement to the theories regarding reactive strategies, one benchmark study will be performed in order to receive empirical information from other companies point of view.

**Directive 1 – The study will include three internal cases and one external benchmark study.**

A company's purchasing department is exposed to many kinds of risks. Some of them are connected to natural disasters and some are connected to e.g. financial and bankruptcy risks. Scania is facing many risks within the supply chain but the three internal cases that this study focuses on are about risks related to natural disasters. Therefore, this study will exclude disasters and crises connected to e.g. bankruptcies, power outages, tool breakdowns and raw material. (Johansson, 2013)

**Directive 2 – The study will only include risks that are related to natural disasters**

The purchasing department at Scania handles a lot of suppliers and components. Some components are very technically advanced and specific for Scania's requirements and have therefore been developed in a close cooperation with the supplier. A disadvantage with these actions is that it could be difficult to find a substitute to these specific products if there would be a problem with the delivery or quality from the supplier, which make these products so called "worst case scenarios" for the economic consequences related to natural disasters. Another disadvantage is that dual sourcing is not an option when choosing strategy since two suppliers, in this case, can't produce identical products. (Johansson, 2013)

**Directive 3 – The study will only focus on handling products that are developed together with the suppliers.**

Risk management is well-implemented in Scania's organization and the employees have access to a lot of information and frameworks when it comes to proactive work. However, Johansson (2013) is convinced that the proactive work can be improved even further. The purpose of the study is therefore not to create a new proactive framework, but to find improvements in the existing one. The reactive part does not have a well-implemented framework to work by in case of a natural disaster, this work is done differently depending on the individual responsible for the supplier. This framework will therefore, unlike the proactive framework, be built up by suggesting a best practice from the information gathered in the three cases and a benchmark interview.

**Directive 4 – The study will focus on building up a new framework for the reactive work, but delimiting the study to only improve the existing framework for the proactive work**

This study focuses on finding improvements in the proactive work and creating a new reactive framework when it comes to working with risks and effects regarding natural disasters affecting Scania's suppliers. Due to lack of relevance, there will be no quantification in any parts of this study.

**Directive 5 – There will be no quantification in the study**

Due to lack of access to information about Scania's sub-suppliers and because that the suppliers involved in the cases are first and second tier suppliers, the authors have decided to only focus on improving the work directly relating to the suppliers on the closest steps in the supply chain.

**Delimitation 1 – The study will only focus on Scania's first and second tier suppliers**

## **2. Business introduction**

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*This chapter is an introduction to Scania, the company that the study is both based on and aimed for. It starts with an overview of the organization and continues with a more detailed description of the purchasing department and relevant parts involved in this study. This chapter is important to present because the whole study is based on Scania's current situation. It is therefore also important for the reader to be well-read on this chapter in order to understand the analysis and the results from it.*

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## 2.1 History

In the year 1891 a man named Philip Wersén founded a company in Södertälje, Sweden and started producing railway wagons, cars and heavy trucks. He named the company *Vagnfabriksaktiebolaget i Södertälje*, or *VABIS*. Nine years later, another man started a company in Malmö. This company was producing bicycles, cars and heavy trucks and the company was called *Scania*, which is the latin name for the local province Skåne. In 1911 the two companies above decided to merge into *Scania-Vabis* to meet the increasing competition on the market in Europe. They stopped all production of bicycles and railroad wagons but continued their production of heavy trucks and cars, but also decided to begin producing buses and fire trucks, both in Malmö and Södertälje. Soon they were also growing outside Sweden, with assembly factories and workshops in Denmark, Norway and Russia. (Boman, 2011)

Ten years later the company suffered from economic difficulties and went bankrupt. A Swedish bank invested a lot of money to start a new company that took over the brand name and grew to a financially stronger and more technically advanced company. The shutdown of the car production and the production factory in Malmö were two important strategic decisions made in the same procedure. About 50 years later, in 1969, the company merged with Saab to become Saab-Scania. That fusion held until 1995 when they went separate ways and after that, Scania became listed. Today Scania has become a global company with factories, sales and service points all over the world. (Boman, 2011)

## 2.2 The organization

Scania is today a company with headquarter in Södertälje, Sweden. They produce heavy trucks, buses, engines and also provide services to these three segments. The largest segment is heavy trucks (64% of total sales) followed by service-related products (19%), buses (9%), used vehicles (5%) and industrial and marine engines (1%). In 2011 the net sales were 87 686 million SEK and the operating margin was 14,1%. (Johnson, 2012)

The company is since 2008 a subsidiary of Volkswagen AG and is thus the ninth brand in Volkswagen's portfolio. The total number of employees at Scania is 35 500 and about 10 000 of those work in Södertälje. The market is global, but the largest markets segments are Europe (42%) and Latin/South America (26%). Brazil is the largest market segment counting by country, where Sweden is number ten on the list. (Johnson, 2012)

### 2.2.1 Core values

Scania has three core values: *Customer first*, *Respect for the individual* and *Quality*. These three values tie the company together and form the basis of Scania's culture, leadership and business success. *Customer first* means to focus on a good knowledge of the customer's needs and business operations to be able to maximize the value for them. The "customer" does not have to be the end-customer, it is also seen as the subsequent employee in the production line. This encourages the employees to always do their best before delivering the product or responsibility to the next employee in the process. (Johnson, 2012)

*Respect for the individual* means that it is of great importance for Scania to stimulate their employees, suppliers and customers to continuously improve their way of working in order to achieve the goals of Lean. Lean is a strategy which is all about continuous development and elimination of waste, that means reducing non-value adding activities as much as possible in an organization. This is achieved by listening to the individual and taking care of their

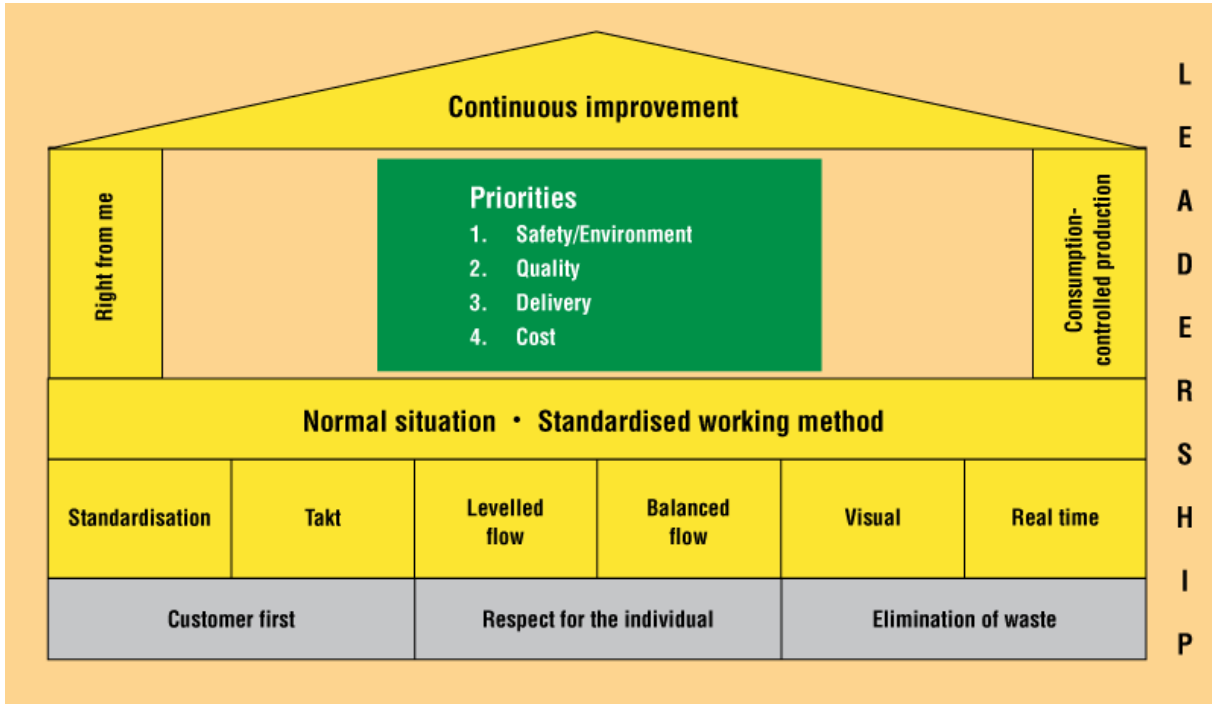


experiences, ideas and knowledge which results in quality, efficiency and job satisfaction. (Johnson, 2012)

Quality is achieved by satisfying the customers to maintain profitability over time. If the two values above are applied well in the organizations, the results will be high quality products to the customer, with continuous improvements over time. Because of Scania’s high-quality strategy, and the fact that they do not have any inspection of the incoming components, it is very important to first choose the right suppliers and then implement the quality strategy in their organization. (Johnson, 2012)

**2.2.2 Scania Production System (SPS)**

Scania has, in their work to become a more Lean organization, modified the famous *Toyota production system* (TPS) which is a system invented by Toyota, a company well-known for its Lean thinking. Scania’s system is called Scania Production System, or *SPS*. The system is described as a house, which will collapse if not all the parts are strong enough. The house is illustrated in figure 3 below and some of the elements is according to confidentiality not filled in. (Johnson, 2012)



**Figure 3: The SPS house**

Figure 3 above shows that the house is built on a foundation that is Scania’s core values described in section 2.2.1 Core values. These values are therefore essential for the company’s existence. Working with all these values in mind will result in a standardized working method. But to continuously improve as an organization it is important that all employees feel the responsibility to make their work right. It is also essential that a large organization has the same priorities to be able to work in the same direction. Thanks to this system Scania has increased its productivity from three to seven vehicles per production employee and year. (Johnson, 2012)

### 2.2.3 The product

Scania produces engines, axles, gearboxes and cabs. The rest of the components needed to produce a complete vehicle is purchased from suppliers located all over the world. Because of the Lean management Scania only has a few hours of stock at the assembling site and no inspection of incoming goods at all, the inspection is made just before assembly in order to reduce waste. Some of the components are very complex and developed together with the supplier which means that it is difficult to find a substitute component elsewhere. Therefore it is very important to have a close relationship with all the suppliers both to secure delivery and to maintain a good quality on all components. Because of this, Scania's purchasing department have an important responsibility for the organization's success.

### 2.3 Scania's purchasing department

All the employees at the purchasing department are working in accordance to the same vision "to continuously be the most efficient purchasing operation in the industry", together with the mission "to provide value to our customers by supplying required material, equipment and services to the right Quality, Delivery and Cost". The purchasing organization tries to pursue the company's vision and mission both in the short and long run. (Billström, 2012)

The Scania global purchasing department is structured into two different business areas. *Automotive Purchasing (AP)* cover commodities that are related to operations which have direct impact on the end-product. *Non-Automotive purchasing (NAP)* does instead contain commodities with an indirect impact on the end-product. A commodity is a group of products with similar functions or supplier base e.g. door components or wheels. (Johansson, 2013)

This breakdown is clearly visible in the organization structure in figure 4 below where two out of seven commodities deal with non-automotive purchasing: Non-Automotive Products and Commercial System. The Automotive Purchasing is divided into five different categories, Powertrain, Cab & Components, Chassis & Bus, Special areas & Business development and Region South America.

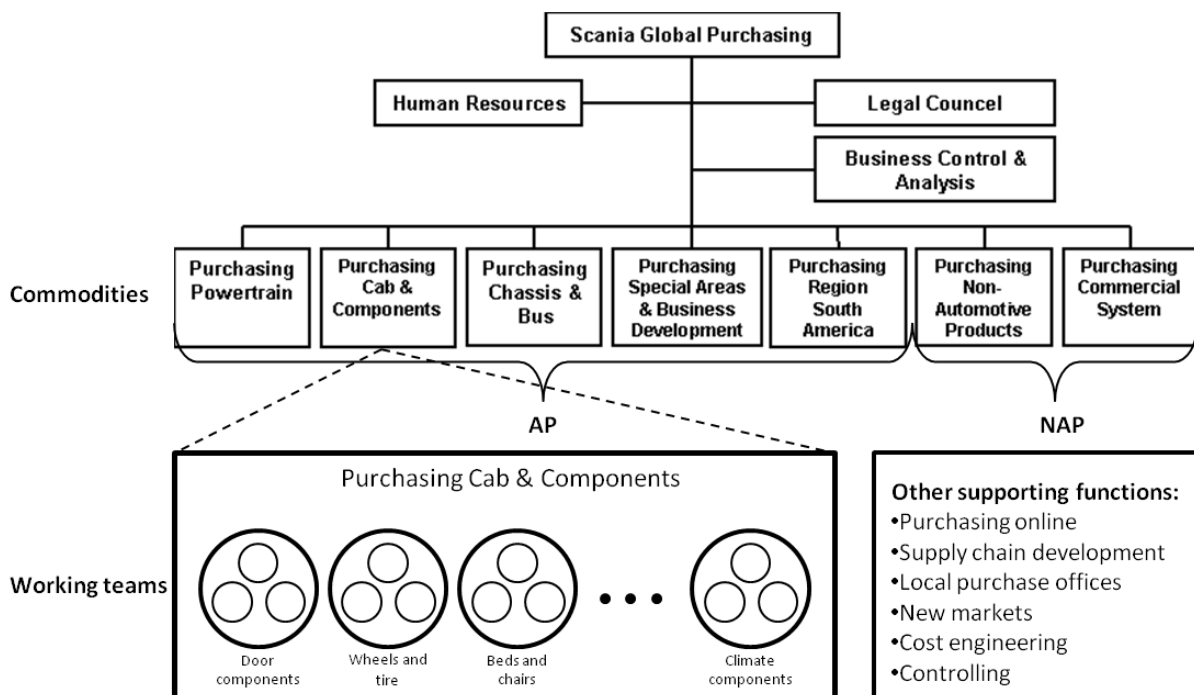
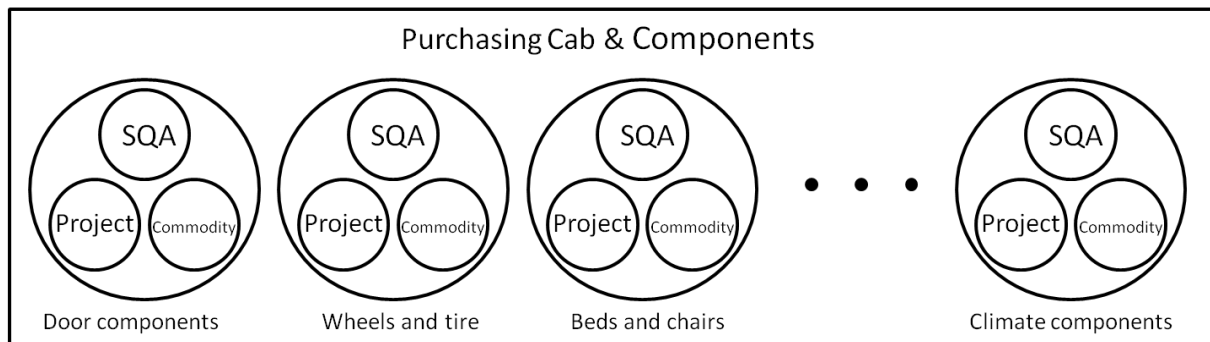


Figure 4: Organizational structure

As seen in figure 4 above, in every commodity there are several working teams where the actual team is more or less dynamic depending on resource allocation. Each working team handles a specific segment of the commodity. Grubbström (2013) describes in detail how the working teams, called “three-rings”, are set up. This is illustrated in figure 5 below.



**Figure 5: Illustration of the working teams called "three-rings"**

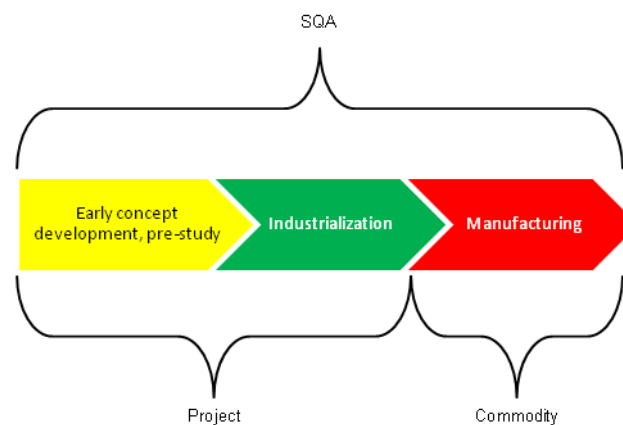
Figure 5 above shows a few three-rings that each consist of three job positions with totally different tasks. One of them is the *Sourcing manager (commodity)* that among other is responsible for quality, deliveries and cost as well as defining and establishing strategies within the segments. The Sourcing manager (commodity) also has the responsibility for the working team. (Nilsson, 2008a) The *Sourcing manager's (project)* responsibilities are among other to plan, perform and follow up project targets and at the same time control and report the performance of the suppliers in a pre-development phase. (Nilsson, 2008b) The third part of the three-ring is the *Supplier quality assurance (SQA) manager* who is responsible for process quality assurance of new and modified products and at the same time evaluate suppliers ability to cope with the requirements Scania gives them. (Nilsson, 2008c) To clarify, the three-ring with its *Sourcing manager (commodity)*, *Sourcing manager (project)* and *SQA manager* are just describing the job positions needed in a team. Therefore, the three-ring does not always include three employees or consist of the same three employees. All that depends on the need of resources at the moment. (Johansson 2013)

There are also some other functions supporting the purchasing organization in general. (Billström, 2012) These are:

- Human resources, that is coping with organizational questions and personnel development.
- Legal adviser, that is supporting categories with expertise in legal issues
- Business analysis, that is providing categories with different analysis regarding business evaluation and potential.
- Business development, that is supporting the categories with strategic development, method development and special projects.
- Purchasing online, that is representing Scania's interest in sudden occurred supplier problems regarding quality and delivery deviations.
- Supply chain development, that is using long term scope to find improvements in the supply chain
- Local purchase offices, that are providing categories with new potential suppliers in low cost countries.

- New markets, that are searching for new potential suppliers in areas without local purchase offices present.
- Cost engineering, that is educating categories with cost insight for specific products.
- Controlling, that are assisting the organization with financial reporting as well as reporting of key performance indexes.

*Sourcing managers (commodity), Sourcing managers (project) and SQA managers* also have different tasks during the lifecycle of a product that is developed together with the supplier. *The Sourcing manager (project)* is responsible for a pre-study but also when the project arrives to the green arrow and actually starts. They are also working close together with R&D engineers for development of early concept. *The Sourcing manager (commodity)* takes over the responsibility when the component moves to manufacturing. During the entire development process the *SQA manager* has the responsibility for quality assurance. An illustration of this process is found in figure 6 below.



**Figure 6: Different manager's responsibilities during a product development process**

In order to work in line with the purchasing department's mission presented above, Johansson (2013) says that right quality, delivery on time and total cost are the most vital requirements within Scania. To fulfill the requirements it is important to work with risks that can affect these requirements negatively. Johansson (2013) introduced the authors with a summary how Scania today works proactively and reactively with risks due to natural disasters.

### **2.3.1 Proactive and reactive tools regarding natural disasters**

Figure 7 below shows which proactive as well as reactive tools Scania is using for reducing risks and economic consequences regarding natural disasters affecting their suppliers. Proactively, *first assessment* and *audit* are two activities that are common. The *first assessment* is only made once for new suppliers while the *audits* are made on a regular basis for the suppliers depending on how good they have performed historically. The *BISSC* analysis is only made for a few high risk suppliers since it requires a lot of resources. *ISO/TS 16949* requires that all suppliers have a *BCP* for proactively planning of an eventual emergency situation. In addition to that, the supporting function *POL* is always ready to take over a case and allocate resources if a disaster affects a supplier. (Johansson, 2013) Each tool is further described in section 2.3.1.1-2.3.1.4 below.

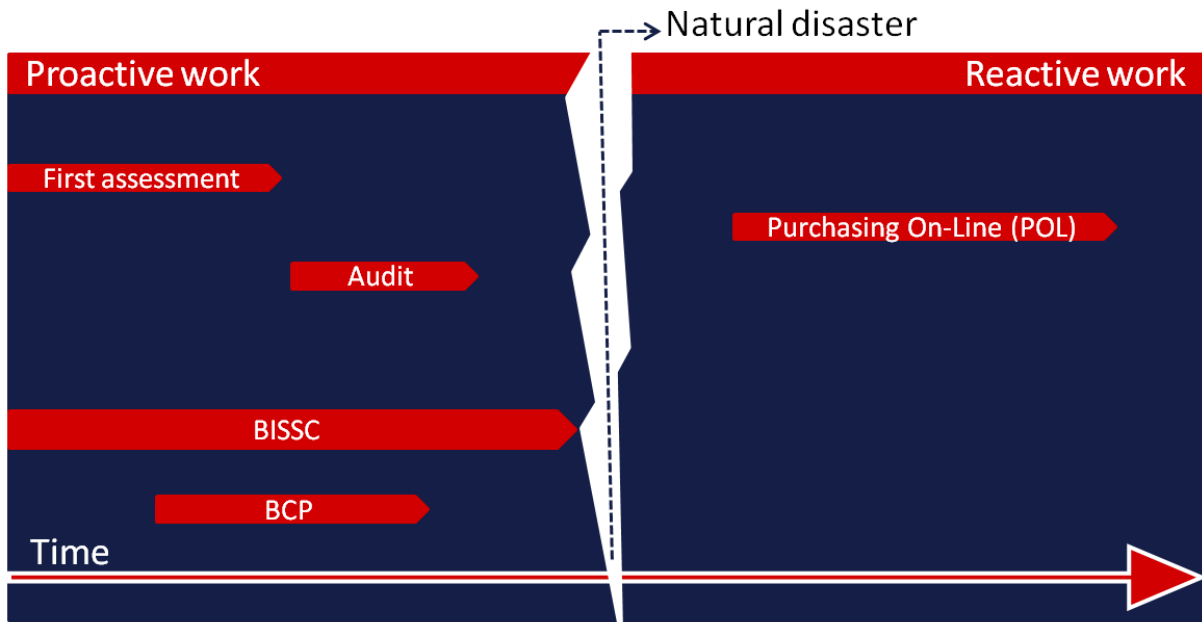


Figure 7: Summary of proactive and reactive tools at Scania

### 2.3.1.1 First assessment/ Audit

The *first assessment* is a tool that are used before giving a supplier the opportunity to deliver for the first time. This is the normal situation, but it happens that the supplier is chosen before Scania gets the opportunity to identify all the supplier's risks. The *first assessment* is performed to check if the supplier fulfills Scania's requirements for a first time supplier. The requirements are if the supplier is capable to deliver the required product, but also what Scania expects from the supplier regarding delivery risks. With help from the *first assessment*, the most obvious risks are identified in an early stage. (Artero, 2012)

The *audit* checks if already delivering suppliers still meet the requirements. The purpose is to assess supplier's significant commercial and quality aspects and assure that the supplier works with continuous improvements. The difference between the *first assessment* and the *audit* is that *first assessments* cover standardized questions from the Best Audit Practice (BAP), that is a huge database with questions helping the SQA manager to form a unique bunch of questions for the *first assessment* or *audit*. An *audit*, on the other hand, can be totally tailored to fit for the investigated supplier. However, the standardized questions do not cover a complete *first assessment*. The responsible SQA must complete the *first assessment* question base for every supplier which gives a subjective assessment, and therefore the potential suppliers cannot always be easily compared to each other. (Artero, 2012)

The risk management self assessment is a part of the *first assessment* that is sent to the supplier before performing the *first assessment*. The purpose of Scania's risk management self assessment is to educate the suppliers about what Scania expect from them regarding different risks in the organization and at the same time, it helps Scania to understand if the supplier actually has a plan for how to work in an adverse situation to get back to the normal situation. (Bracamonte, 2011)

### 2.3.1.2 Business interruption study supply chain (BISSC)

The business interruption study supply chain (BISSC), is one of Scania's tools for reducing risks and it is developed from an internal tool applied at the production line. The purpose with

the *B/SSC* analysis is to identify risks threatening production or deliveries and to, based on the identified risks, give recommendations for how to minimize recovery time after a crisis. The purpose with this analysis is also to make the critical suppliers and the sourcing managers (commodity) aware of where in operations risks may occur. (Vicari, 2011)

There are two steps in the process when performing a *B/SSC* analysis that are further presented below:

- Internal workshop
- External *risk management supplier audit*

The internal workshop is performed to see which of all Scania's products and suppliers that are critical enough to require for a risk management supplier *audit*. It is important to highlight that the *risk management supplier audit* is not the same as the audit presented in 2.3.1.1 *First assessment/ audit*. The *risk management supplier audit* is performed at the supplier to analyze and give recommendations to the supplier on what to work with. The *B/SSC* workshop is supposed to be done annually, but the position responsible for the tool is today a vacancy. This position is called "business continuity manager" and it is found in the corporate risk management department at Scania, and the purpose with the position is to work with risk management in order to secure business continuity during all possible events. (Vicari, 2011)

The high risk suppliers will be evaluated in a risk management supplier *audit* which addresses three different main focus areas: risk mapping, business continuity and fire safety. The risk mapping addressing different risk areas to understand how a business interruption at the supplier can affect the Scania production system. The second focus area addresses business continuity related issues for the supplier and the third focus area is a technical site *audit* which mainly focus on fire safety. (Vicari, 2011)

It is important to see the difference between a regular *audit* and a *risk management supplier audit* since they cover totally different areas. The regular *audit* focus on processes and repeatability while the *risk management supplier audit* focus just on business interruption risks. (Vicari, 2011)

### **2.3.1.3 Business continuity planning (BCP)**

Business continuity planning (*BCP*) is a systematic risk analysis, required to be performed by the suppliers in the automotive industry, in order to be prepared for different kind of interruptions in delivery or quality issues. The plan does look very different depending on how detailed and which production site it is made for but all of them have the same purpose, to minimize the risk of non-delivery from a supplier. The *BCP* identifies risk areas and implements improvements. The business continuity plan shall contain actions for the critical items identified in the *B/SSC*. (Lagerbäck, 2013)

The outcome of the *BCP*, performed by the supplier, is a business continuity plan. The continuity plan shows specific solutions for different risks e.g. machine or tool breakdown, fire, flooding, storm or snow but also the supplier's short term actions and planning to take care of accidents and personal injuries. (Lagerbäck, 2013) *BCP* in this thesis will focus on just solutions and actions for having a continuously flow of components to Scania.

#### **2.3.1.4 Purchasing On Line (POL)**

The only crisis management tool that really exist within Scania today is Purchasing On Line (*POL*) which is a flexible support team function ready to take over problem cases in order to maintain a deviation free production. (Engström, 2013)

For every quality deviation due to non fulfillment of product specification in the production line, will a quality report be sent to the supplier and to Scania. These quality reports summarize what happened and which consequences the deviation lead to. A short term action plan is required from the supplier in the next few days while a root cause analysis and a long term action plan should be presented within the next ten days. The daily inflow of quality reports are seen and evaluated within the *POL* team. Thereafter, the *POL* team measures the risks depending on how urgent the situation is. (Engström, 2013)

*POL* should preferably be summoned for critical quality deviation, production or delivery stop, poor communication with the supplier or frequently inflow of quality reports. The approach of *POL* members is to visit the production site as soon as possible to handle the problem case from there. (Engström, 2013)

### **3. Frame of reference**

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*This chapter presents the theory base for the relevant subject areas handled in the study. The base begins with explaining the purchasing department, its growing role in the organization and their responsibility against risks around natural disasters. The chapter continues by focusing closer on different tools that can be used in both the proactive and reactive work. This theory base will later be analyzed, together with information collected in the data collection phase, to see if improvements can be found in the current proactive and reactive work at Scania. After this chapter, the terms proactive activities will be referred to as risk management and the term reactive activities will be referred to as crisis management.*

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### **3.1 Purchasing, sourcing or procurement?**

During the past years the purchaser's role has become more and more important due to the current competition between companies. Van Weele (2010) says that purchasing nowadays is recognized by top managers as key business drivers. More than half of the sales turnover in a company are often spent on purchased parts and services which is an indication that purchasing has a direct impact on a company's short-term financial position and long-term competitive power. The difference in signification between the terms purchasing, sourcing and procurement are often hard to define. (van Weele, 2010) The definition of purchasing that van Weele (2010 p.8) is using is cited:

"The management of the company's external resources in such a way that the supply of all goods, services, capabilities and knowledge which are necessary for running, maintaining and managing the company's primary and support activities is secured at the most favorable conditions"

Activities included in the purchasing process is, as Van Weele (2010) and Persson & Virum (1991) write, determining of specification, selecting supplier, contracting, ordering, evaluating and follow up. Further van Weele (2010) writes that procurement is similar to purchasing but does not include the activity "determining of specification". Van Weele (2010) also describes clearly that sourcing is just the way of managing the best possible source of supply which means activities like selecting supplier and contracting.

Another article written by Carr & Pearson (2002) describes strategic purchasing. Worth knowing is that it also describes benefits a company can get from a strategic purchasing department. The definition of strategic purchasing is (Carr & Pearson, 2002 p. 1033):

"The process of planning, evaluating, implementing and controlling highly important and routine sourcing decisions"

According to the authors, strategic purchasing from Carr & Pearson's (2002) point of view describes best how the organization look like at Scania. Activities in purchasing as van Weele (2010) describes is not the only activities performed by sourcing managers (commodity) within Scania today. They focus on determining of specification, selecting suppliers, contracting, evaluating suppliers and follow up, but they also work on a strategic level and contribute to sustain a competitive advantage which is in accordance with Carr & Pearson's (2002) theory. The work at Scania does also include activities to preserve good relations with their suppliers in order to strive for a long-lasting relationship. Strategic purchasing is therefore the term that best fit to explain which tasks sourcing managers (commodity) are expected to do at Scania. For that reason, this thesis will from here on refer to the definition of the literature when speaking about strategic purchasing.

Scania's sourcing managers (commodity) are dealing with a lot of different components including in the end product, some with multiple sources and some with a single source (Johansson, 2013). Van Weele (2010) describes the importance of different strategies when the prerequisites vary. Van Weele (2010, pp 10) describes in following quote what matters for setting up a strategy: "from how many suppliers to buy, what type of relationship to pursue, contract duration, type of contract to negotiate for, and whether to source locally, regionally or globally". Nowadays, Ragatz et al (1997) reports it is common to involve suppliers in the product development phase when just using one source to get extra benefits

and establish a more robust relationship. Which benefits and how to collaborate with suppliers in the product development process follows in next chapter.

### **3.2 Supplier Relationship Management (SRM)**

According to Matook et al (2009), the objective with SRM is to develop long term relationships with low risk suppliers in order to be beneficial in a dynamic business environment. Ragatz et al (1997) reported in their article that purchasing managers expect within the next five years manufacturer to reduce cost of goods by 5-8 %, reduce time to market by 40 – 60 % and at the same time improve the product quality. Handfield et al (1999) and Ragatz et al (1997) states at the same time that the actual product cost often account for more than 50 percent of the total turnover in a company. Suppliers do have a direct impact of the quality, cost, technology and time to market for the product they offer (Handfield, et al. 1999). One way to meet future specifications and requirements, like reducing product and development cost or improve quality, is to involve the supplier in the development process. (Birou & Fawcett 1994; Handfield, et al. 1999; Ragatz, et al. 1997; Wynstra, et al. 2001; Van Weele 2010).

Ragatz et al (1997) report that having suppliers involved in the development process will have impact on the cost, quality and cycle time because of the increasing cost and that it is harder to make changes later in the development process. Van Weele (2010) reports this kind of relationship is one among other new developments within purchasing today, where the traditional price negotiations and agreements are replaced by gain and risk sharing agreements and the focus is to establish long-term relationships.

Studies have shown that the development time will decrease in a collaboration between buyer and supplier only if the product line is mature and the goals are well defined. (Ragatz et al 1997) The length of the collaboration will also play a role. If the supplier is familiar with the internal processes and objectives, they can in advance pre-develop for future products in order to meet the needs. (Ragatz et al 1997; Handfield et al 1999) Equity sharing, trust, co-location and information sharing are highlighted in article of Ragatz et al (1997) about identified attributes for successful supplier collaboration. Consent among authors are in the articles written by Ragatz et al (1997) and Handfield et al (1999) where both refer to Littler et al (1995) that key success factors for a collaboration are inter-company communications, trust, partnership equity, both parties contribution as expected and employment of a product responsible. Wynstra et al (2001) highlights the importance of staffing with people that have right commercial, technical and social skills as a success factor of supplier involvement.

When working with SRM, it is important to collaborate with the actors in the supply chain in order to cultivate new partners, maintaining existing partners, reducing interruptions and managing risks. Signs of a well working SRM is, according to Waters (2007 p.212):

- To have a detailed and shared understanding of the supply market and its industries
- To have clear statements of expectations from the suppliers
- To have defined measures of supplier performance
- To have performance based contracts that include risk management
- To have continuous monitoring to ensure that suppliers are meeting expectations
- To have supplier development programs to ensure the performance of suppliers that are critical to the success of the supply chain and that can't be easily replaced
- To collaborate to find ways of improving SRM and tackle problems of mutual concern

- To monitor the supply market to identify alternative sources of supply and to track the competitiveness of existing suppliers
- To explore possible substitution to expand the supplier base.

SRM is just one of several strategies used within companies nowadays to establish robust and long term relationships (Ragatz et al, 1997). A SRM strategy usually brings a lot of benefits but also increase the risk exposure for a company when single sourcing is used (Zeng, 2000). In those cases, it is extra important to have a well developed supply chain risk management process. In the following chapter, a supply chain risk management perspective together with a complementary framework will be presented.

### 3.3 Supply Chain Risk Management (SCRM)

The definition of a risk is, according to Borge (2001, p.4): *"being exposed to the possibility of a bad outcome"*. There are two definitions of risk management familiar to the authors. The first definition of risk management is (Paulsson, 2007, p.29): *"the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence"* Borge (2001, p.4) writes the second definition as: *"taking deliberate action to shift the odds in your favor"*.

Shao and Dong (2012) describes the importance of separating the terms *proactive* and *reactive* when managing a disaster. The authors will use Paulsson's (2007) definition since it is more detailed and will contribute more to the study. Risk management will from now on be the definition of all proactive work with reducing risk regarding natural disasters.

Supply chain risk management (SCRM) is, according to Waters (2007 p.76), *"the process of systematically identifying, analyzing and dealing with risks to supply chains"*. Paulsson's (2007) definition of SCRM is to apply risk management tools, either together with partners in the supply chain or not, to handle risks that impacts on, or are being caused by, logistic activities or resources in the supply chain. The supply chain is defined by Waters (2007) as the activities and organizations that materials go through from the raw material to the end customer. In this study, the authors will also use the term "inbound supply risks" when speaking about the risks of non-delivery due to natural disasters.

Waters (2007) also clarifies the important differences between uncertainties and risks by defining four levels of uncertainty:

- *Ignorance* – the level where the organization has no knowledge about what is going to happen in the future
- *Uncertainty* – the level where the organization can list possible future events but can't give each event a probability
- *Risk* – the level where the organization can list the possible events and also give each event a probability
- *Certainty* – the level where the company knows exactly what will happen in the future

Musa (2012) and Paulsson (2007) describe that the focus on increasing productivity, lowering costs and fulfilling demands has, along with many other factors, led to an expansion in the supply chains, which also increases the chain's complexity. A great disadvantage of this is the organization's loss in control of the processes in the chain. Risks and disruptions occurring at one part of the supply chain can easily affect other chain members if the

problem is handled improperly. In these risk situations it is very important to maintain the expected flow in the affected supply chain, which is achieved by identifying the risks and evaluating the impacts of the risks, but also by establishing risk reducing policies to relocate resources to deal with these risks. (Musa, 2012)

According to Barlow (2012), the number of wildfire and weather-related disasters has increased since the 1970s, due to the global warming. Research studies on the subject also shows that risk issues has become a more important part of the supply chain operations. As an example, the number of elected supply chain executives reporting directly to the CEO increased from 30% in 2005 to 68% in 2010. However, different disruptions still affect companies, and the recognition and preparedness of the problem among the individuals are decisive for the magnitude of the disruption, but also the continuity of the flow in the supply chain. (Musa, 2012) Implementation of lean in an organization may also contribute to these problems, since this way of working increases the vulnerability to disturbances due to e.g. lower stock levels (Carvalho, et.al. 2012).

One example is the case when a Philips Electronics factory experienced a small fire in New Mexico. Philips Electronics were suppliers to both mobile phone companies Ericsson and Nokia. Immediately after the fire, Philips Electronics informed all customers about the situation and estimated the delay of the product to about one week. Ericsson waited, but Nokia went for their backup-plan, in case the delay would be longer, where they instead started shipping materials from another Philips facility in Netherlands. The delay of the products in New Mexico were at the end much longer than expected and this led to a decrease by 6% in Philips' annual profit, which also led to a major financial damage at Ericsson and their retreat from the mobile device market. Therefore, this action by Nokia led to an increasing in market shares from 27% to 30%, but also a great increase in reputation. (Norrman & Jansson, 2004; Waters, 2007)

A well-implemented *SCRM* strategy could result in reducing, or even avoiding, the risks and impact of a disruption (Musa, 2012). The foundation of *SCRM* is for an organization to develop skills to react properly in case of a disaster, to be able to return to the original state as fast as possible (Carvalho et.al, 2012). *SCRM* can, according to Waters (2007) and Manuj & Mentzer (2008), be divided into three activities: Risk Identification, Risk Evaluation and Risk Mitigation.

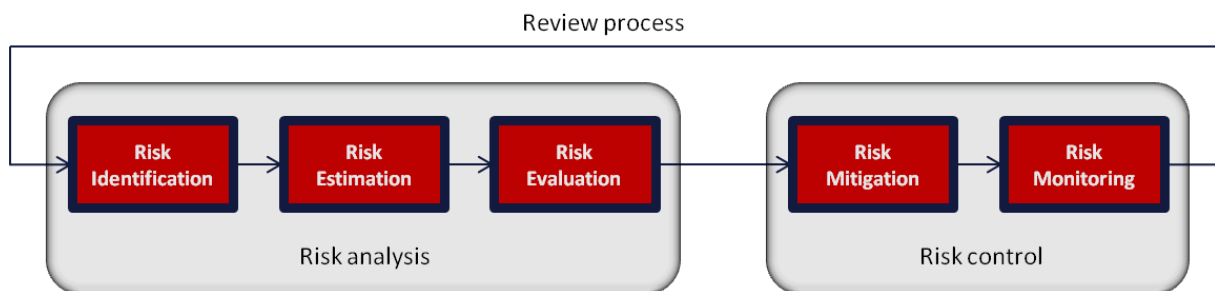
The *ISO 14971* standards includes the Risk Management process, which according to this standards should include:

- Risk Management plan
- Risk Assessment, which includes Risk Analysis and Risk Evaluation
- Risk Control
- Post-Production Information

The most commonly discussed strategies to reduce delivery risk in supply chain are: employing redundant suppliers, increasing responsiveness and/or flexibility, reinforcing co-operation and adopting crisis management planning. Integrating dual sourcing and process improvement for unreliable suppliers and that are carrying limited capacity are also commonly discussed. (Musa, 2012). Speaking about dual sourcing strategy has shown a reduction in inventory holding costs, but the strategy is only better than single sourcing when

both suppliers are equally reliable. (Musa, 2012) The use of dual sourcing is however not possible in this study because the products that are studied are developed together with the supplier which gives Scania a confidential responsibility and in some cases patents are involved, which makes it impossible to use dual sourcing. (Johansson, 2013) This is also presented in directive 3 in section 1.5 Directives and delimitations

Figure 8 below describes the framework of *SCRM* according to Musa (2012). The framework is divided into Risk Analysis, where risk events are identified, estimated and evaluated, and Risk Control, where the purpose is to proactively mitigate and monitor possible risk events in order to reduce or even avoid them. The red boxes in figure 8 are further described in section 3.3.1-3.3.5, followed by a presentation of commonly used tools for these activities in section 3.4 Tools. Musa's (2012) theories, that will be further described below, are confirmed by and are similar to other authors in the literature, such as Waters (2007) and Manuj & Mentzer (2008). Because of the clear and detailed description and illustration of the model, together with the equivalent content as in this study, the authors will use this model as a framework in the study. The authors also believe this framework is applicable to Scania's way of working with risks.



**Figure 8: The SCRM framework according to Musa (2012)**

### 3.3.1 Risk Identification

Risk identification is, according to Musa (2012), defined as the activity when trying to identifying all possible causes of risk events. The definition of a supply chain risk is, according to Musa (2012), Paulson (2007) and Christopher & Lee (2004), the probability of a sudden event that brings negative consequences to the supply chain. The techniques used to perform this process are often qualitative and the expertise of the people involved strongly affects the results.

According to Waters (2007), there are two major categories of risks to a supply chain: Internal risks and external risks. Internal risks are risks that occur in the company's operations e.g. late deliveries, stock shortage, bad forecasts, financial risks, accidents, employee risks, IT risks etc. External risks come from outside of the supply chain e.g. earthquakes, hurricanes, wars, terrorist attacks, diseases, increase in prices, shortage of materials, crimes etc. In this study, the investigated risks are strictly external to Scania's suppliers which leads to strictly internal risks for Scania.

Chopra and Sodhi (2004) presents nine categories of supply chain risks that can affect an organization and their supply chain. These are:

- Disruption risks
- Delay risks

- System risks
- Forecast risks
- Intellectual property risks
- Procurement risks
- Receivables risks
- Inventory risks
- Capacity risks

The authors' study only focuses on disruption risks and delay risks, where the drivers to disruption risks are for example natural disasters, labor disputes, war & terrorism, supplier bankruptcy or dependency on a single sourcing supplier. Drivers that can trigger a delay risk are for example inflexibility, quality deficiencies or yield at a supplier source. In this situation it is clear that the investigated suppliers at Scania are related to the disruption risks, while Scania is exposed to both disruption risks and delay risks.

### 3.3.2 Risk Estimation

According to Musa (2012) and Manuj and Mentzer (2008), Risk Estimation is used to assess three risk dimensions: the probability of a certain risk to occur, the consequences when that risk occurs and finally detection, which is a measure of how much time it takes to detect and implement mitigation techniques for the investigated risk when it occurs. The quality of the risk estimation is also strongly affected by the subjective results and the expertise of the investigator. (Musa, 2012) The process can be either qualitative or quantitative depending on the access to historical data. A quantitative estimation is preferred if backed up by reliable data, but if the historical information is unavailable or unreliable it is often better to do a qualitative estimation. (Ahmed, et al. 2007)

### 3.3.3 Risk Evaluation

The purpose of this process is to estimate the significance, tolerability and acceptability of the identified risks for the organization. One commonly used model is the risk matrix that combines Risk Estimation and Risk Evaluation. It is shown in figure 9 below. (Paulsson, 2007; Waters, 2007)

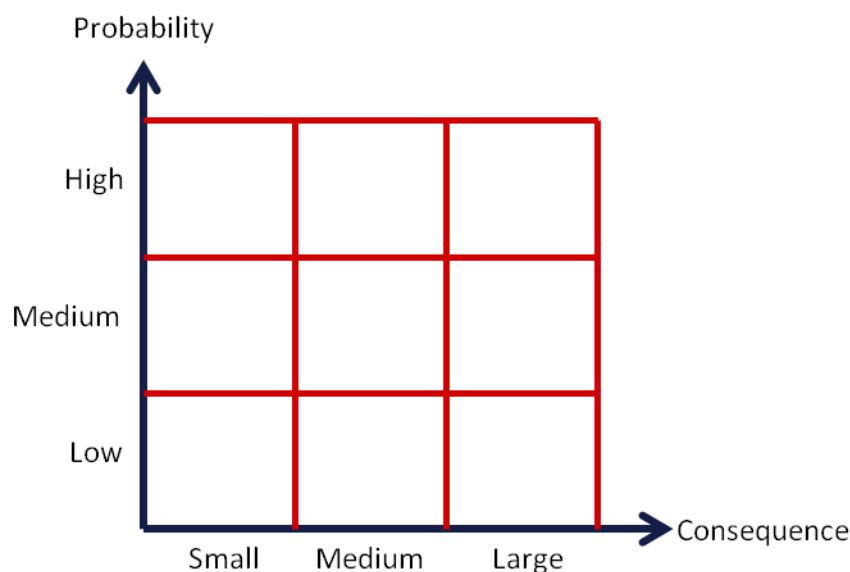


Figure 9: Risk matrix

When using this risk matrix, every risk is categorized into a segment in the figure, depending on probability and consequence, which determines the organization’s tolerability and acceptability of the risk. The purpose of risk evaluation is to obtain a prioritized list of the risks in order to know where to put more attention. (Musa, 2012) This method is confirmed by Norrman and Jansson (2004).

**3.3.4 Risk Mitigation**

Risk Mitigation, sometimes called Risk Handling, is the process where trying to handle risks by either reducing, transferring, eliminating, subdividing or just accepting all possible risks. (Musa, 2012) According to Waters (2007), there are two ways to deal with risks proactively. The first, and easiest one, is to simply ignore the risk. As long as everything works as it should, this seems like a good idea. Many managers say that dealing with events that unlikely to happen is a waste of time, but when the disaster strikes, the reactive approach is often too slow and the damages becomes much greater before the actions taken become effective. One other risk with only working reactively is that the time for consideration will be shorter which can lead to making wrong decisions. (Waters, 2007)

Another way to handle risks is to act, there are several techniques commonly used for acting according to Waters (2007 p.153):

- Reduce the probability of the risk
- Reduce or limit the consequences
- Transfer, share or deflect the risk
- Make contingency plans
- Adapt to fit the risk
- Oppose a change (e.g. new regulations)
- Move to another environment

Paulsson (2007) presents a more detailed list of techniques, which are presented below, where he categorizes these risk handling methods. Presented below are how the method is affecting the scenario, the likelihood or the consequences of the risk. A risk can be seen as a triplet of these three factors. The *scenario* tells what can happen, the *likelihood* describes how likely it is that the scenario is happening and the *consequences* simply tells what the consequences are if the scenario happens. (Paulsson, 2007) Table 1 below summarizes these risk handling methods and if the methods affect the scenario, likelihood or consequence of the risk.

**Table 1: Risk handling methods according to Paulsson (2007) and how the methods affect a risk**

Risk handling method	Explanation	Affected factor
Accept risk	Do nothing and face the risk	
Avoid risk	Discontinuing the activity related to the risk	Scenario
Back-up plans	To have alternative plans ready	Consequence
Buffers	Increase stock levels	Likelihood
Concentrate	Leads to better attention and knowledge of the risks	Scenario and likelihood
Create/ increase risk	The opposite of avoiding	Scenario
Diversify	More suppliers, production sites or distribution channels	Consequence

Flexibility	The production mixture can easily be changed	Consequence
General reserves	Building up economic and human reserves	Consequence
Good relations	Creating relations with other actors in the supply chain	Consequence
Identify	Get access to information about events, changes and trends that might disturb the supply chain	Consequence
Insure	Fire insurance, transport insurance and business disruption insurance	Consequence
Organize	Make changes in staff organization	Scenario, likelihood and consequence
Overcapacity	In production	Consequence
Protect	Protect assets against theft and damage	Scenario
Replace	Replace a missing component with another, equally good or better component	Consequence
Secure supply chain partners	To regularly check the financial status of critical firms and to consider the risk of takeovers by competitors	Likelihood
Training	To educate the employees about identifying, analyzing and handling risks	Scenario, likelihood and consequence
Transfer through contract changes	Make changes in contracts to transfer risks to other actors in the supply chain	Consequence
Quality assurance	Both internal and to key suppliers	Scenario
Quality check	Must be done either inside the organization or at the supplier	Scenario
Quantify	Always try to quantify the risks in order to handle them more efficiently by other risk management methods	Consequence

### 3.3.5 Risk Monitoring

The last process in the *SCRM* is Risk Monitoring, where the purpose is to secure continuous improvement in the Risk Management, but also to keep the risk management updated by checking if risks eventually can be “retired” or if some risks that are critical for the existing *SCRM* model. These reviews of the *SCRM* should be done periodically to ensure continuous improvements in the risks, responses and plans. (Waters, 2007; Musa, 2012)

### 3.3.6 Problems with *SCRM*

The authors will in this section shortly present common difficulties with having a well integrated *SCRM*, according to Waters (2007).



- To give involved people the *knowledge* about the importance of risk management and how to work properly with it.
- To be clear with who has the *responsibilities*.
- Most organizations believe that their own risk stem from their partners and they will therefore not *tackle their own risks*.
- When a risk reduction results in *unequal benefits* in the supply chain it will often cause compromises.
- There will often be *trust* issues between partners in the supply chain.
- *Resources* can be hard to set aside for *SCRM* activities because the results from it is uncertain. This is often a problem for small and medium sized companies.
- *SCRM* requires much more *communication* between all parts in the supply chain.
- Many organizations are nervous when it comes to visibility and *sharing information*, which is essential in *SCRM*.
- The *terminology* is also often a problem when different organizations are trying to cooperate, because companies tend to use their own terminology.
- Organizations often use *different strategies and operations* that make it more difficult when trying to cooperate.
- Risks has a way of *expanding* throughout the supply chain.
- There is always an inertia when it comes to changing organizations.
- To get all parts of the supply chain aware of the importance of *training* their staff in *SCRM*.

### 3.4 Tools

This section will cover detailed descriptions of theories around tools that are commonly used in *SCRM*. The tools are rather presented since they have their counterpart tool in the risk management work at Scania, see figure 7. The two tools, used at Scania, that are standardized enough to have a counterpart in the literature, and will therefore be theoretically described in this section, are:

- Risk assessment (called *First assessment/Audit* at Scania)
- Business continuity planning (*BCP*)

The business interruption study supply chain (*BISSC*) and Purchasing On Line (*POL*) are the two tools that is not presented in the frame of reference, since they are developed inside Scania and therefore they can't be compared to any relevant theories in the literature. The amount and kinds of tools will be limited to these four presented in figure 7 that are used at Scania today, according to directive 4 in section 1.5 Directives and limitations.

#### 3.4.1 Risk assessment

Techniques for assessing different kind of risks at the supplier's production site, mentioned in the business introduction, exist within Scania today and are called "*first assessment*" or "*audits*" depending on if the suppliers delivers to Scania for first time, see figure 7.

The literature describes similar ways to proactively assess risks. Scorecards, self-assessments, process *audit*, certifying designated representatives within the supplier organization are good examples of that according to Zsidisin et al (2004). Even Kraljic (1983) mention in his article that a lot of firms assessing supply risk when evaluating potential suppliers, both new suppliers can be assessed as well as former with new processes or

products. In general can the purchasing organization, in a proactive way, assess both impact and probability of supply risk. Authors are agreed, concepts such as probability and impact describes risk (Zsidisin 2004; Hallikas et al 2002). Probability describes further is defined as how many times a devastating event occur while impact refer to the significance of a loss in the organization. The same authors therefore defines a high risk when an event has high likelihood to occur which will imply big consequences for the firm.

Zsidisin et al (2004) says the research about risks connected to inbound supply is not very investigated in the literature today but since the consequences may be devastating is it very important for a lot of firms. Risk assessment can, as earlier described, be performed in a various of ways. Steele and Court (1996) present one example, where step one is to estimate the probability of an event occurring. Estimation of how long the duration time of an event can be is the second step and the third step is to approximate the impact of a potential risk. Another example of a risk assessment is one developed by Microsoft which instead focus and cover 19 potential risk factors divided into four families: infrastructure, business controls, business value, relationships. All these families and risk factors will be covered during a risk assessment and will then be weighted depending on importance for the company (Zsidisin et al, 2004)

### **3.4.2 Business continuity planning (BCP)**

Techniques for proactive planning of actions in a disaster recovery situation, mentioned in the business introduction, exist within Scania today and is called “business continuity planning”, see figure 7.

Business continuity planning is the set of processes by which the company prepares for unplanned events. (Jrad, et al. 2004; Herbane, et al. 2004; Colicchia, et al. 2011). Waters (2007) is using almost the same words in his introduction to business continuity management. The difference is that business continuity management is the knowledge and business continuity planning is the verb according to work with continuity management activities. Hereafter will the authors use business continuity plan as the term when speaking about the result of the business continuity planning.

It will be an effect of good work first when the disaster occur why managers tend to ignore or defer improvements or creation of a plan during the year. (Baker & Writer, 2012) Even Jrad et al (2004) highlights that business continuity planning is an activity that takes place before an actual disaster occur.

An approach to do a continuity planning should, according to Jrad et al (2004), contain following six practical phases:

- Plan validation
- Risk assessment
- Business impact analysis
- Plan design and development
- Plan testing
- Plan maintenance

The plan starts off with learning the baseline and the company before it goes on to the risk assessment and business impact analysis stage where all potential risks and its impacts should be stated. Thereafter should a recovery plan for identified risks be presented before

testing and maintenance of the continuity plan takes place. (Jrad, et al. 2004) For doing the risk assessment should all parts of the business be included such as details about human safety, storing of data, facilities, operating system, application system, policies and procedures. (Jrad, et al. 2004)

Relative to Jrad et al (2004) does Water (2007) have a very similar approach to set up a more detailed business continuity plan, based on the standard *BS 25999*. Water (2007) does not just mention practical stages to do a business continuity plan, he does also go over, in detail, what should be considered and mentioned in it. As Jrad's (2004) approach is Waters' (2007) approach also divided into six different practical phases which follows below:

- Initiate the business recovery plan process
- Define requirements and develop strategies to achieve them
- Assess the risks
- Prepare the business recovery plan
- Implement the business recovery plan
- Maintenance of the existing plans

Activities in business continuity planning, according to Waters (2007) is to get a sponsor within the company, form a team, recognize the need, acquiring resources and getting all the needed approvals within the company. During the following phase does the requirements need to be defined and at the same time have a long-term aim, which are supposed to fit with other business strategies. During the risk assessment is an identify-analyze-respond approach often used. It starts with identification of vulnerable operations in supply chain which are critical for quality issues or delivery problems. It is hard to identify all risks why it sometimes can be easier to just identify where in the supply the critical risks are. The work continues with analyzing the impact of each single risk identified before designing of option for dealing with each risks. Afterwards does Waters (2007) say that all critical key operations identified and how they are supposed to be dealt with are specified and presented in a business continuity plan. Even though the business continuity plan is planned proactively it is still executed reactively and the theories on that subject will therefore be presented in section 3.5.3 Business continuity plan

### **3.5 Crisis management**

The definition of a crisis is, according to Booth (1993 p. 86): "A situation faced by an individual, group or organization which they are unable to cope with by use of normal routine procedures and in which stress is created by sudden change."

Shao and Dong (2012) describes the importance of separating the terms *proactive* and *reactive* when managing a disaster. Crisis management will from now on be the definition of all reactive work with reducing the consequences regarding natural disasters.

The authors of the thesis think Wallace and Webber (2011) describe the challenges of a disaster in a very detailed and chaotic way. Wallace and Webber (2011) express how chaotic an emergency situation can look like when:

- Customer expect delivery as it wouldn't have been any disaster
- Employee will help but don't know what they can contribute with

- The executive team must focus on communication with media and overall communication in the company
- Someone needs to take care of injured
- On top of that will the insurance company ensure the facilities are untouched in order to review the damage.

The list describes how problematic it can be to get people and the entire company to focus on the operations recovery. (Wallace & Webber, 2011)

According to Musa (2012) taking immediate action after a disaster will give a better result than if there is a delay in taking action. A quick reaction time could further reduce disruption impacts (Musa, 2012). An excellent example of that is shortly presented in Shao and Dong (2012) article about the Nokia-Ericsson case as described in section 3.3 Supply Chain Risk Management (SCRM). In this case both had the same lightning bolt exposed supplier of one component but treated the disruption in various ways. Nokia found alternate sources before Ericsson which implied that Nokia won market shares during the crisis while Ericsson later on retreated from the phone market. (Shao & Dong, 2012)

Although every disaster is unique, planning and preparation can anticipate many issues that may come up (Schneid & Collins, 2000). Even though a crisis has occurred before, organizations don't have the ability to make the changes necessary to avoid the same kind of crisis in the future. One reason is underestimation, to plan for the easiest option instead of the right one. Another reason is that the employees learn the wrong lessons. (Schneid & Collins, 2000)

There is no way in which an enterprise can vaccinate themselves to become immune to crisis. Even in the most stable environment there are always potentials for rapid change that can lead to crisis, and it is often the firms that have "invested in certainty", and therefore are unable to respond quickly, that suffers the most. (Booth, 1993).

The authors have seen the following three key drivers in the literature for succeeding in a crisis situation, which are further described below:

- Importance of communication
- Forming of a crisis management team
- Having a business recovery plan

### **3.5.1 Importance of communication**

When studying crisis management there are, according to Musa (2012), two important aspects that needs to be considered: the dynamics of supply chain information flow and the behavior of supply chain entities towards disruption. According to Barton (2008), a good and well prepared communication system is very important when it comes to quickly solving a crisis. Information flow is often transmitted throughout the network, resulting in a continuous influence on individual entities after any change occurs. In addition, each entity reacts differently when it identifies disruption in information flow. This variety of reactions further influences the information flow and may also contribute to the disturbance of information. (Musa, 2012) From what Musa (2012) and Barton (2008) said in their articles can the communication in a crisis really be highlighted as an important attribute for succeeding in a crisis.

### 3.5.2 Forming the crisis management team

Another significant action to do quickly after an emergency arise is, as Wallace and Webber (2011) mention, to roll out the crisis management team. In a disaster situation it is as earlier described hard to know who are responsible to do what why the crisis team is appointed. The team should, according to Wallace & Webber (2011), contain of a small group with different tasks. One should be a member of the R&D team which knows the technical issues involved. Another important person in the team is someone with authority who can allocate resources quickly if needed. A legal counsel can also be a vital part of the team who know the legal issues regarding the contract.

There are different views of which should be included in a crisis management team. According to Schneid and Collins (2000) there are five functional positions in an organization that need to be allocated immediately after a disaster: Command, operations, planning, logistics and finance. *Command* is the function that directs the overall incident. *Operations* is the function that is responsible for implementing the tactical objectives directed by the command function. *Planning* is the function that gathers and analyzes information to be able to forecast the impact and to change the plan of action in order to make the plan as successful as possible. *Logistic's* function is to ensure that the resources will be continuously available when they are needed. Finance is finally a function that only gets allocated in major disasters and the purpose with this function is to assist with financial planning and regulatory issues. (Schneid & Collins, 2000)

When selecting the people responsible for the continuity plan, different results can be achieved depending on the formed group of people. According to Schneid and Collins (2000), there are some guidelines that should be followed to optimize the results:

- The team should have representation from many different groups and areas within the organization. This is good because the group has interests and knowledge from different parts of the company which leads to broader knowledge and each area will bring unique challenges which creates a solution that benefits the whole organization.
- Include the people that knows the operations and processes best. This is important in order to take advantage of the expertise available inside the organization.
- Include a representative from upper management to have overall advisory responsibility. This will show management commitment which will help to provide the budgetary resources required .

### 3.5.3 Business continuity plan

Even though the business continuity plan is planned proactively it is still executed reactively and theories about that will therefore be covered in this section.

Waters (2007) describes a framework for how the recovery work should look like, which starts off with ensuring physical safety for all employees of the company. He also highlight how important it is to always have health and welfare as the first concern during a disaster. The second most important issue is the protection of facilities and assets which is crucial for a quickly recovery before the work to return a minimum acceptable level of service preferably without affecting players in the supply chain. After reaching deliveries to a minimum level is it time to work externally, in a collaboration with partners to re-establish the appropriate service to customers. Restoring of full operations should thereafter take place in a cost effective way by in-house the business with partners. (Waters 2007)

Waters (2007) suggests in his article what should be contained in a business continuity plan. A statement of when the recovery plan should be activated is of importance and which event that constitute a risk enough to trigger the action described in the continuity plan. Roles within the organization responsible for each action in the continuity plan is another important part to contain. Waters (2007) also highlight how important the communication is during a crisis event. The business continuity plan should therefore contain the routing of communication. Other procedures Waters (2007) highlights are actions for saving of backup data, handle public relations, moving manufacturing and stick to a recovery checklist. It is also of importance that all supporting functions know their roles and responsibilities. (Waters, 2007)

Waters (2007) also highlight the importance of testing the continuity plan to emphasize problems and weaknesses for a suggested risk. In specific cases such as new suppliers, sites, processes, products or other changes should the continuity plan be evaluated and maintained. Baker and Writer (2012) says in their article that auditors nowadays focus on testing of continuity plans, the last time updated and which scenarios it covers.

Virginia (2011) agrees with Waters (2007) in many cases when it comes to what should be contained in a business continuity plan. For instance do both of them see the importance to have explicit roles and responsibilities in an disaster situation. They do also go along with the importance of testing the plan. Virginia (2011) has on the other hand seen some other elements, which Waters (2007) not saw, that should be included in the plan. Funding information is an example of that, salary and supply expenses ready to offer for recovery of a crisis event. Another example Virginia (2011) mention is a priority of in which order the different tasks should be executed.

Paton D (1999) highlights another interesting fact in his article, backed up from other authors, that a business continuity plan can be done from anyone in the company but has to be familiar to and accepted by someone who are required to act on them. Baker & Writer (2012) covered in their article how to get executives and the entire enterprise to understand the importance of a business continuity plan and also how to get them to do something about it. A business continuity framework from Water's (2007) theory can be found in Appendix B.

#### **4. Specification of task**

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*The purpose of this chapter is to specify how the authors have broken down the study to be able to answer to the study's purpose. The chapter begins by introducing the reader to the system perspective, that is the perspective the authors used in this study. This perspective is then the background to the analysis model that is presented. This model then works as a foundation for creating the precised questions that need to be answered in order to fulfill the purpose of the study. This chapter ends with a presentation of these questions and how they are rooted in the business introduction, the risk and crisis management theories and the analysis model.*

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## 4.1 Perspective

Björklund and Paulsson (2003) assert that people deal with tasks differently depending on which perspective or mindset one has. The same authors also mention three of those perspectives: the entrant perspective, the analytically perspective and the system perspective.

People who think the human and the reality affect each other have the entrant perspective and they believe the reality can be described various depending on different experiences and philosophies.

Another perspective is the analytical perspective, which is when a person describes the reality objectively without room for any subjective experiences. This kind of person is convinced that everything in the reality has a cause-effect relationship. The reality can be divided into parts and the sum of these parts is equal to the reality.

The third perspective that Björklund and Paulsson (2003) mention is the system perspective. When using this perspective the reality is seen as a set of parts that are linked and dependent of each other (Björklund, 2012). People with this perspective also have an objective view on the situation but, unlike people with the analytical perspective, they think that the reality is *not* equal to the parts that the reality is divided into. Because of synergy effects, the parts of the reality are often *more* than the reality itself. According to people with synergy perspective the relationship between the parts is just as important as the parts themselves. It is therefore important to find relations and connections between the different parts of the system in order to understand the big picture. (Björklund & Paulsson, 2003; Björklund, 2012)

The authors have an objective view on this study and are convinced that synergy effects, relations and connections will affect different parts of the study in a way that makes the sum of the parts greater than the reality. Therefore, this study is carried with the system perspective. Using the analytical perspective would have given sub-optimizations on the parts of the system instead of optimizing the system as a whole, which is not relevant for this study. Likewise, a use of the entrant perspective would not be relevant, because the study in that case would have been assumed by the authors' experiences and views.

Before starting to use the system perspective it is important to get a basic knowledge about it, in order to understand the system's relations and connections to then be able to identify an appropriate course of action. It is for example essential to understand the interactions between the parts of the system before performing a change in one of the parts. (Björklund, 2012) This introduction of the system perspective is presented in the section below.

## 4.2 The system perspective

Björklund & Paulsson (2003) and Björklund (2012) clearly describe the importance of having a strict description of the studied system and its delimitations. A description of the studied system and its delimitations is described in figure 10 below.



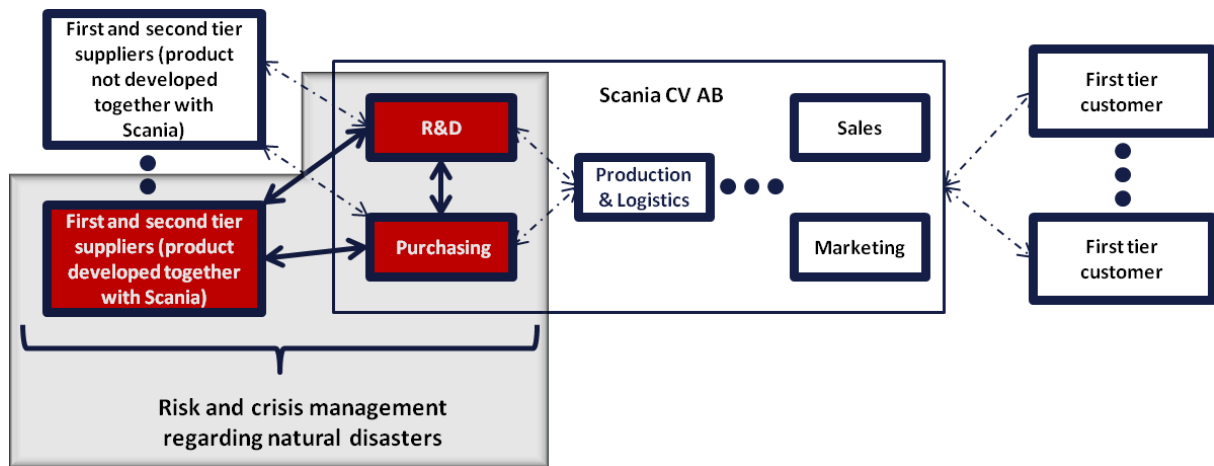


Figure 10: The studied system

The grey area in figure 10 represents the studied system. The system includes first and second tier suppliers of products developed together with Scania, Scania's purchasing department, Scania's R&D department and all relations and flows between them. The system also includes Scania's risk and crisis management regarding natural disasters over these parts and its material and information flows. The purpose is to improve the already existing framework for risk management activities, but also to create a new framework for crisis management activities. These system boundaries are clearly described and motivated in section 1.5 Directives and delimitations.

A description of the system is preferably built up systematically by identifying all parts and interactions of the studied system. Some parts that should be taken into account in all system descriptions are the goal or purpose of the system, the system's resources, the system's stakeholders and its activities (Björklund, 2012). Churchman (1984) mentions similar parts that need to be established before implementing the study: the system's objectives, environment, resources, components/activities and management. These parts are described below in section 4.2.1 - 4.2.6.

#### 4.2.1 The system's purpose

The purpose, goals and objectives are set from the needs of the interests of the system. (Björklund, 2012) It is important to have goals in order to be able to measure the performance and to see if the goals were fulfilled. (Björklund, 2012; Churchman, 1984)

The purpose of this study is to find improvements in Scania's risk and crisis management work regarding natural disasters affecting their suppliers. This is described further in section 1.2 Purpose.

#### 4.2.2 The system's resources

Resources could be for example competence, material, equipment, management, control, policies, data, programs, economical resources or personal resources. (Björklund, 2012) Resources are things that can be affected or changed by the system. (Churchman, 1984)

In this study, the most important resources are the knowledge and competence of Scania's employees inside the system and their relations and connections with the suppliers, but also the power of Scania's IT-system is a good resource. Other resources inside the system are buildings, economical resources, data, material, equipment and Scania's management.

#### **4.2.3 The system's stakeholders**

The stakeholders of the system are all of those who has requirements and interests on the system's performance according to their needs. Typical stakeholders are the customers/owners of the system, the users and developers of the system or authorities that sets the rules and parameters of the system. (Björklund, 2012)

In the system of this study, the stakeholders are Scania's purchasing department, top management, R&D department along with the first and second tier suppliers for automotive products developed together with Scania.

#### **4.2.4 The systems environment**

It is important to not see the system as an autonomous unit and therefore only focus on the inside of the system. (Björklund, 2012) The environment of the system represents everything outside of the system boundaries. Even though these factors are outside the system, they still affect the system largely. (Churchman, 1984)

In this study, the most affecting factors outside the system is Scania's top management, who has to accept a lot of the changes and decisions made at Scania before they can be implemented. The supplier base and their properties and choices are also strongly affecting the system and the same applies to local governments and their changes in legislations. The production and logistics departments within Scania are also very influenced by the risks the studied system is facing. The authors are therefore aware of the risks also affecting production but will not include them in the studied system since the study will not cover how the production and logistic department work with these risks.

#### **4.2.5 The systems components and activities**

The components of the system consists of the activities made with help from the system's resources. Examples of activities are transportation, storage and handling. (Björklund, 2012) As described in section 4.1 Perspective, it is important to not just look at the different parts of the system, but also focus on the activities between them in order to find the optimal solution. (Churchman, 1984)

The risk and crisis management strategies covered in this study are extensive and they don't only cover the different affected units of the system, but also all the activities and flows between the units.

#### **4.2.6 The systems management**

The management of the system is the people responsible for setting the goals, allocating the resources, controlling the system performance and also making sure that the guidelines are followed in order to achieve the goal. (Churchman, 1984)

In this study the management of the system is Hanna Johansson, who is Scania's supervisor for the study.

### **4.3 Specific questions**

To concretize the study and to help the authors to collect the empirical data needed for proceeding with the analysis will questions be formulated and mentioned below. The business introduction, describing how Scania works today, together with the frame of reference, describing established and accepted theories, will be a basis for the questions covering the risk management work. Theories about crisis management strategies are rarely

described in the literature and a crisis management framework is not very detailed within Scania today which makes it challenging to concretize the problem into several questions. The questions for the risk management work is formulated in section 4.3.1 Supply chain risk management (SCRM) while the questions for the crisis management work is formulated in section 4.3.2 Crisis management. All these questions together give the authors a platform to answer the two main questions presented below in order to fulfill the purpose of the study:

The purpose of the study is to *improve* the *proactive* and *reactive work* at the purchasing department within Scania CV AB in order to reduce the *risks* and the *economic consequences* that occurs due to *natural disasters* affecting their suppliers.

As Jrad et al (2004) mention, sooner or later all businesses will experience a disaster, where the goal only can be to reduce the economic consequences by being well prepared. One approach for being prepared for different kind of risks is Musa's (2012), identification of risks before the evaluation and estimation can take place. When the risks are mapped, the control of them can take place by both mitigation and monitoring. (Musa, 2012) This approach will help the authors to improve the already existing supply chain risk management (SCRM) framework and will therefore be used as the strategy for building up the question base to answer question 1, that is:

*1. How can Scania improve their risk management work for reducing risks regarding natural disasters?*

A quick reaction time after a crisis can reduce the disruption impacts, according to Musa (2012). It is therefore of importance to have a proven plan to use in a crisis situation. Since Scania don't have a very detailed crisis management framework today, question 2 be the following:

*2. How should the crisis management work be performed by Scania in order to minimize the consequences after an event of a natural disaster?*

#### **4.3.1 Supply chain risk management (SCRM)**

The answers to the questions presented in this section will be analyzed in order to answer question 1, that is: *How can Scania improve their risk management work for reducing risks regarding natural disasters?*

The structure for building up the question base in the supply chain risk management (SCRM) section will follow the structure presented in Musa's (2012) framework, that includes the five following stages of SCRM:

- Risk identification
- Risk estimation
- Risk evaluation
- Risk mitigation
- Risk monitoring

The questions covering each stage will be presented in section 4.3.1.1 – 4.3.1.5.

### 4.3.1.1 Risk identification

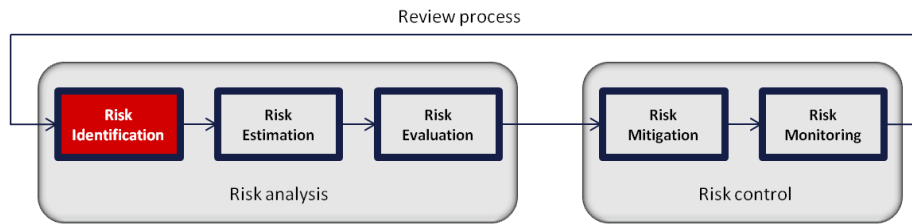


Figure 11: The risk identification process in Musa's (2012) SCRM framework

Figure 11 above shows where the risk identification process is presented in Musa's (2012) SCRM framework. Musa (2012) uses the term risk identification activity in his dissertation "Supply chain risk management" while describes the importance of risk management. According to Musa (2012), is risk identification defined as an activity trying to identify possible causes of risk events. Based on Musa's (2012) definition is it of importance for the authors to know which activities are important when it comes to identifying risks regarding natural disasters and lead to following question:

1A. Which activities, connected to risk identification, are used within Scania today?

There are a lot of risks that can affect both the company and the supplier but also risks that occur outside of the supply chain which can't be influenced. Waters (2007) called these types of risks internal and external risks. Supplier and customer do not face the same risk since it is internal to the customer when it is external to the supplier. Chopra & Sodhi (2004) agree with Waters (2007), there is different kind of risks which, in this case, must lead to exposure of both disruption and delay risk. The BCP is for example carried out on the supplier but it is not clear for the authors if it is carried out on Scania which is interesting to investigate further.

1B. Which of the activities, mentioned in the answer to question 3, are applied on the supplier and which are applied on Scania?

Disrupted or delayed deliveries might occur according to Chopra & Sodhi (2004). Continuous can a natural disaster be a trigger of that. Scania has today some different tools, according to figure 7, to identify risks nevertheless Scania has been threaten by disrupted and delayed deliveries due to natural disasters. In this study, the authors wants to investigate further in this matter why following question is qualified.

1C. Which are the deficiencies in the risk identification activities regarding natural disasters?

### 4.3.1.2 Risk estimation

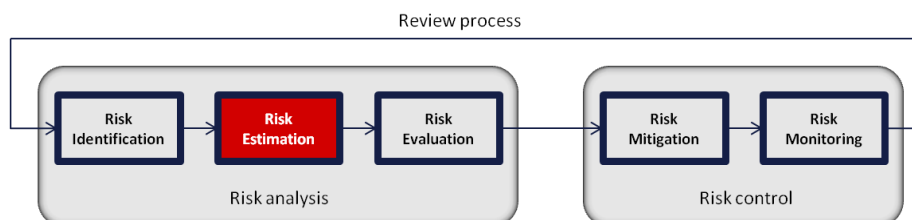


Figure 12: The risk estimation process in Musa's (2012) SCRM framework

Figure 12 above shows where the risk estimation process is presented in Musa's (2012) SCRM framework. Manuj & Mentzer (2008) and Musa (2012) assert risk estimation is used to assess three dimensions. The likelihood of the risk, the consequences it creates if occur

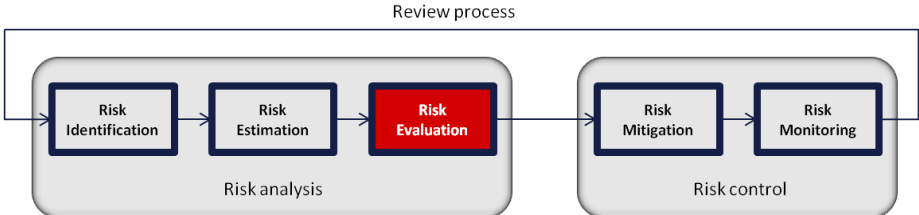
and the detection time. Likelihood, consequence and detection time is just what these authors highlight as important dimensions to estimate risks. The authors are unfamiliar with how and when Scania estimate risks which imply following question:

1D. How are the identified risks estimated?

Disruption threats due to natural disasters have occurred within Scania according to Johansson (2013). How the risk estimation activity not prevented these events will be answered in subsequent question:

1E. Which are the deficiencies in the risk estimation activities regarding natural disasters?

**4.3.1.3 Risk evaluation**



**Figure 13: The risk evaluation process in Musa's (2012) SCRM framework**

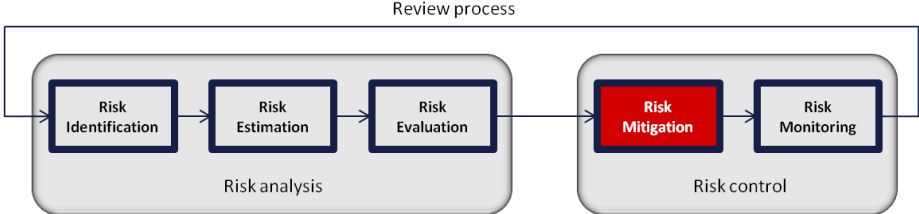
Figure 13 above shows where the risk evaluation process is presented in Musa’s (2012) SCRM framework. It is useful for a company to have an order in how they prioritizing the different risks they are exposed for. Paulsson (2007) and Waters (2007) suggest a method of a matrix with a visual result. The prioritizing order is, according to Musa (2012) important in order to know the amount of attention put on every single risk which leads us to the questions:

1F. How are the identified risks evaluated or prioritized?

Disruption threats due to natural disasters have occurred within Scania according to Johansson (2013). Why the threat occurred may refer to lack of prioritization of different risks identified. Following question will investigate what can improve the prioritization:

1G. Which are the deficiencies in the risk evaluation activities regarding natural disasters?

**4.3.1.4 Risk mitigation**



**Figure 14: The risk mitigation process in Musa's (2012) SCRM framework**

Figure 14 above shows where the risk mitigation process is presented in Musa’s (2012) SCRM framework. Musa (2012) describes risk mitigation as the process to handle risks in different ways by reducing, transferring, eliminating, subdividing or accepting. Another author, Waters (2007), mention his ways of handling risks, act or ignore. Paulsson (2007) has a completely different mindset when it comes to risk mitigation techniques why it is of

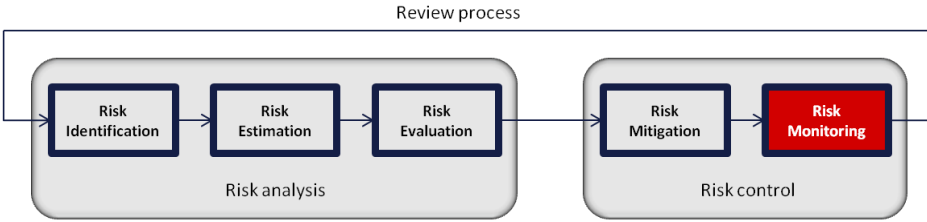
importance for the authors to investigate further which techniques are used and can be applied to Scania.

*1H. Which methods are used by Scania to mitigate the identified risks connected to natural disasters?*

Johansson (2013) express Scania have experienced some disruption threats due to natural disasters which imply the risk mitigation did not work properly. The authors learned from Musa (2012), Paulsson (2007) and Waters (2007) the importance of mitigate the risks why following question is interesting to get answered:

*1I. Which are the deficiencies in the risk mitigation activities regarding natural disasters?*

**4.3.1.5 Risk monitoring**



**Figure 15: The risk monitoring process in Musa's (2012) SCRM framework**

Figure 15 above shows where the risk monitoring process is presented in Musa's (2012) SCRM framework. Musa (2012) and Waters (2007) mention how important it is to keep the risk management updated and also secure the continuous improvement. According to section 2.2.2 Scania Production System (SPS) is continuous improvement a part in Scania's overall strategy. New risks can arise whenever why it is of importance to do reviews periodically according to Musa (2012) and Waters (2007). Since the authors don't know how Scania today works with risk monitoring are following questions specified:

*1J. How is the follow-up work performed to keep the risk identification, estimation, evaluation and mitigation techniques updated?*

When performing these five above presented stages, it is presented in figure 7 that Scania uses some risk management tools today. In 3.4 Tools, some authors describe their theories about risk management tools in a different way than how Scania practice them which may indicate that there are room for improvements in Scania's tools. Waters (2007) reports and states some problems identified connected to SCRM, it is very interesting to see if Scania have seen the same issues so far. Scania's history, when facing disruption threat events, is another evidence that not makes existing models totally flawless. Following question is therefore essential for the improvement of the risk management models.

*1K. What parts of the risk management tools and models used at Scania today can be improved?*

Ragatz et al (1997) states both pros and cons for having suppliers involved in the development process. It will have impact on the cost, quality and cycle time depending on where in the development process the collaboration takes place. Where in the development process the risk management process takes place will therefore also contribute to how Scania is exposed to risks, which leads to following question:

1L. *When in the product development process are the risk management tools and models used?*

#### **4.3.2 Crisis management**

The answers to the questions presented in this section will be analyzed in order to answer question 2, that is: *How should the crisis management work be performed by Scania in order to minimize the consequences after an event of a natural disaster?*

According to Musa (2012) is immediate action after a disaster vital to survive the disruption impacts. The Nokia-Ericsson case was a good example of that when one crisis management strategy decided the entire outcome. (Shao & Dong 2012) Therefore is the execution of the continuity plan crucial for the outcome after a natural disaster. Waters (2007) reported a disposition for an continuity plan decomposed into different operations. In an event of a disaster at a supplier's production site, Scania employees react differently since the a procedure or framework is not planned proactively. (Johansson, 2013) Today it does not exist a detailed recovery procedure within Scania why following questions are asked:

2A. *What operations are included in a typical crisis management process in an event of a natural disaster that delays the delivery of the product?*

2B. *In which order are these operations performed?*

2C. *Which operations are most critical for the consequences of the natural disaster?*

2D. *Which operations can be improved?*

2E. *Are there typical milestones on the way back to the normal state?*

Wallace & Webber (2011) have another approach than Schneid & Collins (2000) when it comes to allocate resources in an recovery situation. The authors cannot see an explicit best practice method in the literature but understand the importance of having the right formed group. Following questions are made to get different perspectives in this area from the respondents

2F. *Who has the main responsibility for solving the problem?*

2G. *Which employees should be included in the team solving the situation?*

Shao & Dong (2012) highlights the importance of separating the terms proactive and reactive when it comes to managing a disaster, which are defined by the authors as risk management and crisis management. Crisis management strategies can be planned but executed first after a disruption event, one example of that is the preparedness of the business continuity plan. In order to be the best prepared as possible will the authors get following questions answered:

2H. *Which of the crisis management operations can be planned proactively?*

An interview guide that tells the authors what answers are expected from each question can be found in Appendix C. The questions in the interview guide are not necessarily the same as the specified questions presented above. The questions in the interview guide are structured to be asked during interviews, while the questions presented above are structured to fit to the analysis. The questions are however strongly correlated, but the interview questions are more adapted for the interviewee to avoid misunderstandings, but to still get the answers needed for the analysis.

## 4.4 Analysis model

In the recent years, Scania has experienced some natural disasters that have affected their supply chain, which has led to an awakening in improving their risk and crisis management strategies used when fighting these disasters. In this study the authors will analyze the possibilities of improving the risk management work, but also to find a whole new framework for handling the crisis management work in an event of a natural disaster.

As described above, the purpose of the study is divided into two main questions that need to be answered. These two questions are:

1. How can Scania improve their risk management work for reducing risks regarding natural disasters?
2. How should the crisis management work be performed in order to minimize the consequences after an event of a natural disaster?

The questions are built up so that each question require their own analysis. The first question handles the improvement of the already existing risk management framework regarding natural disasters. The knowledge, conclusions and results of that analysis is then the foundation when building up the new crisis management framework. According to Johansson (2013) it is important to understand the risk management work before understanding the needs in the crisis management framework. A simple analysis model can therefore be illustrated as in figure 16 below.

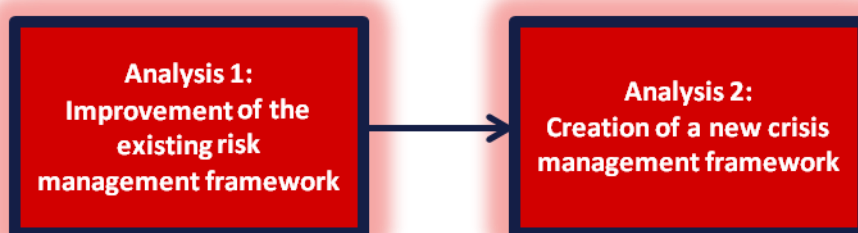


Figure 16: Simple analysis model for this study

### 4.4.1 Analysis 1: Improvement of the existing risk management framework

The first analysis will be done with knowledge from the current risk management work situation at Scania described in section 2.3 Scania's purchasing department, but also with help from accepted theories found on the subject presented in section 3.3 Supply Chain Risk Management (SCRM) and 3.4 Tools. The framework for the analysis will follow the five-step framework presented by Musa (2012) in section 3.3.1 – 3.3.5 and the information collected in section 6.1 Risk management will be based on the tools interviews and case interviews. The possible improvements found with help from the analysis will not be implemented at Scania by the authors, the results will only be given as recommendations for how improvements can be accomplished.

### 4.4.2 Analysis 2: Creation of a new crisis management framework

When the first analysis is done the authors will start with the second analysis, which is based on the current situation at Scania presented in section 2.3 Scania's purchasing department, but also with relevant theories on the subject presented in 3.5 Crisis management. As presented earlier, a crisis management framework barely exists at Scania today, which is



why the analysis will mostly be based on theories and interviews rather than a comparison with today's work, made in analysis 1. To ensure a good foundation for the new crisis management framework, the authors have chosen to supplement the case interviews with a benchmarking study, whose only task is to contribute to the second analysis. The new reactive framework will not be implemented at Scania by the authors, the results will only be given as recommendations for how their crisis management framework should include.

As a conclusion to the chapter, a more detailed analysis model will be presented in figure 17 below. This model includes all earlier described theories and descriptions from chapter 2 Business introduction and 3 Frame of reference, that are used to complete the analyses together with their connection and contribution to respective analysis. To complete the model, the case interviews and benchmarking interviews, and their contributions to the analyses, are presented.

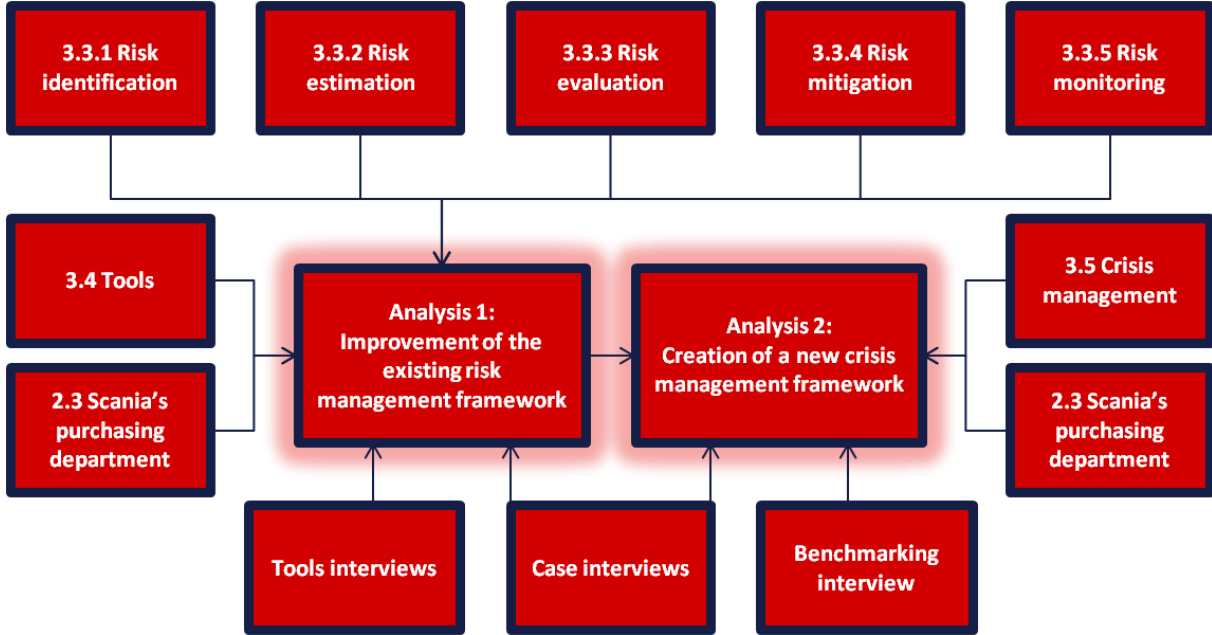


Figure 17: Detailed analysis model for this study

## **5. Methodology**

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*Before entering the data collection phase it is important to be clear about, and to theoretically motivate, the methods used in different parts of the study in order for the study's results to be credible. This chapter will begin with an introduction to the approach of the study and then continue by presenting relevant theories about the methods used. The chapter also includes a discussion about credibility and how the authors have worked through the study to keep a high validity, reliability and objectivity. The last section contains a detailed description of how all parts of the study were performed. These five first chapters will work as the foundation, also known as the pre-study, when the study leaves the planning phase and moves along to the data collection phase.*

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## 5.1 Approach

Björklund and Paulsson (2003) describe that there are several ways to achieve the purpose of a study, but to keep the study credible it is important to motivate the choice of work method. In this section, the authors will therefore present a few alternatives and in what cases they are good or bad.

### 5.1.1 Explorative, descriptive, explanative or normative study?

At first, it is important to look at the existing knowledge within the subject area. According to Björklund and Paulsson (2003) there are four different studies that could be used depending on the extent of existing knowledge:

- *Explorative study* – preferably used when trying to find basic understanding in a subject area with little existing knowledge.
- *Descriptive study* – preferably used when trying to describe but not explain any relations in a subject area with basic existing knowledge.
- *Explanative study* – preferably used when trying to get a deeper understanding and when the purpose is both describing and explaining.
- *Normative study* – preferably used when trying to provide guidance and propose actions in a subject area with some knowledge and understanding.

The purpose of this study was to propose improvements in the risk management work while trying to create a framework for the crisis management work. Relevant risk management theories were common while there were just a few relevant theories on crisis management. Because of the system approach, the purpose was also to investigate relations and therefore it was not a descriptive study. After the introduction the study went to a more explanative phase to get deeper knowledge to be able to find improvement possibilities on the subject. The explanative part of the study was important to get a more credible base for the improvements. As a summery, this study began as an explanative study with an explorative touch on the crisis management part, while it at the end was a normative study.

### 5.1.2 Case study or cross-sectional approach?

According to Lekvall and Wahlbin (2001) a study can also have a *case study approach* or a *cross-sectional approach*. A study has a case study approach if it focuses on a few cases, which are studied on a deeper level without any comparison between the cases or generalizations to larger areas. A study with a cross-sectional approach covers a larger group of cases but the study level is not as deep as in the case study. (Lekvall & Wahlbin, 2001)

The purpose of the study was to find improvements in the daily risk management work and also to build a framework for the crisis management strategies. To be able to find deficiencies in the crisis management system, and to understand how to best work reactively, it is vital to dig deeper. In this study, which was performed on behalf of Scania, the authors focused on three cases covering previous disasters that have affected the organization and studied them deeper to, together with benchmarking and theories, find loopholes in the existing risk management system and to find a new crisis management strategy framework. This case has therefore a typical case study approach.

### 5.1.3 Qualitative or quantitative approach?

Different studies can also be divided into having a *qualitative* or *quantitative* approach and it is mainly the study's purpose that determines if the study is of a qualitative or quantitative nature. A qualitative study aims to create a deeper knowledge about a subject, while a quantitative study includes measurable information. (Björklund & Paulsson, 2003) This study is not measurable and aims to create deeper understanding which makes it a qualitative study. This is also described in directive 5 in section 1.5 Directives and delimitations.

As a complement it is also important to present the, for this approach, best suited methodology that can be used to collect relevant information. These methods will be presented in the following section.

## 5.2 Methods for collecting information

There are a lot of methods that can be used for collecting information and they all have pros and cons. None is better than the other, they are just more or less suited in different situations. The following methods are the most common according to Björklund and Paulsson (2003):

- *Literature*
- *Lecture and conference presentations*
- *Interviews*
- *Surveys*
- *Observations*
- *Experiments*

The authors will also use benchmarking, which is a method used for measuring performance in products, processes and services to leading organizations on the subject (Pryor, 1989), see section 5.2.5 Benchmarking.

However, in this chapter only the methods used in this study will be presented. Because of the approach and the purpose of the study, the authors at first used interviews, observations and conference presentations to get basic knowledge about the organization and the problem behind the study. Literature was then a useful method to collect theories on the subject and to build the structure of the study. In the data collection phase interviews were the single most used method for collecting information. This section will therefore only present literature, lectures & conference presentations, interviews, observations and benchmarking and will thereby omit surveys and experiments. The reasons for using these methods will be presented below.

### 5.2.1 Literature

Literature is a generic name for all written material, for example books and magazines. The great advantage of using this method is that a lot of information can be quickly gathered in a cheap way to build a theoretical framework. One disadvantage for using this method in a study is that literature is secondary information, which means that the information often is developed for another purpose than directly to the current study. The information can therefore be comprehensive or angled, which can have impact on the study's result. The method of collecting this information, for example which words and databases that were used when searching for the literature, can also lead to inaccuracy in the literature base.

(Björklund & Paulsson, 2003) To keep a high credibility on the study, the authors will present a detailed list of how the literature search was performed is presented in Appendix D.

In this study, most of the physical and electronic literature was gathered via the internet site of the library at Linköping University and Libris. The desired books were then collected by a library service at Scania. The articles were found at a database called Business Source Premier. As mentioned above, a more detailed description of the literature search can be found in Appendix D. The results of the search were valued after relevance towards the search word, the credibility of the source and the age of the literature. This was done to make sure to get the most accurate literature for the current study.

### **5.2.2 Lecture and conference presentations**

Information can also be collected from presentations about relevant parts of the study. The pros and cons for this way of collecting information is often identical as presented in section 5.2.1 Literature. It is important to figure out to who the presentation is aimed for and how that can affect the structure of the information. (Björklund & Paulsson, 2003)

In the planning phase of the study, the authors used this method frequently. Many initial presentations about the organization and different job tasks were in form of conference presentations, but Scania's ERP-system also provided conference presentations when searching internally for specific or additional information. The information used were always verified by knowledgeable employees inside the organization in order to ensure the credibility of the information.

### **5.2.3 Interviews**

According to Björklund and Paulsson (2003), an interview is defined as different forms of questionings performed either through direct contact, telephone, SMS or e-mail. The greatest advantage by using this method is that the result is very detailed primary information, which means that the information is collected to be used direct for the study's purpose. The method also leads to deeper knowledge because the investigator can adjust the questions depending on the respondent and his/her earlier answers. The greatest disadvantages is that the method is very time consuming and sometimes expensive if traveling is involved. (Björklund & Paulsson, 2003)

There are three different forms of interviews:

- *Structured interviews* – interviews where all questions and in what order they will be asked are defined before the interview.
- *Semi-structured interviews* – interviews where the subject areas are determined in advance but the questions will be formed and asked differently depending on the respondent's reactions and answers on earlier questions.
- *Unstructured interviews* – interviews in form of a regular conversation where questions are formed as the conversation is in progress.

All these forms of interviews can also be designed in many different ways. Both the numbers of investigators and respondents may vary, and also the number of questions and the duration of the interview. It is also important to store the collected information to get a more complete interview. The way of storing the information from the interviews can be done by taking notes, recording or just memorizing. To increase the credibility of the study, at least two different sources should always store information to avoid misinterpretation and

deficiencies in the information. However, if handling confidential questions it can be better to not record or take notes during the interview because this can affect the answers from the respondent. (Björklund & Paulsson, 2003)

When performing an interview it is very important to be prepared and to have a good and structured question base. Breakwell in Breakwell et al (2000) has set up guidelines for how a question should NOT be asked. The guidelines are:

- NEVER ask two questions in the same question. One bad example is “Do you use *BCP* and *BISCC* in the risk management work?” It will be difficult to know which question the respondent answers.
- NEVER add personal thoughts and assumptions into the question. An example could be “Do you think that your inadequate *BCP* is something that you have to work on?” These questions will affect the respondent’s answer and make it less credible.
- NEVER use difficult words in the questions. The answer to the question “Do you have stringency in your *BCP*?” can be unreliable because the respondent could have answered the question without knowing the meaning of it.
- NEVER ask leading questions. An example is “Is the *BCP* included in your risk management work?” when it should rather be “What is included in your risk management work?” This leads the respondent into a specific answer, which gives the answer less credibility.
- NEVER use double-negations. One example is “Don’t you think that your *BCP* isn’t sufficient enough?”. The answer on this question will not be credible because it can easily be interpreted in the wrong way.
- NEVER ask questions that are too extensive by trying to fit a lot of information in the same question. An example is “Can you tell me all about your risk management activities?”. A lot of necessary information will then not be brought up. Try to divide the question into sub-questions to get more detailed answers.

In this study, direct contact interviews were used to receive most of the organizational information needed in the planning phase that wasn’t covered by conference presentations, but it was also used to obtain all the empirical information collected in chapter 6 Collection of empirical information. All the cases and interview respondents covered in this study were suggested by Scania. There were more cases and interviewees that could have been included in the study, but after a discussion with the supervisor at Scania, the three cases covered were considered best suited for the study, together with the interview respondents with most knowledge about the cases.

To get the initial organizational information the authors used unstructured interviews because none of the authors had much knowledge about the subject and therefore many questions came up first during the interview. During the collection of the empirical information the interviews were more of a semi-structured nature. The frame of reference built up to the questions, which therefore could form a more structured interview. However, during these interviews some uncovered subjects came up, because different organizations and employees work differently. This led to some unprepared questions during the interviews, to receive additional important and relevant information, which made the interviews semi-structural. Both authors were always present at every interview to both ask questions and to store the information by taking notes. A list of the interviews performed in the data collection phase, when they were performed and which specific questions that were answered is

shown in table 2 below. A compilation of methods used for answering the specific questions can also be found in Appendix E.

**Table 2: Interviews performed in the data collection phase**

<b>Interview respondent</b>	<b>Date</b>	<b>Questions answered</b>
Sourcing manager (commodity) for Case #1	2013-03-26	1A-1J and 2A-2H
R&D engineer for Case #1	2013-04-10	1A-1J and 2A-2H
Sourcing manager (commodity) for Case #2	2013-04-08	1A-1J and 2A-2H
R&D engineer for Case #2	2013-04-02	1A-1J and 2A-2H
Sourcing manager (commodity) for Case #3	2013-04-03	1A-1J and 2A-2H
R&D engineer for Case #3	2013-04-09	1A-1J and 2A-2H
SQA manager 1	2013-03-22	1A-1L
SQA manager 2	2013-04-03	1A-1L
Benchmark company	2013-04-18	2A-2H

### **5.2.4 Observations**

Observations can be performed in many different ways. The observer can either be participating in the observed activity or not. The observed object could either be aware of the observation or not. This method is often very time consuming, but the information collected can be more objective than by the other methods presented above. (Björklund & Paulsson, 2003)

In this study, observations were used only in the planning phase, to get additional information and knowledge about the risk and crisis management activities performed at Scania. This method gave the authors a more objective view on the activities, but it also gave the authors deeper knowledge about them.

### **5.2.5 Benchmarking**

The definition of benchmarking is, according to Pryor (1989) and Zairi (1992), to measure business performance against the best competitors in the industry. The purpose is to find how the best companies work to achieve the high performance levels, in order to use this information inside the own organization and in its strategies. This method is thus used to achieve and maintain competitiveness on the market. Pryor (1989) also means that it is often better to benchmark against non-competitors because they tend to be more willing to share valuable information because they don't see the observing company as a competitor, and to share the information is therefore not as vulnerable. However, it is important to find a company that is leading in the studied function. (Pryor, 1989)

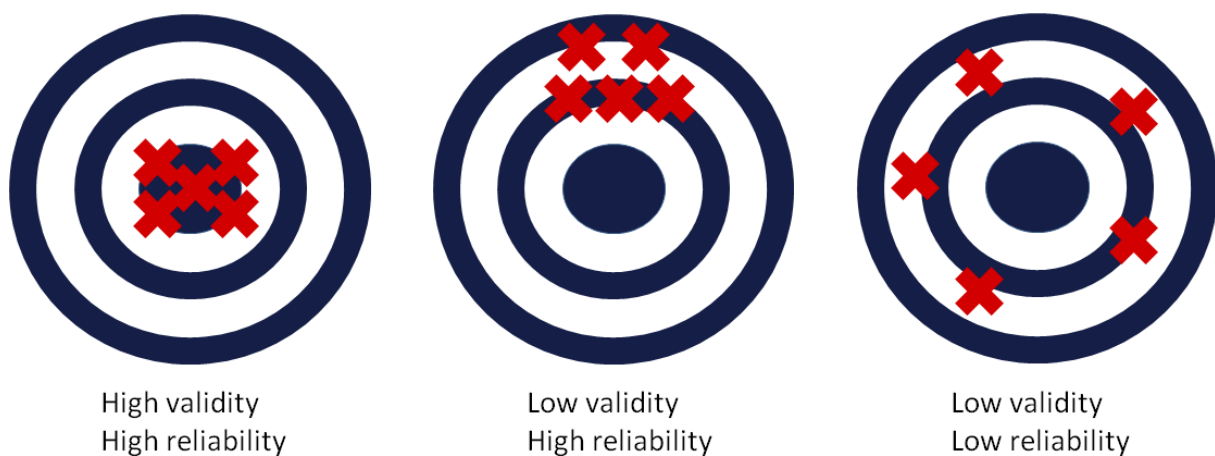
The goal with the benchmarking in this study was therefore to find the best companies within supply chain risk and crisis management, in order to use their strategies inside Scania. The authors were, in this study, strongly focusing on non-competitors but still with similar risks towards their suppliers. The benchmarked companies' products had to be complex, with many components developed together with their suppliers. It was also an advantage if many of their suppliers, because of their geographical position, had a higher risk of being exposed to natural disasters. The authors found a few companies that, according to the authors, fitted into the requirements presented above. However, at the end there were only one benchmarking company who participated in the benchmark study. More details on this can be found in section 9.2 Method criticism.

### 5.3 Credibility

According to Björklund & Paulsson (2003) the credibility of the study depends on three major factors:

- *Validity* – Is the study measuring what it is supposed to measure?
- *Reliability* – Will the same results be given if the research is repeated?
- *Objectivity* – Are valuations affecting the study?

The explanation of validity, reliability and the relationship between those two factors can easier be done by an illustration. In figure 18 below there are three dartboards presented with three different results after throwing five darts at each dartboard. A high validity will be achieved if the dart hits the center of the dartboard, where the center of the dartboard represents what the authors want to measure with the study. The hits represent what is actually being measured with the study.



**Figure 18: An illustration explaining validity, reliability and the relationship between those**

The left dartboard shows a study that measures what it is supposed to measure, even if the research is repeated. The study both has high validity and high reliability. The dartboard in the middle represents a study that doesn't measure what it is supposed to, but it gives the same results when repeated, which means that the study has high reliability but low validity. The third dartboard shows a study with low reliability and low validity, because the results vary with every repetition of the research and the study doesn't measure what it is supposed to measure. (Björklund and Paulsson, 2003)

The goal with a study is always to have high validity, reliability and objectivity. The validity can be increased by e.g. triangulation and avoiding angled questions in the interviews. Triangulation means to use different methods to achieve the same purpose. This can be practiced either by using different sources on the same information (e.g. books and interviews), to let different people evaluate the information, or by using different theories on the same subject. The reliability in a study can also be increased by triangulation, but also for example by asking control questions in interviews to see if the same answers will be given as the first time. The objectivity can be increased by motivating the decisions done in the study and thereby letting the reader assess the study from an objective standpoint. (Björklund & Paulsson, 2003) Objectivity problems are usual in abstracts and summaries, where it is important to have the following things in mind (Björklund & Paulsson, 2003):



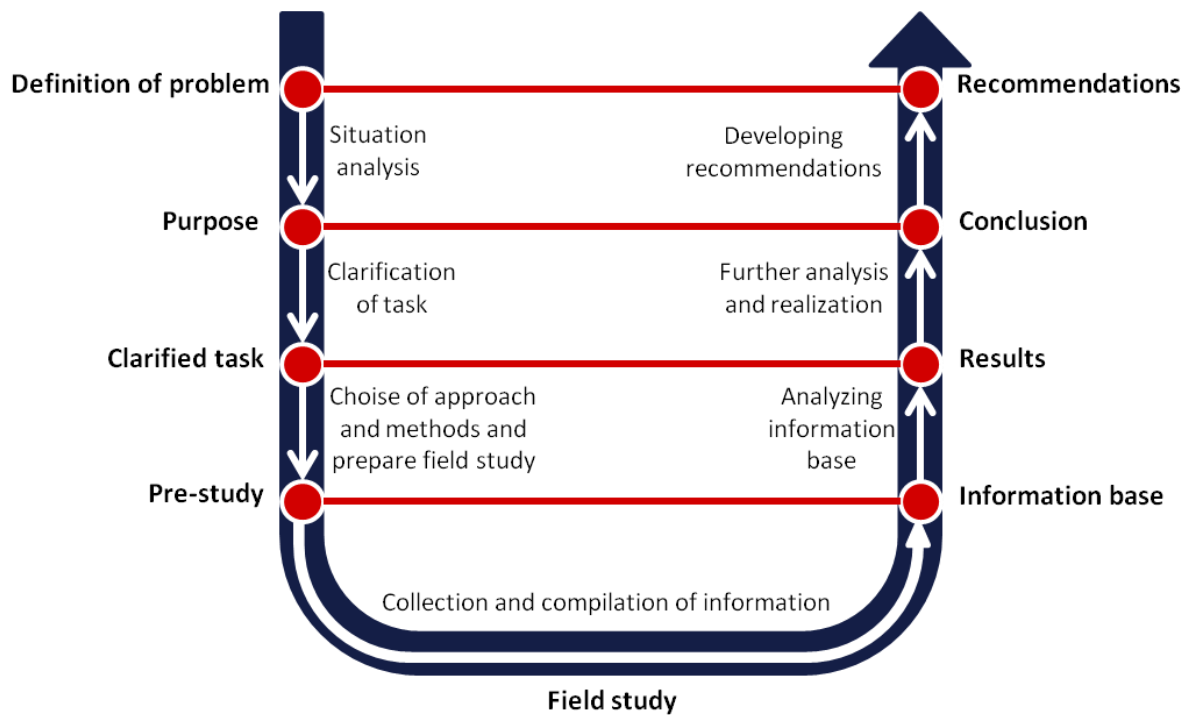
- Avoid factual errors. The information that is summarized has to be correct
- Avoid to only pick out “good” information. To keep the objectivity high it is important to not only choose information suited for the benefit of the author’s own opinion.
- Avoid emotionally charged words and phrases. Phrases like “The employee *realizes..*” or “The employee *claims..*” reduces the credibility of the employee’s statement.

The authors have tried to keep a high credibility on the study by always interviewing more than one person on every case and subject and by establishing theories, questions and methods from at least two different sources when possible, which increased the validity. The authors tried to keep a high reliability by always verifying collected information and results from analyses with employees at Scania, but also by asking control questions to the respondents during the interviews. By motivating the decisions made and by following the guidelines in summaries and abstracts, the authors also tried to keep the objectivity at a high level. Other actions performed by the authors to increase the credibility was to get the specific questions confirmed by the thesis’ supervisor at Scania, but also to inform the interviewees during the data collection phase that the study will not include any information about the interviewees or which supplier that was affected in each case, which means that the study will not reveal any connections between the interviewee and the information given from him/her. Therefore, the interviewee doesn’t need to be afraid of what information to give, and therefore the interviewee gets the chance to answer the questions more trustworthy.

While keeping the above presented information in mind, a course of action has been created based on the study’s approach and methods for realizing the study. This course of action will be presented in the section below.

#### **5.4 Course of action**

According to Lekvall and Wahlbin (2001) it is important to get a grip on the course of action of the study before entering the data collection phase. To be able to choose the best possible methods it is essential to understand all steps in the study, the connections between them and why the steps are needed. A typical process of a marketing study with its steps and connections are illustrated by Lekvall and Wahlbin (2001) and even though this study is a purchasing study, the study process will look the same. The illustration is shown in figure 19 below (Lekvall & Wahlbin, 2001 p.183).



**Figure 19: The study process**

The illustration clearly shows the study process from the upper left corner, going down by breaking down the problem and shaping a pre-study for the project. The pre-study has a purpose to fulfill, connected to the problem definition, with motivated methods and a clarified task. The instructions in the pre-study will then be followed in the rest of the study, which continues with the field study where all information is collected. This information base, which is strongly connected and will answer to what is presented in the pre-study, will then be analyzed to reach the results that will respond to the clarified task of the study. Further analysis and realizations will be done to the results to reach the conclusions that are sought in the purpose of the study. By then developing recommendations from the conclusions, the study will find solutions for the problem that is the foundation of this study, which explains the top red line going between those two steps. (Lekvall & Wahlbin, 2001)

As mentioned earlier, the model in figure 19 above will be followed in this study. With this model in mind, the authors have created a more detailed activity network for how the study will be done. It is important both for the reader, but also for the authors, to have a more precise view of the process and the connections between the activities and thereby understand why all different activities are done. The course of action for this study is shown in figure 20 below.

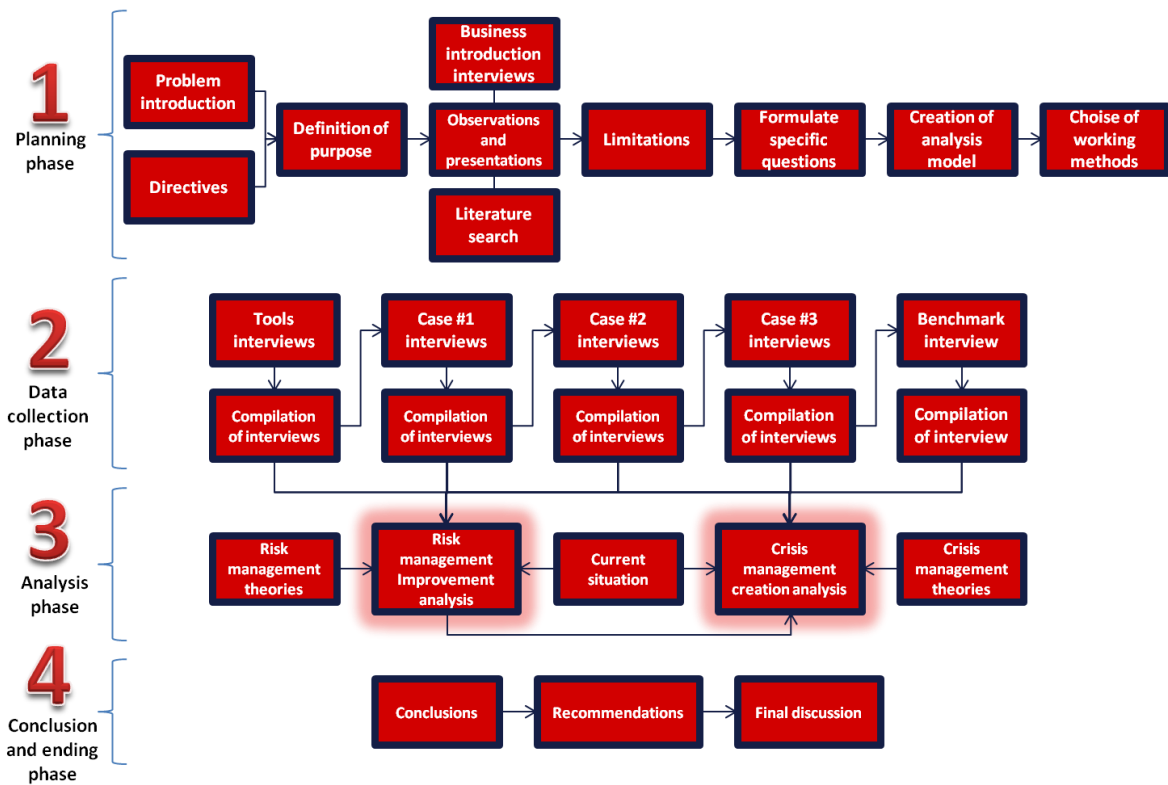


Figure 20: The course of action for this study

The study followed the four stages presented in figure 1, which also can be found on the left side in figure 20 illustrated above. What is not presented in figure 20, but is important to present, is that one phase was always completed before the next one began. Below follows a detailed description of how the whole study process was performed, based on this illustration.

#### 5.4.1 Planning phase

The study began at the time the problem was presented to the authors, which is in the upper left corner on the first step in figure 20. The authors were introduced to the problem and were given directives by Scania, that is the case organization, and this discussion led to the definition of the study's purpose, that is the second step in figure 20. The authors got an introduction to the organization with focus on the purchasing department and their work with tools regarding risk and crisis management. Between these introduction interviews, the authors both collected additional information from conference presentations found in Scania's ERP and searched for relevant theories on the subject in the literature. This information base gave the authors a deeper understanding about the problem which, after delimitating the study, led to specific questions and an analysis model that explains the foundations and connections between the parts of the study and therefore the third step in figure 20 was reached. To complete the pre-study, the working methods that were going to be used in the data collection phase, analysis phase and conclusion & ending phase were established, which ended the planning phase and step four in figure 20.

#### 5.4.2 Data collection phase

The collection of data, performed in this phase, were performed to get the information base needed to be able to fulfill the purpose of the study. As seen in figure 20 above, the phase began with collecting information about the tools used at Scania, presented in figure 7. This

information were collected by direct contact interviews with SQA managers at Scania. Then other direct contact interviews were made covering the three cases. Two interviews were made on each case, one with the sourcing manager (commodity) responsible for the case and one with the responsible R&D engineer. After the case interviews, a benchmark study was made by visiting another organization to perform a direct contact interview. This company was chosen according to the directives presented in section 5.2.5 Benchmarking. The information was compiled after each interview to obtain the information most suited for the study and to see if additional questions needed to be asked. A compilation of methods for answering the specific questions can be found in appendix E.

One important decision, made by the authors, was to always start the interviews by informing the interviewees that the study will not include any information about the interviewees or which supplier that was affected in each case. The motivations for this decision can be found in section 5.3 Credibility. This is why there are no personal information about the employees interviewed in the data collection phase, no detailed information about what had happened in the three cases, and this is also why chapter 6 Collection of empirical information does not include any references. One other reason for not including any information that could indicate which suppliers that were affected in the three cases is because of the commercial confidentiality.

#### **5.4.3 Analysis phase**

In this phase, the compilations from all the interviews were analyzed together with information about the current situation at Scania and relevant theories presented in chapter 3 Frame of reference. The purpose with the interviews about the tools used at Scania was to find loopholes in the existing risk management framework, while the purpose with the case interviews was to see how the risk and crisis management have been performed by Scania in reality, how the different tools worked, and how the different cases were solved. The information from the benchmark study were used to see differences between Scania's crisis management strategies and the work performed by the benchmarked companies. The theories were used to see if Scania's work is done properly according to the theory. The theories, the benchmarking studies, the case studies and the tools interviews were then compared to the current situation at Scania in order to find deficiencies in Scania's risk management, but also to establish a new framework for the crisis management.

#### **5.4.4 Conclusion and ending phase**

The conclusion to this study was to find improvements in the risk management work by analyzing theories, the tools interviews and the case studies, but also to create a new crisis management framework by analyzing the case studies and the benchmark study which then gave Scania a so called "best practice model". The solutions regarding the risk management work were given as recommendations for how to improve their existing work model. The solutions for the crisis management strategies were given as a whole new framework because there were no existing one. At the end, the authors finished the study with a general discussion, together with the employees at Scania, about method criticism, the results and the generalizability of them, but recommendations were also given about further research on the subject.

## **5.5 Methods for answering the specific questions**

This section presents the methods that the authors used to answer the specific questions presented in section 4.3 Specified questions. The first specific question, that represents the first analysis of the study, is answered by analyzing the answers from question 1A-1L. The second specific question, that is the second analysis of the study, is answered by both analyzing the results in the first analysis and by analyzing the answers from questions 2A-2H. A detailed list for how each question was answered can be found in Appendix E.

All specific questions below were answered by using direct contact interviews. Interviews are time consuming, but the information gathered is primary and it is easy to get the information needed if interviewing the right people. It is also easy to form the interview during the process to receive deeper knowledge about the subject, which was needed in this study.

The study consisted of two different analyzes, as earlier described. The first analysis focused on theoretical and empirical differences. The frame of reference was used as a base together with collected data, from both the three case interviews and interviews about the risk management tools used at Scania today, to determine improvements for Scania's risk management activities regarding natural disasters.

The second analysis focused on a theoretically not so explored subject, that is crisis management. The analysis couldn't therefore just use the theoretical framework. Instead was the second analysis more of an empirical comparison where both three different case interviews and a benchmark interview contributed, in order to find a so called "best practice model". The methods for answering the questions for each analysis will be further presented below.

### **5.5.1 Supply Chain Risk Management (SCRM)**

Questions 1A-1L covers the risk management work at Scania. The questions dig deeper into the tools used in the risk management work performed today. In order to find deficiencies in the risk management framework, it is important to have a detailed view of the tools and models that are used and how they work. The authors found that direct contact interviews were best suited for these questions because the authors wanted to get detailed information about subjects that they didn't have much knowledge about prior to the interviews. The interviewees were chosen because they work with these tools in their daily work and therefore have expertise on the subject.

Because natural disasters is a problem at Scania, they have many cases where they have been forced to test how their risk management framework works in reality. The authors found it important to understand how the risk management work was performed in reality, which is why direct contact case interviews were considered to be best suited for answering these questions. Questions 1A-1J were also answered by interviewing two employees from each of the three cases. As earlier presented, the interviewees on each case were the sourcing manager (commodity) and R&D engineer, responsible for the crisis when the case occurred in reality.

The difference between the questions asked during the tools interviews and the questions asked during the case interviews is that the case interview questions were situation based, while the questions for the tools interview were more of a general structure. This was done to obtain both general information about the risk management work at Scania and examples of

how the work is performed in reality. Answering these questions is important in order to understand the risk management work performed at Scania, but also to build a foundation for how to build up the crisis management framework.

### **5.5.2 Crisis management**

The answers to questions 2A-2H represents the base that, together with the results from the first analysis, were used in the second analysis. These questions are only focusing on the crisis management work and because this framework barely exists at Scania today, these questions were not only asked during the case interviews to see how the crisis management work was performed. They were also asked to another company in a benchmarking study, in order to obtain the best information possible to form a framework for how to perform the crisis management work at Scania. These questions are situation based in order to find out how the crisis management framework has been performed by both Scania and the benchmarked companies in earlier situations.

## **6. Collection of empirical information**

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*This chapter includes all information gathered in the data collection phase needed to answer the specific questions presented in chapter 4 Specification of task. The information was collected by using the methods described in chapter 5 Methodology. This information will later be analyzed, together with theories presented in chapter 3 Frame of reference, in order to find the conclusions and recommendations that answers to the purpose of the study.*

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### 6.1 Risk management

In this section, the authors will present how the purchasing department at Scania works proactively to reduce the risks of their suppliers being affected by a natural disaster. The information presented will be from the risk management work performed at Scania in general, but the information was also gathered in the interviews regarding the three cases. The section is not divided into the three cases because the questions asked are not mainly case specific. Instead, the information will be divided into the five stages of SCRM presented by Musa (2012). The stages are illustrated in figure 21 below and the information gathered in each of the steps will be presented in section 6.1.1 – 6.1.5.

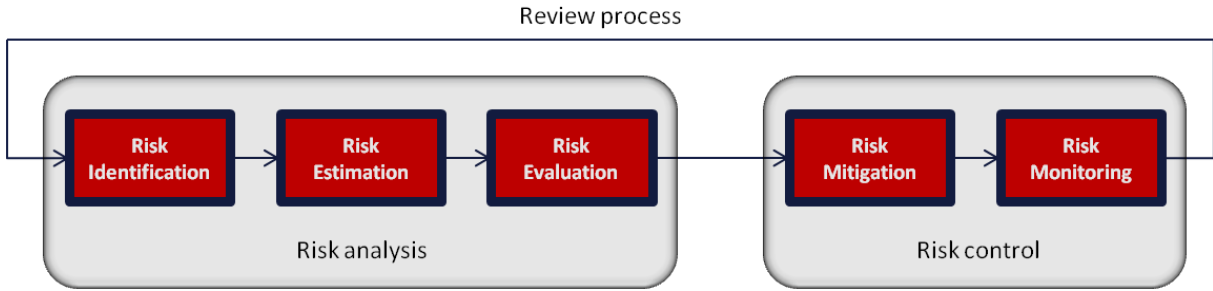


Figure 21: Musa's (2012) framework for risk management

#### 6.1.1 Risk identification

The information in this section is gathered to be able to answer the specific questions 1A-1C, presented in section 4.3 Specific questions.

Some suppliers that Scania is doing business with today have been suppliers for many years and, according to one SQA manager, when Scania chose the suppliers many years ago the visits performed were of a more symbolic character and there were barely no investigation or identification around risks at all. The discussions were only about techniques and processes in the making of the component.

According to some interviewees, risks regarding natural disasters are today identified by using the *first assessment* and the *BISSC*, which are also presented in figure 7. The *first assessment* and *audit* are performed on the supplier. The internal workshop in the *BISSC* is performed on Scania, while the last part of the *BISSC* called "*risk management supplier audit*", is performed on the supplier. The *first assessment* is however the only tool that today is used for risk identification regarding natural disasters before a supplier is chosen, but the tool is sometimes used after choosing the supplier depending on the situation. One of these interviewees said that it is therefore difficult to use risks identified in the *BISSC* analysis as a criteria when selecting supplier, but according to another interviewee it has happened in a few projects that parts of the *BISSC* was performed on the potential suppliers before the supplier selection process.

As said by some interviewees, the *first assessment* is mainly performed by the SQA manager. However, according to some interviewees, the focus by using this tool is mostly on if the supplier can produce the component at right quality and repeatability and not so much on other risks such as natural disasters. Some interviewees say that it would be favorable for Scania if the focus on risks connected to natural disasters would be increased. One employee within Scania also thinks that cost together with performance are the most



weighted criteria when choosing a supplier why risk due to natural disaster are not of greatest importance in this process today.

When it comes to the risk management self assessment, that is a part of the *first assessment*, one SQA manager doubts the results from the risk management self assessment since the supplier will seem to have superior handling of Scania's requirements and that the suppliers fill out the risk management self assessment form in the way they think Scania wants. The SQA manager continues by saying that the most important is that suppliers are honest in the assessment so that problems can be solved together.

According to some of the interviewees, another deficiency that Scania is facing is that all risks are not covered by the tools at every supplier today. According to these interviewees, a solution for this could be to have a more detailed *first assessment* to cover more risks when visiting a potential supplier for the first time. One SQA manager also mentions that the questions in the *BAP* are out of date and an update of the question base needs to be done.

One sourcing manager (commodity) told that earlier, Scania's strategies have pointed towards single sourcing, but lately, the organization have gone towards dual sourcing strategies when possible. The sourcing manager (commodity) continued by saying that sharing risks with dual sourcing may not always ensure the supply to Scania. The more the both suppliers are pressured in negotiations, the more likely is it they have the same sub suppliers and will, in the worst situation, mean shortage for Scania anyway.

Some of the interviewees also stated that many employees at Scania's purchasing department don't know where in the world a component is produced. They continue by telling that it is easy to see the location where the supplier is registered, but the registered address is not always in the same location as the supplier's production site.

### **6.1.2 Risk estimation**

*The information in this section is gathered to be able to answer the specific questions 1D-1E, presented in section 4.3 Specific questions.*

According to some of the interviewees, there is no estimation of the risks performed in the *first assessment* or *audit*. However, according to some of the interviewed people, the risks are estimated in the *risk management supplier audit* that is the last part of the *BISSC* analysis, but not all suppliers gets a *risk management supplier audit* because it requires a lot of resources both from Scania and the supplier.

When choosing which suppliers that requires a *BISSC* analysis the estimation and evaluation focuses on the criticality of the product and the supplier that produces it rather than likelihood and consequence of the identified risks. According to one sourcing manager (commodity), Scania uses the measurement "weeks to full recovery" when checking which suppliers and products that are critical, but they also check how many percent of all Scania's produced units that include the specific component. The sourcing manager (commodity) highlights that there also are other questions that are important to consider, for example Scania's priority from the supplier, which depends on how big the transaction is between the companies. Another thing could be if the supplier only has one production site, which makes it impossible to move the production to another location in case of a natural disaster. A supplier-developed component may also lead to finding alternatives in case of non-delivery. The reason for not

using likelihood and consequence as factors is, according to an SQA manager, because it is very difficult to measure.

The interviews have shown that a supplier's risks are not estimated before the supplier is chosen and, as earlier presented, according to some interviewees there are also deficiencies in the identification of the risks. These interviewees therefore agree that the risk management work can be improved in the work done before choosing a supplier.

### **6.1.3 Risk evaluation**

*The information in this section is gathered to be able to answer the specific questions 1F-1G, presented in section 4.3 Specific questions.*

According to many of the interviewees, there is no evaluation of the risks performed in the *first assessment* either. However, according to some of the interviewed people, the risks are also evaluated in the *risk management supplier audit* that is the last part of the *BISSC* analysis but, as earlier stated, not all suppliers gets a *risk management supplier audit* because it requires a lot of resources both from Scania and the supplier.

During one interview it is stated that the SQA manager is determined that there are improvement possibilities when performing the *first assessment* if the questions from the *BAP* were more standardized. The SQA manager also states that it would be preferred if the results from the questions were weighted because this would increase the possibility of both estimating and evaluating the suppliers' results between each other.

### **6.1.4 Risk mitigation**

*The information in this section is gathered to be able to answer the specific questions 1H-1I, presented in section 4.3 Specific questions.*

During one interview with an SQA manager it was stated that the *audit* is performed on a supplier depending on the suppliers earlier performance towards Scania. However, the performance focuses mainly on process risks and barely nothing on risks regarding natural disasters. According to the SQA manager, Scania also requires that all suppliers have a business continuity plan (*BCP*). Otherwise the most obvious risks are mitigated in the *first assessment*, while other risks are mitigated by performing the *risk management supplier audit* in the *BISSC*.

According to one SQA manager, the corporate risk management department at Scania are supposed to perform the workshop in the *BISSC* tool. One employee was once responsible for developing the *BISSC* tool, but this position responsible for working with this tool is now a vacancy. The SQA manager continues by telling that in some cases, during the *risk management supplier audit*, the sourcing manager (commodity) brings a fire engineer from the corporate risk management department at Scania to investigate the risks regarding fire at the supplier's production site. Some of the interviewees thinks that this *audit* should of course be performed as often as possible and for all Scania's high risk suppliers, but because of limited time and resources, this tool is not performed enough today. One SQA manager also says that if more time and resources were granted, supplier visits and *audits* would be performed more frequently. Therefore, according to the SQA manager, limited time and resources leads to lowering the priority when it comes to risk management.

According to most of the interviewees, one thing that is included in the risk management is that Scania demands that the supplier has continuity plans in case of a disaster. However, according to one sourcing manager (commodity), Scania does not have a detailed crisis plan of their own for how to act in a situation where a supplier is affected by e.g. a natural disaster which leads to non-delivery of the affected component, and as cases have shown, they are therefore often dependent on that the supplier's plan will work. According to one sourcing manager (commodity), the plan is not always analyzed by someone at Scania. However, the employees at Scania always checks that the supplier has an existing plan, even though it is not always analyzed. A risk management specialist would, according to many Scania employees, be useful to coordinate the risk handling at the supplier's site. One sourcing manager (commodity) also asserts that there is no working method implemented at Scania telling suppliers how they should work with continuity plans and what the plans should look like.

### **6.1.5 Risk monitoring**

*The information in this section is gathered to be able to answer the specific questions 1J-1L, presented in section 4.3 Specific questions.*

As stated by most of the interviewees about supply chain risk management, the R&D engineer focus on product quality risks because of their detailed knowledge, while the SQA managers focus more on risks in the processes. When it comes to other supply risks such as natural disasters, the interviews have shown that it is not clear who has the main responsibility. For example, one SQA manager mentions that no one within the purchasing organization works explicitly with these kind of supply risks today.

According to one SQA manager, the *audit* is a tool that is performed depending on how a supplier performs in quality and to ensure that they work with continuous improvements. The SQA manager continues by telling that the *audit* does not mainly focus on risks regarding natural disasters.

One SQA manager says that today at Scania, the employees know that a *risk management supplier audit* from the *BISSE* will result in useful recommendations, but not all of them know how, or have time to work with and follow up these recommendations that are given to the affected suppliers. The SQA manager also says that a deficiency around the *risk management supplier audit* is that only the suppliers required for the *risk management supplier audit* will be given recommendations to work with. Results from the interviews have also shown that monitoring of the risks suffer from limited time and resources.

One R&D engineer also says that after a disaster, an organization often can be afraid to continue working with an affected supplier because of the possible weakness in working with the risks at their site. However, the interviewee says that it can be an advantage to continue with a supplier that have experienced one kind of disaster and showed good result in how they went through it. The interviewee means that in a risk management point of view, it could be good to continue working with these suppliers because they hopefully have increased the awareness and knowledge of their weaknesses after a disaster.

As explained by an SQA manager, the *first assessment* is the only tool that can be used before a supplier is chosen, but sometimes it is performed after. The *BISSE* is continuously performed within Scania including their existing suppliers. The *audit* is also performed

continuously, where the frequency depends on how the supplier have performed earlier, and the *BCP* is something that Scania requires that their existing suppliers have.

## **6.2 Crisis management**

*If a natural disaster is affecting a supplier, an sourcing manager (commodity) stated that the purchasing department have a vital role in solving the situation of securing delivery and maintaining tolerated quality. Today, according to one interviewee, there are no guidelines for how to work in these situations, the behavior is very individual. However, there are some methods that are often used when events occur for a supplier. In this section, the authors will present how the purchasing department at Scania worked reactively when a natural disaster affected their suppliers in the three cases covered in this study. After that, the authors will present how the benchmark companies works reactively with these situations and if they have a detailed framework for the crisis management work. The information in section 6.2.1-6.2.4 is gathered to be able to answer the specific questions 2A-2H, presented in section 4.3 Specific questions.*

### **6.2.1 Case #1**

*The information presented in this section is a collaboration of interviews with employees at Scania that were working with this case when it occurred. In this case, one R&D engineer, one SQA manager and one sourcing manager (commodity) has been interviewed.*

One day, the responsible sourcing manager (commodity) at Scania received a call from a supplier that had been affected by a natural disaster. Their production factory was affected and the work could not continue in the new state, and Scania had no other supplier for this unique product. According to one interviewee, Scania has no guidelines for how to work in a crisis situation when a supplier is affected by a natural disaster but fortunately, the sourcing manager (commodity) had experience from a similar crisis that had happened recently.

Immediately after receiving the call, the sourcing manager (commodity) called affected managers at Scania to inform about the situation. Google was then used to check for news about the disaster to find out where the affected production site could be located. According to one interviewee, it was then important to estimate how much time Scania had before production stop, how much time it would take for the existing supplier to fully recover and start delivering again, and also to find out how long time it would take to find an alternative supplier to implement for this component. To know this it was important to know how much material that was in the material flow of the upstream supply chain. Because these components were shipped by boat, the time to production stop were quite long.

The R&D department worked in close collaboration with the purchasing department through the whole crisis, by sharing information, helping and keeping each other updated on the situation. They immediately tried to understand the situation and gathered relevant information found on the component. According to one interviewee, the employees involved from the R&D department then started checking if there were any alternatives in other brands or at competitors that could fit and they also performed a SWOT-analysis on the alternatives.

As stated by one interviewee, one crisis team was created during this crisis, where the members of the team had different functions. In this team, two parallel activities were performed. This team chose to not let any member of the team to travel to the supplier during this time because they didn't want to stress the supplier even more than necessary. One

activity contained working with the affected supplier to see if their continuity plan were on time and to support the supplier. Four people were included in this activity: the responsible sourcing manager (commodity), SQA manager and their both managers. The other activity was performed by the same sourcing manager (commodity) and SQA manager, but also three R&D engineers and one material planner were included, and the activity included working with finding alternative suppliers. They contacted companies in the same line of business to see which components that were on the market and if they could fit for Scania. They also checked what parts of the product specification that could be compromised if they could find a similar product that could fit into the specification. According to one interviewee, the technical evaluation of the alternatives was the activity that was most time consuming in the process.

The R&D and purchasing department then started contacting potential suppliers. They identified potential suppliers, but encountered different difficulties with these supplier's components, such as not fulfilling specifications regarding geometry and/or performance. At the same time, they didn't want to close any options before the crisis was more stable. However, according to one interviewee, the best alternative is always to try to continue with the existing supplier. The sourcing manager (commodity) also checked stock levels at the supplier and in their logistic flow, to see how much time they had before production stop. The material planning department stopped all spare parts to send everything to the production to maximize the time to production stop.

While the R&D engineer started looking for alternatives, the sourcing manager (commodity) demanded the supplier to create a Business continuity plan (*BCP*) for how and when they should perform different activities to get back to a normal production rate as fast as possible. While the supplier worked with the plan, the sourcing manager (commodity), together with R&D engineer, started looking for alternatives for how to secure the supply to Scania. In the early stage of the crisis, the sourcing manager (commodity) also created a product change request (*PCR*) in order to allocate resources.

One interviewee states that if a supplier goes through a change, consciously or not, they have to inform Scania about the change as soon as possible. This information often flows as a "supply change request" (*SCR*) that is an electronic document sent to Scania with specific data about the change. It is then up to the sourcing manager (commodity) at Scania, responsible for the supplier, to inform and evaluate the effects of this change. Depending on the extent of the effects, the responsible employee can send a "product change request" (*PCR*) to affected employees inside the organization. The *PCR* gets different priorities depending on the severity of the change, and can therefore be taken care of faster if a disaster occurs. However, according to one interviewee, this is not fast enough in a real crisis situation so in case of a disaster, cell phones are more often used to spread the information even faster.

One interviewee states that at the end, Scania found one or two possible alternatives where they negotiated about price and time to production and also bought prototypes and prepared a testing plan. However, as stated earlier, the main strategy for Scania was to support the existing supplier to recovery and re-starting the production throughout the whole crisis.

The team also checked the location of the sub-suppliers to the affected supplier to find out if moving the production site to another location was a good idea, according to what was

suggested in the supplier's continuity plan. Scania got informed that the supplier had another production site at another location. To move the production to the other production site was considered a good idea. The new line was approved by Scania and the production went back to a normal state.

First when the line was approved, the plans with alternative suppliers were closed. The logistic chains were monitored until the crisis was over. The whole case was chosen to be solved without help from the support function *POL*. According to one sourcing manager (commodity) it is not always clear when *POL* should take over a case.

After the emergency was over at Scania, some follow up activities and monitoring of the work done was performed. They gathered lessons learned and the results were stored, but the results were not actively shared to other employees at Scania.

According to the interviewees, close communication to the supplier, the helpful attitude, the clear demands and the resource allocation helping the employees to only work with the case were the factors that were critical for the outcome of the crisis. One of the interviewees states that some sort of guide for how to handle these situations would have made the work easier. Most of the interviewed sourcing manager's (commodity) time was spent answering phone calls and e-mails the first time of the crisis, and most of the questions were the same. There would have been easier to focus on solving the situation if the communication could have been done by anyone else. The test plan could also have been made and handled by someone else than the sourcing manager (commodity). One interviewee also states that the risk identification at the site could be improved and could also have prevented this crisis from happening in the first place. In this case it could have been good to at least produce the component at two different production sites, according to the interviewee.

According to one interviewee, the strength of the supplier, that kept this plan all by themselves was also important for the outcome of the disaster. However, as stated by one interviewee, because of Scania's flexibility and competence this would probably have worked out even if the supplier wouldn't have made it by themselves. The alternatives found by Scania were good enough to temporarily put in the vehicles. According to one interviewee, the typical milestones was when all the tools were installed in the new factory, the first produced component and when the component was approved for mass production by Scania.

In an event of a disaster affecting a supplier, a crisis team is always created, according to one interviewee. The team's primary task is to maintain *quality* and *delivery* of this component at a reasonable *cost* and to get back to a normal situation as fast as possible. The priorities of these three factors: quality, delivery and cost, can be found at the centre of the *SPS* house illustrated in figure 3. The interviewee also states that the work performed by the team is of course specific for every situation, but the goal is always to quickly find a solution for quality, delivery and cost. Examples of action, presented by the interviewee, are trying to find another supplier that can deliver a substitute component or analyzing the product to find the suppliers to the parts that the component consists of.

### **6.2.2 Case #2**

*The information presented in this section is a collaboration of interviews with employees at Scania that were working with this case when it occurred. In this case, one R&D engineer and one sourcing manager (commodity) has been interviewed.*

The natural disaster occurred on a Saturday morning, and immediately on Monday a crisis team was created. The sourcing manager (commodity) and SQA manager booked tickets and traveled to the affected production site the first day. When they got there, they found that the office building was the only part of the factory that wasn't totally destroyed. They immediately booked a meeting with managers working for the supplier.

At the production site, the thoughts both inside the heads of the supplier's and other customers' employees were very negative. Other customers to this supplier were setting demands and threats to the supplier, while Scania went for a more helpful approach. According to one interviewee, Scania was not one of the biggest customers, but they still got a lot of attention and trust from the supplier.

At the production site, a temporary crisis office was created for the customer's representatives. According to one interviewee, many other customers sat quietly by their computers, communicating and calculating together with their employees at home. Scania went for an open approach and illustrated their crisis situation on a whiteboard for both the supplier and for competitors to see. They were available on the site every day, even on the weekends.

Totally, 10-15 employees from Scania worked in the crisis team. While the two employees mentioned above traveled to the affected production site, the material planning worked from Scania in Oskarshamn, and the purchasing and R&D department worked from Scania in Södertälje, where different employees were responsible for different components.

The team in Södertälje were analyzing the situation and putting priorities on the affected components according to demand that was gathered by the material planning team. This team also acted as a coordinating team and gave tasks among other involved employees within Scania. The team in Oskarshamn were also checking how many components that were in the stock and material flow in order to calculate how much time Scania had before production stop. The material planners updated the demand every two hours so that everyone knew which component that was most critical, because it was difficult in the beginning to know how much material that was going to the production of which component. Most of the work from Scania was performed in Sweden, according to one interviewee, while the representatives at the affected production site were messengers and had a support function. The messengers were good because it improved the communication between Scania and the supplier at the affected site.

A team was created in Södertälje that included two R&D engineers (styling and development), one sourcing manager (commodity) and one SQA manager. The R&D engineers started looking at what parts of the product specification that could be temporarily compromised in order to see if alternative solutions could be found. According to one interviewee, legal requirements together with properties connected to Scania's premium brand are the most important to keep.

After receiving the call, the first task for Scania was to check the stock levels to see how much time they had before production stop. After this it was important to distribute the already produced material to the first tier suppliers that needed them most. Many of Scania's first tier suppliers are dependent of this second tier supplier, which makes this process even more complex.

One interviewee stated that by just being calm, the purchasers could keep the situation from feeling chaotic to other employees. They also had a good communication with the supplier during the whole process. During the first day, the R&D engineers were available in case they were needed and the sourcing managers (commodity) started to check if there were any alternative suppliers possible for this component.

Luckily, the instruments needed to produce this component in the way Scania requires had survived the natural disaster. The supplier was willing to share their knowledge, and during the first week the two Scania employees that had traveled to the supplier went with a technician and a manager from the supplier to local companies known to the supplier that maybe could produce the product. When they found a company, they asked two questions:

1. Can you produce the required product?
2. Do you have the capacity needed?

This was a time where much production was moved to East Asia and therefore many of the local companies had much freed capacity. They found six companies that took over the production of one component each. However, when dealing with these products, two different machines can never achieve exactly the same results. Therefore, tests from these six new suppliers were sent home to Scania for evaluation. They were not exactly alike, but could all be approved according to Scania's standards. After about a week from the accident, the first component was produced by the new suppliers.

The supplier's continuity plan was to let local companies take over the production during the recovery period. In Oskarshamn, Scania had samples of how the products should look like in order to be approved. After a month, the responsible R&D engineer and sourcing manager (commodity) at Scania traveled to the affected area to visit the new temporary suppliers to approve the quality. The purpose of the trip was because design requirements on these products are difficult to measure from distance. The testing of the products were then performed by the first tier suppliers. The quality was kept high, but it was difficult to receive the same look on the products because they were produced with different tools.

It took about three weeks before the production was running again, but the supplier's production site wasn't fully recovered until about a year after the natural disaster. The key factors to the consequences was, according to one employee, the fast response with letting other local companies doing the work during the recovery time. The high prioritization from Scania's side that made it possible to be available for the hard working employees back in Sweden was also a key factor.

One other discussed key factor to the outcome was that Scania showed that they supported the supplier and participated in the recovery process, while other customers only set demands on the supplier. The skills and knowledge of the supplier's employees together with the freed capacity was also important for the outcome of the disaster.

There were no milestones in the work performed by the R&D engineer, the employees were always there if needed. They received time plans from the supplier every week, even daily in the beginning, to see how the recovery was going and if it went according to the plan. Scania was the only customer to this supplier that avoided a production stop. There were no milestones for the purchasing department either, the only task was to avoid a production stop.



One reactive activity performed by the R&D engineer that could have been performed proactively is the process where Scania determines what things in the product specification that could be compromised with in the short run. The continuity plan, with accurate time plans, could also have been performed better, according to one interviewee. The solution that was performed in reality, when letting local companies take over the production, could have been planned proactively, as stated by one interviewee.

Because Scania used to own the tools used for producing the components, one reactive strategy could be, according to one interviewee, to quickly move the tools to another production site when possible. In the cases when Scania just owns the design of the component, an interviewee stated that it could be a strategy to completely change supplier.

One deficiency around Scania's strategy with working with small and medium sized suppliers is, as stated by one interviewee, that it often is impossible to have dual production on the components which could have reduced many of the investigated risks. However, because Scania is not one of the biggest companies on the market, they are sometimes a rather small share of the supplier's total turnover when working with big sized suppliers and does not therefore have the most focus in situations like these. However, according to one interviewee, they compensate this by helping and supporting the supplier during the recovery process. The interviewee highlight even further how important it is to build confidence and understanding for the situation between the companies, there are deficiencies both when working with small and big size suppliers.

At Scania, the affected employees summarized what they had learned from the experience. At the R&D department, they made a step-by-step model for how a product like this one was produced, to be used in case of similar cases in the future. It is easy to forget details in these situations after a while, as stated by one interviewee, why many employees at Scania after this have understood the importance of documenting the activities immediately after the events, so that the information can be used both proactively and reactively in the future. At the purchasing department they also summarized the process and the lessons learned. This lead to a presentation that sometimes is used for internally informing and educating purchasers at Scania.

### **6.2.3 Case #3**

*The information presented in this section is a collaboration of interviews with employees at Scania that were working with this case when it occurred. In this case, one R&D engineer and one sourcing manager (commodity) has been interviewed.*

When the supplier called and announced the situation, the reactive work process started by gathering information about the chaotic situation. The first thing to do was a damage control to see which products were affected of the disaster. According to one interviewee, there is no environmental scanning performed within Scania today that can be useful for a quick status report of affected products if a natural disaster occur. It is either not possible to identify affected production sites in a disaster area. The interviewee continues by describing that the systems can only discover where suppliers are registered which is not always similar to where the production sites are located. That is a weakness for Scania, according to the interviewee, which also depends on the sourcing manager's (commodity) own knowledge about the suppliers they are responsible for.

During the first day, the material planner were contacted in order to check the balance in all the possible logistic chains. The most important question was how long Scania could survive with the already produced components. Booking a trip to the affected production site and briefing the problem upwards in the organization were other mandatory activities during the first day of the disaster event.

In the first week two teams were set up. One team working with the current supplier to support them in solving the situation the best as possible while the other team investigated alternative solutions in different ways. The team that worked with the current supplier were on site trying to support the best as possible and coordinating in order to secure supply. They also investigated what the supplier was able to do at other production sites within the company.

The other team had some real challenges to identify all the affected components, where a "bill of material" where all components were specified helped them a lot. Follow-up meetings occurred on daily basis between the two teams both inside Scania and with the supplier. The functions and competences involved in this case were a sourcing manager (commodity), a SQA manager, an R&D team, a material planner and the purchasing director.

Just some weeks afterwards, the team at the supplier's site realized that the supplier had enough capacity on other sites to supply Scania enough which lead them to dismantle the team in Södertälje that searched for alternative sources. All the focus came instead to be on the existing supplier and their new process to manufacture the components. The work process for the representatives of Scania changed drastically. Instead of searching production possibilities they could start approving the new production line.

All this was performed before they reached their first milestone, that was the first produced unit from the new line. A lot of test equipment, and other important machines were destroyed by the natural disaster why Scania offered software-programming, testing and verifying of the products in-house, which also fulfilled the second milestone set by Scania. Employees within the R&D department were eager to help in this situation so they worked day and night to avoid stoppage. Due to the cross-functional planning of material could Scania survive without stoppage on line.

The first milestone, to produce the first units, were quickly solved but the long term solution and the last milestone, a robust supply frequency, took much longer time. To first identify the current situation and then start two parallel teams were the way to go in this case.

According to one interviewee, Scania's cooperative attitude was highlighted as a key factor which resulted in high priority when production started all over again. Also the internal cooperation from managers and from specific functions within Scania was a huge success in this case. In an otherwise robust organization was it easy to allocate resources, as stated by one interviewee. Other beneficial factors, according to one interviewee, were to own the tools used for easy access and the ability to move the tools. Being open-minded for parallel working groups with different solutions in the beginning and when time is right only use the most favorable way was also a key factor, according to the interviewee. The lack of a standardized way to proceed in a chaotic situation were highlighted by some employees within Scania as a factor that could have been planned proactively.

As one interviewee stated, a general key factor for succeeding in the recovery process of a disruption event is to really understand the problem and allocate the right resources as well as setting up the crisis coordination meeting as early as possible. The interviewee continues by telling that potential time consuming bottlenecks for recovery is often carried out by the suppliers in a disaster situation why activities for reducing the total recovery time is mainly depending on the supplier's performance. An exception is, according to the interviewee, when another supplier has to be chosen and in that case will Scania have the responsibility for the most time critical activity. Regardless of how time consuming the recovery process after a disruption is, the three milestones are, according to the interviewee, short term agreement, root cause analysis and long term agreement.

After the crisis, a "lessons learned" from the case was made, but without a structured database where the lessons learned can be stored, it is probably difficult to find the lessons learned if searching for it, as stated by one interviewee, and at the same time it may lack of relevance for another case in future.

**6.2.4 Crisis management at benchmark company**

The following information was gathered during an interview with the benchmark company presented in 5.2.5 Benchmarking. A compilation of the crisis management framework performed by the benchmark company, with presented examples of reactive strategies, can be found in figure 22 below. Further details about the steps are presented below.

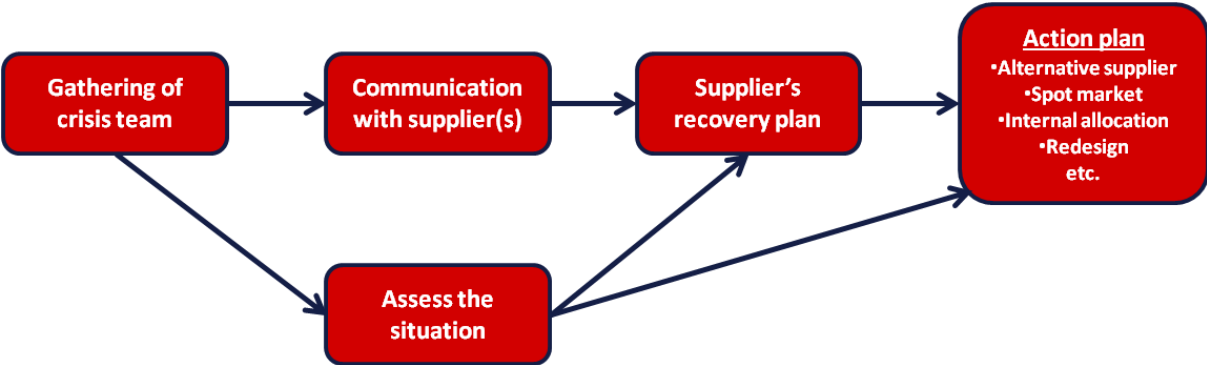


Figure 22: The benchmark company's reactive framework

Immediately after a disaster the first thing the company does is informing the employees and other people that needs the information. It is here very important that the people that are supposed to answer specific questions about the crisis, knows what and what not to say.

Then, the organization tries to assess the situation, the damages and what problem they are facing. The company immediately checks which affected suppliers that are critical and which are not. They also contact the supplier to see what continuity plans they have. For these situations they have a clear organization for which employees that should be gathered into a crisis team and which position each employee has. This organization looks different depending on the situation. They also have continuous crisis drills where they can see how the organization reacts and gathers in case of a disaster.

The crisis team always include representatives from legal, communication, sourcing and supply department, depending on the extent of the situation, R&D engineers, insurance

companies etc. can also be included in the crisis team. The communications representative is important because that employee handles all external communication with e.g. media, stakeholders and can therefore filter what they can and cannot inform others about in an event of a disaster.

Google earth is a simple but useful tool to have in crisis situations. Except the service when they receive text messages if an event occurs, they also continuously check the internet for news about threatening events. By looking at Google Earth where they have put coordinates on all their first and second (and sometimes even third) tier suppliers, they can immediately see which suppliers that can be affected by a natural disaster. This tool can of course be used in any geographical case and not just in natural disaster situations. The needles on the map that shows the supplier's location also has different colors depending on the criticality of the supplier or product.

When a disaster occurs, the organization has a service from USGS<sup>1</sup> that sends them a text message on their cell phones about possible threats, which makes the response even quicker. This service provides environmental monitoring and also damage estimation in different events. Also important to say is that organizationally, the benchmark company has separated the sourcing role from the supply role in these situations. Also in smaller situations, when a disaster occurs to a single supplier, the supply department often handles the situation instead of a gathered cross-sectional team. The choice between going with the crisis team or letting the supply department handle the case is experience based. They can here go from everything between ignoring the situation to gathering a large team with many employees and solve the case.

When entering a crisis situation, the organization thinks it is important to not put too much pressure on the supplier during the first time, because the supplier probably has more important things to think about. They also never travel from the office in Sweden to the affected suppliers because the benchmark company often has a contact person on the suppliers' sites. Instead of going to the affected site, they travel to the location where the decision makers of the supplier are located. The head office is most likely located in a different part of the world than the production site. To be able to maintain a good relation with an affected supplier it is, through the whole crisis, important to have a good balance between humility and determination.

After the situation is assessed, it is important to quickly establish an activity plan for how to solve the situation. These activity plans can look very different depending on the situation, but it is important that this step is quick in order to start working with the plan as fast as possible. After this they perform a cost analysis on the action plan in order to see how much money the action will save versus how much the action plan will cost the company. They estimate if the action plan developed still will lead to production stop and in that case, for how long. From being informed of the disaster to this point, everything needs to go very fast, because when dealing with standard products in the industry your company is not the only customer of the affected products. Therefore, if the supplier experiences a production stop at their production site, it is important to get your hands on as many already produced components as possible. A disaster will therefore lead to a competition of gathering components between competitors in the industry.

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<sup>1</sup> United States Geological Survey, visit [www.usgs.gov](http://www.usgs.gov) for more details.

The benchmark company has developed a lot of strategies for how to avoid these situations. For example, they always try to have at least two production sites on different locations for every component. Dual or multiple sourcing is also a strategy that they are performing, because it is possible when sourcing more standardized components. When dual or multiple sourcing is not an option, but the component is still considered critical, it is important to inform the supplier about the importance of working towards securing the supply of this component, and that it also is important that their supplier also do what they can to work towards this. Another strategy that sometimes is used is that they let the supplier have a specific number of components in stock to cover for the most critical time after a disaster.

According to the organization, the key factors in a crisis are the speed from being informed about the crisis to physical action. It is very important to secure the existing components to your organization before your competitors do. The information channels and the organizational structure is also very important in these cases. To already before the crisis, know what to respond to questions and to know which employee that should perform different tasks in a crisis, is critical to be able to respond quickly enough.

When going through a crisis, according to one interviewee, the company usually does not have any milestones on the way back to normal state. First when they have got their hands on enough components to cover the time to full recovery of the supplier, the crisis can go over to a controlled state.

## **7. Analysis**

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*This chapter covers the analysis phase of the study. The analysis will be performed by using the theories presented in chapter 3 Frame of reference together with organizational facts from chapter 2 Business introduction and empirical information presented in chapter 6 Collection of empirical information. The analysis is done in order to find the conclusions needed to fulfill the purpose of the study. The structure of the analysis can be found in section 4.4 Analysis model. As it shows, the study is divided into two analyses. The purpose of the first analysis is to find improvements in the risk management work and the purpose of the second is to create a new crisis management framework.*

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## 7.1 Improvement of the existing risk management framework

As stated by van Weele (2010), the purchaser's role has become more important during the past years due to increasing competition. Matook et al (2009) also describes that a dynamic business environment requires long term relationships with low risk suppliers in order to be beneficial. Van Weele (2010) also mentions that risk management has got a lot more focus lately, where traditional price negotiations have been replaced by risk sharing agreements. This trend is confirmed by Barlow (2012).

At the same time, Paulsson (2007) and Musa (2012) say that the recent year's growing focus on increasing productivity, lowering cost and fulfilling demands has led to an expansion in the supply chains which increases the complexity of the chain. They mean that this leads to that the organization loses control of the processes, which often increases many risks.

Carvalho et al (2012) also mention that an implementation of lean into an organization may also contribute to higher risks, since it increases the vulnerability to disturbances because of e.g. lower stock levels. Because Scania has implemented lean, described in chapter 2 Business introduction, this is another reason for focusing even more on *SCRM*. A well-implemented *SCRM* strategy can result in reducing, or even avoiding, both the risks and the impact of a disruption, according to Musa (2012).

As presented in figure 16, this study is divided into two analysis areas. The first analysis will be about finding improvements in the existing risk management framework at Scania today. To get a good structure on the analysis, the authors will continue to use the framework presented by Musa (2012). This framework is once again presented in figure 23 below.

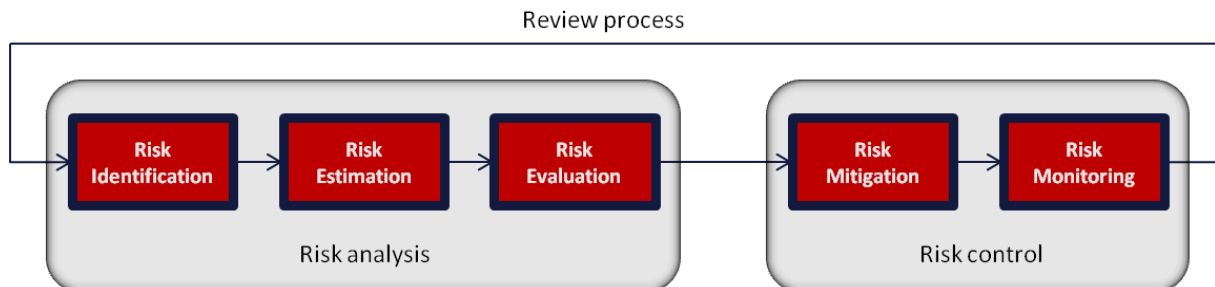


Figure 23: Musa's (2012) framework for risk management

### 7.1.1 Risk identification

According to Musa (2012), risk identification is the activity when trying to identify all possible causes of risk events. As stated during interviews, the *first assessment* is a tool used on all Scania's suppliers today when identifying risks and it is the only tool that can be used before the supplier is chosen. It is therefore very important that this tool covers all relevant risks to be able to perform a well-working risk management work already when choosing suppliers. Musa (2012) also mentions that dual sourcing is a good strategy for reducing inbound supply risks, but because the components of the investigated suppliers are developed together with Scania, it is difficult to use a dual sourcing strategy and therefore it is even more important to strongly focus on identifying inbound supply risks. Production stops leads to enormous economical consequences, why this always needs to be avoided even during a natural disaster affecting Scania's suppliers.

The results from the interviews have shown that the *first assessment* can be improved. During one interview it was stated that the *first assessment* is not standardized and the result from the *first assessment* is therefore subjective because the result depends on who is performing the *first assessment*. As also mentioned during one interview, updating the *BAP* with questions about supply risks would increase the focus on those risks in both the *first assessment* and the following *audits*. It is important that this tool covers everything needed to have a trustworthy risk identification result on the investigated potential supplier, but it is also fundamental that the tool is used properly by the employees at Scania. The solution to this is, according to the authors, to both improve the tool and to increase the employees' risk awareness. Analysis around risk awareness will be covered in section 7.1.5 Risk monitoring.

The risk management self assessment is a part of the *first assessment* where the supplier answers yes or no to some questions regarding risk management. The authors believe that it is important to inform the suppliers the reason to why the risk management self assessment is performed. Today some employees at Scania believe that there is not always pure honesty in the answers, and sometimes it can also depend on lack of understanding the question. Improvements can be done even in this activity by being clear in the communication to the supplier about why the risk management self assessment is performed. True answers are important for Scania to be able to know which suppliers that truly need extra attention regarding risk management.

It is also usual that the employee that was responsible when the *first assessment* was performed on the supplier is not responsible today. Awareness of the risks can therefore be improved by always documenting these risks or by having a stronger focus on those risks in the *audit*, that is continuously being performed on the supplier.

According to the authors, the tool will be improved by implementing a stronger focus more on inbound supply risks and not only on process and product risks. Inbound supply risks, including risks regarding natural disasters, are barely covered at all in the *first assessment* or *audit* today. The conclusions and recommendations around how the *first assessment* can be changed to improve the risk management work at Scania will be presented in section 8.3 Improvement of *first assessment* and *audit*.

Interviews and investigations from the authors have shown that the employees at Scania are not always informed about where in the world a component is produced. It is easy to see the exact address where the supplier is registered, but there are no information that can be found about where the supplier's products are being produced. This leads to an insecurity in which suppliers that are affected when a natural disaster occurs. In a crisis, the time it takes to find out which suppliers and components that are affected is critical, and therefore a lot of time and consequences could be reduced if Scania had more knowledge about their production sites' locations. By sending out a form to all suppliers, where they could fill out the coordinates of their production sites and for critical suppliers also the location of sub-suppliers, the information could easily be obtained by Scania. Further analysis on how this information could be used by Scania will be presented in section 7.2.1 Assessment of the situation. The conclusions and recommendations regarding how locating the production sites would improve the risk management work at Scania is presented in section 8.2 Location of suppliers' production sites.



### 7.1.2 Risk estimation

According to Manuj and Mentzer (2008) and Musa (2012), risk estimation is used to assess three risk dimensions: probability, consequence and detection of a risk.

Today, Scania has no tools for estimating the risks identified in the *first assessment* or *audit*. However, when performing the *BISSC* analysis all suppliers are estimated and evaluated depending on other factors linked to the criticality of the supplier and/or product, presented in section 6.1.2-6.1.3.

It is clear that Scania's way of estimating differs strongly from what proposed by Manuj and Mentzer (2008) and Musa (2012). As stated during an interview, it is not of Scania's interest to estimate the probability of a certain event, because it is difficult to approximate the probability of an event. In the *BISSC*, the suppliers are therefore instead mainly estimated regarding down time in weeks to full recovery which is more accurate to approximate, as presented during an interview. The remaining suppliers with most weeks to recovery will then go through some more detailed and advanced steps before finally having a result of which suppliers that are required for a *risk management supplier audit*.

As presented earlier, the most critical supplier's will then go through a so called *risk management supplier audit* in order to make both Scania and the supplier aware of the risks and also to give suggestions for how to work with them. The *BISSC* tool is, as described, very extensive and covers many risks at Scania today. This *risk management supplier audit* is very good for finding risks regarding natural disasters but also many other risks. The reasons for performing the *BISSC* in the way Scania does today is considered good by the authors and the authors will therefore not investigate further about however Scania's way of estimating suppliers in the *BISSC* is good or bad.

Because the *BISSC* is performed on Scania's existing suppliers, there is however no existing tool today that estimates risks before the supplier is chosen. The solution for improving risk estimation would be to have a more standardized *first assessment* with more focus on inbound supply risks. As presented earlier, during one interview it was stated that the *first assessment* is not standardized and the result from the *first assessment* is therefore subjective because the result depends on who is performing the *first assessment*. This is in line with what is stated by Musa (2012), that the quality of the risk estimation is strongly affected by the subjectivity of the results and the expertise of the investigator. The expertise will be kept high by implementing risk awareness in an organization and to continuously educate and update employees about risk management issues. The improvement of the *first assessment* will, as earlier stated, be further described in section 8.3 Improvement of *first assessment* and *audit*, while the risk awareness will be further discussed in section 7.1.4 Risk mitigation.

### 7.1.3 Risk evaluation

Paulsson (2007) and Waters (2007) says that the purpose of risk evaluation is to estimate the significance, tolerability and acceptability of the identified risks. According to Norrman and Jansson (2004) and Musa (2012), the purpose of risk evaluation is to obtain a prioritized list of the risks in order to know where to put more attention. Today, there is no estimation or evaluation performed on the identified inbound supply risks found during a *first assessment* or *audit*. Product risks are estimated and evaluated by the R&D department and process risks are estimated and evaluated by the SQA manager, but inbound supply risks are not

estimated or evaluated except for the *risk management supplier audit* in the *BISSC*, as stated in section 7.1.2 Risk estimation.

As presented in the risk matrix in figure 9, Paulsson (2007) and Waters (2007) agrees with Manuj and Mentzer (2008) and Musa (2012) on two of the three factors and thinks that risks should be evaluated according to probability and consequence. As presented earlier, Scania has no focus at all on a risks probability, and instead focuses all estimation and evaluation on consequences. In Scania's "risk matrix", the suppliers and components are compared on "time from zero to full recovery" as a first step, and then it is based on many factors that describes the component's criticality towards Scania and different risks regarding the chosen supplier.

As stated earlier, the authors will not investigate further around why Scania differs from what is said in found theories. During interviews, the employees have had very good reasons for why to use Scania's own factors and therefore the authors will not propose any changes in the way of estimating or evaluating suppliers in this study.

As stated during interviews, the *first assessment* can be improved even when it comes to evaluation. The solution is the same as presented in 7.1.2 Risk estimation, that is to get the inbound supply risk part of the *first assessment* and *audit* more standardized and the results must also be able to be weighted in order to make Scania's suppliers comparable to each other. This improvement has also been suggested by an interviewee, and the recommendations around the improvements of the *first assessment* are further described in section 8.3 Improvement of *first assessment* and *audit*. According to the authors, other relevant factors covered in the *BISSC* would also be parts of the *first assessment* to be able to cover more inbound supply risks, in order to have risk management as a factor when estimating and evaluating potential suppliers.

As stated by Ahmed et al (2007), a quantitative estimation is preferred when backed up with reliable data, but if that is unavailable it is often better to perform a qualitative estimation. When comparing potential suppliers it could be difficult to rely the estimation and evaluation on reliable historical information since Scania maybe doesn't have earlier experience of the potential suppliers. However, it is still important to have risk management as a factor when choosing supplier, and therefore it is important to be able to compare them to each other, no matter if the result is qualitative or quantitative.

#### **7.1.4 Risk mitigation**

As stated by Musa (2012), risk mitigation is the process where trying to handle risks by either reducing, transferring, eliminating, subdividing or just accepting all identified risks. It is therefore very important to identify as many risks as possible, because if you don't identify a risk you can't handle it.

When it comes to mitigating the risks at Scania, it is mainly performed in the last step of the *BISSC*, called risk management supplier *audit*, where Scania visits the supplier and makes the suppliers aware of the most important identified risks and also gives the suppliers instructions for how to handle them. According to the authors, this leads to that Scania is very dependent on that the suppliers perform well in their risk handling. However, it is difficult to work with risk mitigation in many other ways with already existing suppliers when Scania also has developed the product together with the supplier. As stated by Ragatz et al (1997), having suppliers involved in the development process will make it more difficult to perform

changes later in the process. When looking at the risk mitigation techniques presented by Paulsson (2007) in table 1, together with the list presented by Waters (2007) in section 3.3.4 Risk mitigation, most of them are more difficult to perform later in the collaboration process with the supplier in other ways than what is performed in the *risk management supplier audit*.

However, mitigation techniques are also used before the supplier is chosen. As an example, Scania always try to find suppliers in low-risk zones when it comes to natural disasters. The authors think that during this phase it is much easier to work with risk mitigation, because many risks can be reduced by simply choosing another supplier or component. Even Kraljic (1983) mentions that a lot of firms are assessing supply risks when evaluating potential suppliers, but also existing suppliers with new processes or products, why this also can be an improvement for the *audit*. This also requires that the *first assessment* is more standardized and covers more inbound supply risks in order to be able to chose the right supplier from the beginning. As earlier stated, the conclusions and recommendations around improvement of the *first assessment* will be covered in 8.3 Improvement of *first assessment* and *audit*.

As stated by Musa (2012), dual production would be a very good mitigation technique, but in Scania's case this is not an option, as stated during an interview. However, it was said during an interview that trying to find suppliers that can use dual production is a strategy that is possible to Scania in cases when developing products together with a supplier. This is considered, by the authors, to be a great example of what to look after when trying to mitigate risks before choosing supplier.

During some of the interviews it has been stated that there are deficiencies regarding the responsibilities around inbound supply risks. Because it is unclear who has the responsibility, this will not be prioritized. A solution to this would be to put more time and resources on inbound supply risk management. Research performed by the authors have shown that Volkswagen, that is Scania's parent company, has a whole department working with these risks, and also the benchmark company have employees responsible for working with these types of risks. The benchmark company even had prepared teams that could take over cases in crisis situations.

Van weele (2010) clearly describes that sourcing is just the way of managing the best possible source of supply which means activities like selecting supplier and contracting. Carr and Pearson (2002 p. 1033) describes strategic purchasing as "the process of planning, evaluating, implementing and controlling highly important and routine sourcing decisions." Sourcing is however, according to Waters (2007 p.76) "the process of systematically identifying, analyzing and dealing with risks to supply chains" and Paulsson (2007) has a similar definition. As earlier mentioned, the benchmark company also separates the terms sourcing and supply when it comes to who has the responsibility and who are included in the crisis team. After further investigation by the authors it was confirmed that Volkswagen, who is the parent company to Scania, also has this separation when it comes to these terms.

It was stated during an interview that earlier, there were a position at the corporate risk management department working with inbound supply risks, but this position is now a vacancy. By filling this position with someone with good experience from risk management, or by creating a position here at the purchasing department, the awareness on the subject could be increased throughout the whole organization and especially in the purchasing

department. This employee could be responsible for training and education of other employees, but also to monitor and improve the risk tools used and to monitor results from the tools and work with high risk suppliers in order to reduce the risk of production stop at Scania. The employee that worked on this position earlier had a big role in the *B/SSC* work performed at Scania, since that employee had developed the tool. Today, this strong tool is not performed because of the vacancy, but to be able to improve the risk management, the authors think it is important to continue working with this tool and the results from it, since it is considered by the authors to be the most powerful tool in Scania's risk management regarding inbound supply risks.

According to Musa (2012), the most commonly discussed strategies to reduce delivery risk in supply chain are:

- Employing redundant suppliers
- Increasing responsiveness and/or flexibility
- Reinforcing co-operation
- Adopting crisis management planning.

These are, among others, factors that also could be handled by this responsible employee, according to the authors. The authors think that the first factor could be successful by working more with the *B/SSC* and the results from it. The responsiveness and flexibility will be improved by working more with all parts of risk management, which also will improve the co-operation, both inside Scania and in the supply chain. Crisis management planning at Scania takes a big step in this study, but will need improvements and updates in the future, which the authors think will be done only if someone has the responsibility of it.

There are also a lot of problems mentioned in the theories about *SCRM* that, according to the authors, would be reduced by having someone responsible for the risk management work at Scania. Waters (2007) presents 13 problems with *SCRM*, and the first one are about that it is difficult to get the people involved knowledge about the importance of risk management and how to work properly with it. Waters (2007) continues with the importance of being clear with who has the responsibilities and the importance of training the staff in *SCRM*, and then also mentions that many organizations think that their partners are responsible for their own risks and will therefore not tackle those risks. The authors think that these problems presented by Waters (2007) can all be dealt with by employing a risk management responsible. The conclusions and recommendations around how this would improve the risk management work at Scania is further described in section 8.1 Improvement of risk awareness.

Baker and Writer (2012) highlights that first when a disaster occurs it will be an effect of good work, why managers tend to ignore improvements or creation of plans proactively. Waters (2007) also mentions that it is hard to set aside resources for *SCRM* because the results from it is uncertain. The authors agree with that but still thinks it is important to set aside resources because of Scania's vulnerable situation with their most critical suppliers and components.

One of the mitigation techniques, presented by Waters (2007), that also is performed at Scania today and that is the making of continuity plans. At Scania it is called business continuity planning, where Scania requires that their supplier has a business continuity plan.

What has been stated during interviews is that there are no guidelines for how this business continuity plan should be created and the interviews have also stated that it would be good to have a risk management specialist that could coordinate the risk handling at the supplier's site. The *BCP* is very important because Scania's success depends a lot on the supplier's *BCP* in crisis situations, as also shown in the cases investigated in this study. Therefore, the authors think it is important for Scania to have a standardized framework for how this *BCP* should be created. According to the authors, the risk management specialist could be created as a result of improving the awareness at Scania's purchasing department, why this is further described in section 8.1 Improvement of risk awareness.

Jrad et al (2004) presents a list of phases that should be included in a continuity plan, and Waters (2007) presents similar phases. Waters (2007) then presents in more detail, in appendix B, how a business continuity plan would be created. To use this as a framework and then modify it for Scania's specific needs would, according to the authors, be a good framework for Scania. Conclusions and recommendations around how this would improve the risk management work at Scania is further described in section 8.4 Standardized *BCP*.

### **7.1.5 Risk monitoring**

The last process in Musa's (2012) framework is risk monitoring, where the purpose, according to Musa (2012) and Waters (2007) is to secure continuous improvements in the risk management work, but also to keep the risk management updated. They also highlight that risk monitoring should be done periodically to ensure continuous improvements regarding risks, responses and plans.

During interviews, it has been clarified to the authors that the risk monitoring can be improved at Scania today. As long as no one has the main responsibility for working with these risks, the authors think that there will not be any continuous improvements on the subject. This part can therefore also be solved by being clear with who has the responsibility for it. By employing a risk management worker, discussed earlier, would therefore also be a solution to this problem.

*Audits* are performed depending on how a supplier performs in quality to ensure that they work with continuous improvements. This is a system that also could be implemented for risk management issues. It has earlier been proposed that there needs to be more focus on inbound supply risks in the *first assessment*. By also having more focus on these risks in the *audits*, it would be easier to ensure that the suppliers work with continuous improvements. One thing that Scania could perform to work with continuous improvements in the crisis management framework, as also is performed by the benchmark company, is the testing of the systems. By sometimes simulating a crisis, it will be easier to see how the employees at Scania handles a crisis. It is also good to perform simulations or tests to see deficiencies in the risk management framework to ensure continuous improvements in the tools used. According to the authors, continuous improvements is also something that could be improved by creating awareness and responsibilities around risk management, why this will be further described in section 8.1 Improvement of risk awareness.

One interviewee also stated that there would be beneficial if lessons learned always were documented and that the documents later were collected in a folder on Scania's network for everyone to see. According to the authors, this is a good idea. Even if every crisis is individual, there are still a lot to learn from every situation. This will however not be a

suggestion from the authors, but still something that the authors want to highlight in the study and to think about in the future at Scania.

When it comes to increasing the awareness of risk management, especially regarding natural disasters, it is important to clearly state who is responsible for working with those risks. Today, the R&D engineers have responsibility of product risks and the SQA manager have responsibility for process risks. However, there are no clear responsibility for the inbound supply risks at Scania today. Some say that it is the SQA managers' responsibility and some say that it is the corporate risk management department that has the responsibility, and one interviewee even says that no one has that responsibility. The solution is therefore to clearly state who has the responsibility for it and also put resources into it. Today, many positions already have too much on their desk and therefore, according to the authors, it would be easier to start a whole new position that has overall responsibility of implementing the risk management mindset in the employee's work at Scania's purchasing department. As earlier stated, this is further described in section 8.1 Improvement of risk awareness.

**7.1.6 Summary of risk management analysis**

This section will contain a summary of what has been analyzed and what the authors will bring to the next chapter. As shown in figure 24 below, the authors want to show the relationship between the risk management framework, presented by Musa (2012) and the risk management tools used at Scania today.

	Risk identification	Risk estimation	Risk evaluation	Risk mitigation	Risk monitoring
First assessment	X			X	
Audit				X	X
BISSC	X	X	X	X	X
BCP				X	

Figure 24: Connection of Musa's (2012) framework with Scania's existing tools

Figure 24 above shows an "X" if the authors think that the analyzed tool includes a specific part of the risk management framework presented by Musa (2012), and will therefore work as a summary of what the authors have found in the first analysis. According to the authors, the *first assessment* covers risk identification and risk mitigation, but because it is the only tool that is used before the supplier is chosen, risk estimation and risk evaluation should be able to be included in the tool in the future. Both the *first assessment* and the *audit* need to have more focus on risks regarding natural disasters, which would improve the already existing parts marked with an "X".

The *BISSC* is, as shown in figure 24 above, very extensive and covers many parts of the risk management. The authors will not try to find any improvements in this tool, but more around risk awareness and responsibilities around the investigated risks in general at Scania's purchasing department. As long as no one is responsible for the risk management work, the risk management work with the tools will not be improved. This responsible has the ability to improve every part of figure 24 above, and may also expand this figure with additional and

improved tools that improves all parts of Musa’s (2012) risk management framework. At last, the authors have also found that Scania would need a standardized *BCP*, which would improve the risk mitigation around that tool.

Figure 25 below shows what the authors have found in the risk management analysis of this study and which parts of the risk management framework that can be improved. The improvements are marked with white dots to show which parts of the risk management framework that needs improvements, and in what section the improvements will be presented.

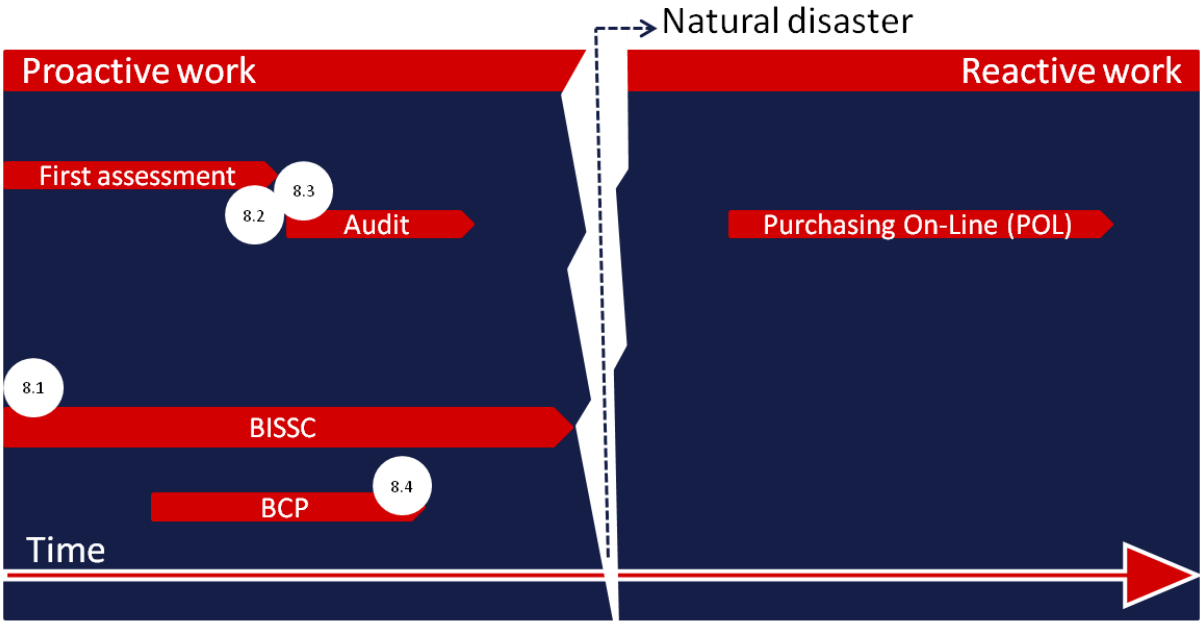


Figure 25: A summary of risk management improvements found by the authors

The greatest finding in the improvement of the risk management framework at Scania, according to the authors, is the lack of awareness and clear responsibilities around the work with inbound supply risks. As seen in the analysis, this is a very important issue at Scania today, according to the authors. The conclusions and recommendations regarding this will be described under section 8.1 Improvement of risk awareness in the next chapter.

The second finding is regarding the lack of knowledge about the locations of the suppliers’ and sub-suppliers’ production sites. The authors’ suggestions and conclusions around that will be described in section 8.2 Location of suppliers’ production sites. The third finding is about the *first assessment* and the need to standardize the tool in order to be able to use risk management as a factor for evaluating potential suppliers, but also about the need for stronger focus around natural disaster risks in the *first assessment* and *audit*. This improvement will be further described in section 8.3 Improvement of *first assessment* and *audit*, where the authors will present the conclusions and suggestions for how improvements can be done. The fourth and last finding in the risk management framework is about the *BCP* and the need for a standardized *BCP* that Scania can use to tell their suppliers what they need want included in their suppliers’ business continuity plans. The conclusions and suggestions around this improvement will be further described in the next chapter in section 8.4 Standardized *BCP*.

## 7.2 Creation of a new crisis management framework

Booth (1993) says there is no way in which an enterprise can vaccinate themselves to become immune to a crisis. Musa (2012) on the other hand says taking immediate action after a disaster will give a better result than if there is a delay in taking action. According to the authors, being prepared with a well-structured crisis management framework would therefore definitely reduce the reaction time when a disaster occur. Every disaster is very unique, according to Schneid & Collins (2000), but planning and preparation can anticipate many issues that may come up. The authors of this study will therefore suggest a crisis management framework, with related activities that can be used at Scania in case of a natural disaster affecting their suppliers. As some of the interviewees responds, some activities are critical in the reactive work process to recover after a disaster. Even the benchmark company has almost the same vision when it comes to how a reactive framework should be structured. Figure 26 below shows the crisis management framework that the authors have found after interviews, internal as well as external. Since Scania don't have a standardized way of handling these kind of crises, the author's framework will be based on both the benchmark company's existing framework but also on the three cases, presented in section 6.2.1-6.2.3. The literature also contribute to the authors crisis management framework, where theories cover the importance of communication, how the formation of a crisis management team should be done and how the action plan should be structured, all presented in section 3.5 Crisis management.

Below follows the author's reasoning around how the Scania crisis management framework would look like. The benchmarked company had a well developed framework, shown in section 6.2.4 Crisis management at benchmark company, which were used as a base in the formation of a Scania specific crisis management framework. The authors understand that the gathering of the crisis management team often starts the crisis management process for the benchmarked company since they have a clear organization for which employees that should be gathered in the crisis team. From Scania's point of view is it important to both know how extensive the situation is and also about which continuity plans the supplier have before creating the team. Scania don't have a dedicated team which is supposed to take care of disruption events why the formation of the team should be suited depending on the supplier's continuity plan and how extensive the situation is. Therefore, the authors will suggest "creation of a crisis team" to be an activity/element parallel together with checking "supplier continuity plan" that takes place after the situation is assessed. The benchmark company also has one activity in their crisis management framework called "communication with the supplier". Interview respondents at Scania also clearly answer how important the communication and right mindset is during the entire process, both internally and externally. The authors of the study learnt from the interviews at Scania that a continuously communication is favorable for the relationship between Scania and their suppliers. The authors therefore don't think the communication can be referred to as one activity in the crisis management process, why the communication activity/element instead will be symbolized as a dashed line around the whole crisis management process just to highlight the importance of communication during the entire process. After all the information is gathered and the crisis team is created, the action plans should be formed. In the following sections, all five elements included in the crisis management framework will be described in more detail.



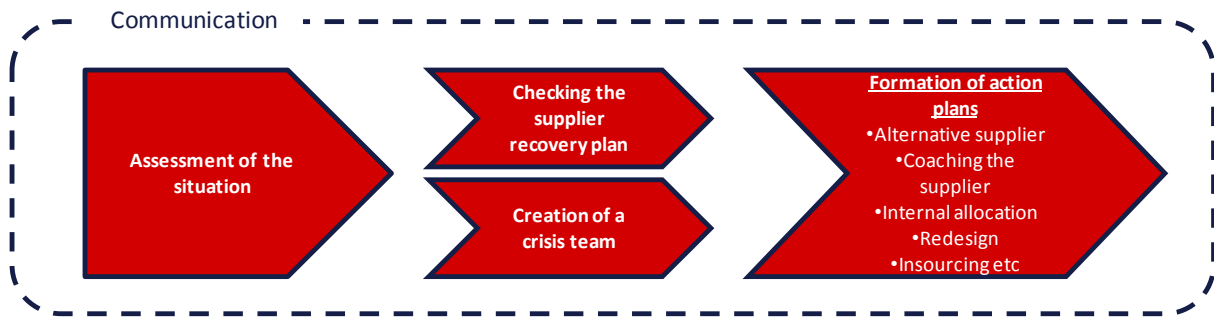


Figure 26: Scania's reactive framework suggested by the authors of the thesis

### 7.2.1 Assessment of the situation

Theories about how to best assess the situation when a crisis occur somewhere around the world does barely exist and the “best practice” is probably also very subjective depending on the organization and its strategies and structure. Consensus among interview respondents is that the first step in the reactive process should be to create a damage assessment by contacting different departments, internal as well as external. Focus externally should be to investigate which components and suppliers (in a regional catastrophe) that are affected of the crisis. Internally is information about amount of components in the logistic chains very essential information in this early stage, according to some of the interview respondents. The authors also see the importance of connecting affected part numbers with Scania’s production units to understand where the shortage takes place first. With information such as supply and demand can the material planners estimate a potential production stop date for each production unit.

Often, the sourcing manager’s (commodity) knowledge is the single most useful source to detect which suppliers and components that are affected by a natural disaster. To only rely on one employee’s ability is risky and the knowledge can easily be lost. The benchmark company has a useful tool that the authors believe in and think can be valuable for Scania since it will increase the speed of the assessment. This tools would be an application in Scania’s system that can show where their supplier’s production sites are located and which of them that can be affected when a natural disaster occurs. All the benchmark company’s first, second and sometimes third tier suppliers were mapped in Google maps, with different colors depending on the supplier’s and/or component’s criticality. They also had a text message service, that notified the employees in case of a natural disaster, which helped them to faster be aware of the natural disaster. Prerequisites for the tool would be to gather information about where the suppliers’ production sites are located, as described in section 7.1.1 Risk identification.

The benchmark company is operating in an industry where a lot of standard products are used. For them it is important to secure supply before the competitors since they sometimes are using the same components and suppliers. The Google maps tool is therefore an advantage to quickly detect which suppliers that are affected. The authors see the possibility for Scania to use a similar tool, especially for the standard products they are sourcing but also for Scania’s other products and suppliers. After a discussion with the head of corporate risk management, it was found that Scania also has a service for environmental monitoring that could be used together with this application.

During the interviews the authors of the study learned how Scania's logistic chains to the supplier work. Used terms were FCA and Ex-works which are standardized contract terms regarding how responsibility and costs will be distributed in a logistic chain. Depending on where the delivery point is defined, different international commerce terms will be used. Scania own the components from the delivery point and also know exactly how many components there are both at the delivery point as well as in transit from the delivery point to Scania. It might also be components in transit, to the delivery point from the supplier, which should be taken in account. The authors think that it is very important in an early stage to specify how many components there are in the supplier's transit that are dedicated to Scania. This is performed to get a fair idea of the real amount of inflowing components which therefore will generate a better estimation of the production stop date. The authors also think it is important to quickly get this information since the components in supplier's transit is in the supplier's possession and can in worst case be re-distributed to competitors, especially if dealing with standard products.

As already mentioned, interview respondents say that an assessment of the current situation should be the first step in a crisis management framework. A damage assessment can be performed in different ways. The authors will here present a suggestion of how an assessment can be performed at Scania based on interviews and own thoughts. Interview respondents said it is mandatory to early investigate which components and part numbers that are affected of the crisis. In a regional catastrophe it may also be important to investigate which suppliers and components that are affected. The easiest way to get this information is, except from the Google map application, through external communication. According to interviewees, it is then of importance to collect information about stock volumes in different parts of the logistic chains for the different components. Information is gathered both internally within Scania and externally by contacting the supplier. With that information in mind, an estimation of the global production stop can be done. Material planners, on the other hand, have a better tool for estimating production stop for different production units within Scania. A good suggestion is therefore also to communicate with material planners and give them information about stock in the supplier's transit. The authors highlight that information about production stop determines how urgent different parts of the crisis will be managed.

### **7.2.2 Checking the supplier's continuity plan**

The following chapter were barely not covered in the literature, why the analysis mainly will cover the authors' and the interview respondents' own thoughts.

It should be mandatory, according to the authors, to assess which suppliers that are affected before starting to require and evaluate their continuity plan. According to the standard *ISO/TS 16949*, the supplier is required to have a continuity plan. Since all the continuity plans are not continuously checked by Scania and that the plans not are standardized, which is described in section 7.1.4 Risk mitigation, the sourcing managers (commodity) just have to hope the supplier is well prepared if a disaster occur. According to interview respondents, it is also favorable to require a time plan in order to follow and evaluate the supplier's recovery.

The authors think that how the supplier's continuity plan looks like and when they approximate to recover their business to the normal situation, determines how the strategies and actions at Scania will be formed. The checking of supplier's continuity plan should

therefore be executed right after the situation is assessed and parallel with the creation of the crisis team.

Checking the credibility and feasibility of the supplier's continuity plan can also help the supplier to verify that their continuity plan is well dimensioned for the prevailing situation. The authors have learned from the interviews that there are an advantage to stay with the same supplier in a crisis situation. Because of this, a validation of the existing supplier's continuity plan is primary and an important part in Scania's crisis management framework.

According to Waters (2007), a continuity plan should be tested to emphasize problems and weaknesses for a certain risk. Testing of the continuity plan can also be a part of an *audit* to ensure that the continuity plan is working. As Baker & Writer (2012) says, focus for auditors should also be to check which scenarios that the continuity plan covers but also the last time it was updated.

Interviewees say, which the authors confirm, that this activity should include to require a short term action, a long term action and also a well formulated time plan for recovery back to the normal state.

### **7.2.3 Creation of a crisis team**

According to section 6.2 Crisis management, interviewees were not united in when and how the crisis teams should be created. The benchmarked company however, has clear roles in the organization for which employees that should be gathered in a disaster situation and therefore always has the possibility to roll out their team very quick in the process. This action is, according to Wallace & Webber (2011), significant to be able to react quickly after a disaster. As earlier described, the size and competence of Scania's crisis team will depend on how extensive and critical the situation is but also how long time the supplier predicts the disruption to be. According to one interview respondent, it is a time consuming activity to get the supplier's continuity plan why formation of the crisis team should take place parallel when getting the supplier continuity plan, according to the authors. Wallace & Webber (2011) also point out how hard it is to know who is responsible for doing what at an early stage after a crisis why the authors of the study suggest Scania to gather information about the situation and the checking of supplier's own continuity plans before setting up a crisis team.

Different result can be achieved depending on the formed group of people, according to Schneid & Collins (2000). Interviewees clearly describe how the team were formed in the three cases presented in section 6.2 Crisis management. Best practice for cases in this study has been to divide Scania's team into two groups. One cross-functional group working in-house ready for critical considerations while another group support and coaches the supplier at the affected production site. Consensus among theories is also that a cross-functional team should be rolled out in disaster situations. Already in figure 7, the authors mention *POL* as a crisis management tool. As understood during the interviews is that *POL* is not always included in the crisis team, because sourcing managers (commodity) often have more knowledge about the supplier and situation and therefore leads the assignment themselves. One interview respondent also says the consideration of, and when, including *POL* or handle the case themselves is not very clear. The authors of the study highlight that the consideration of bringing *POL* in the team should be done in this activity. Even if *POL* takes over the case, the situation must first be assessed and the supplier's continuity plan must be checked.

Before *POL* can act, material about the current situation must be handed over, preferably by the supplier responsible.

Schneid & Collins (2000) highlights five functional positions that should be represented in a crisis team. Some of these functional positions have also been mentioned in the interviews. According to Schneid & Collins (2000), a coordinator should be a part of the team. The authors cannot comment if all the cases investigated at Scania included a coordinator but the authors understand the importance of having one in the team. Since the sourcing manager (commodity) often has the supplier contact, this employee would be a good choice to have as coordinator. However, the sourcing manager (commodity) is responsible for more suppliers and are therefore often fully booked. The authors believe a crisis team at Scania doesn't always need a coordinating person, rather a close collaboration between different functions.

Another function that, according to Schneid & Collins (2000), should be a member of the team is what Schneid & Collins (2000) call "operation". Both interviewees and the authors of the study agrees that representatives from the production units should be a part of the team. Schneid & Collins (2000) says the functional positions "planning" (long-term forecasting) and logistics (ensuring components are in place when needed) also should be members in the team. Theory and practice differ in this sentence. Scania divides these responsibilities over the central planning department (which are responsible for long term forecasting), material planner (which are responsible for short term forecasting and ordering) and also strategic sourcing (commodity) which ensures capacity at the supplier's production site. The conclusion is therefore, what also correlates with the answers from the interviewees, that members in a crisis team should be representatives from production, material planning and purchasing. The authors don't think its valuable for Scania to include central planning in the crisis team when the disruptions maximum have a monthly characteristic. According to Schneid & Collins (2000) should also someone responsible for financial planning be involved in the crisis team in some way. No interview respondent suggested that someone responsible for financial planning should be a part of the team when asked, that will probably depend on the urgency situation a disruption case will arise. In those situations are inbound supply rather than cost the most important consideration, according to one interviewee.

Wallace & Webber (2011) suggest, which also is in line with answers of interview respondents, that the R&D department should be included in the crisis team since they know the product specification and the technical issues involved. If any changes in the product specification can lead to continuously inbound supply must the R&D department be involved. The last two representatives that should be included in the team, according to Wallace & Webber (2011) but also according to some interview respondents and the authors of the study, are a legal counsel who know legal issues regarding the contract and a manager who has authority enough to quickly allocate resources if needed. Interview respondents answer that a SQA manager should be a part of the team due to their knowledge about the supplier's production processes. With help from an SQA manager can a new production line at the suppliers's site be approved. The membership of an SQA manager in the crisis team is not covered in the theory probably since their responsibilities can be found under the purchaser's in the general company.

The authors' final conclusions are that following functional positions preferably should be involved in the crisis team:

- Production
- Material planning
- Purchasing
- R&D engineer
- Legal

#### **7.2.4 Formation of action plans**

According to Paton (1999), an action plan can be formulated by anyone in the company but has to be familiar to and accepted by someone who are required to act on them. Understood from the interviews is that the sourcing manager (commodity) is responsible for the potential case for respective supplier and therefore, the authors suggest that the sourcing manager (commodity) also should be responsible for formulating the action plan in collaboration together with a manager.

According to Waters (2007), an internal continuity plan should primarily focus on physical safety for employees before protection of facilities. After that should the focus be on prototype deliveries and then full operation. Since this action plan is designed to specify actions for Scania's recovery, the first two steps will not be a part of the action plan but in a sensitive situation, when people might be injured or dead, must every supplier be carefully contacted.

According to one interviewee, the action plan in the crisis management framework should be set up immediately after the situation is assessed. The authors of the thesis disagree with the interview respondent and think that the evaluation of the supplier's continuity plan and the allocation of right resources also is important before setting up the action plan. Without the team and the supplier's continuity plan, it is much more difficult to accurately evaluate which considerations that can be favorable for the action plan. With this information in mind, the authors realize that the action plan can look totally different upon which situation it is made to handle. The authors also understand that the action plan is the activity where critical considerations have to be made.

Critical considerations can, according to the benchmark company, be strategies for surviving the crisis situation without internal production stop. Considerations the benchmark company suggests are among others:

- Alternative supplier
- Internal allocation
- Redesign

The authors agree with the benchmark company regarding the above mentioned considerations for a crisis situation. "Alternative supplier" can be tricky since Scania has a lot of components that are developed in a collaboration with the supplier, but it is still a consideration and a potential solution from production stop. "Redesign" can often be a supplementary consideration when switching supplier but also a solution for avoiding production stop. When it comes to "internal allocation", helping the supplier with critical activities in their production, for example testing, and thereby letting them focus on their core competence can reduce the recovery time, according to the authors. This consideration has been tested before at Scania, according to the case presented in section 6.2.3 Case #3, which had a good outcome.

As the authors have seen, but not explicitly heard, from the interviews is that the single most efficient way to solve a crisis situation for Scania is to coach the already existing supplier. As earlier described, it is of highest prioritization to stay with the same supplier since it gains a lot of benefits. Coaching and helping the supplier can both generate a good outcome for the supply chain but Scania will probably also be prioritized among the supplier's customers when the production is up and running.

Insourcing of a component in a crisis situation is another suggestion from the authors. There is a lot of knowledge within the company why a short term solution to avoid production stop could be to produce the component in house. With all this in mind would critical considerations from Scania's point of view be following:

- Alternative supplier
- Coaching the existing supplier
- Internal allocation
- Redesign
- Insourcing

A short term solution as well as a long term target are ways of stating how to solve the crisis. The different considerations mentioned above can be strategies or actions to reach these short term solutions or the long term targets. Every component may have a specific strategy depending on stock levels, demand etc. The authors suggest Scania to set up an activity list of all operative activities that has to be performed to reach the different strategies and full recovery. Since all the cases are very different, this activity list will vary depending on the situation. Waters (2007) also says that it is important to stick to a checklist of activities in the recovery work. Waters (2007) also says that it is good to specify who is responsible for each activity in the recovery to normal situation. Interview respondents agree with that, why the authors realize that these activities are important to cover in the crisis management framework. Virginia (2011) highlights the importance of grading in which order the activities should be executed. That is something that the authors also think should be covered, since it is important to do the right things in right order even if it was not clearly mentioned during the interviews. Even implementation dates for both short term solutions and long term targets as well as follow up dates for activities should also be included in an action plan, according to the authors.

### **7.2.5 Communication**

According to Barton (2008), a good and well prepared communication system is very important when it comes to quickly solving a crisis. The authors of the study understand that communication is important both internally as well as externally. According to Musa (2012), it is important internally, since information flow often is transmitted in a network which results in a continuous influence of individual entities, where different entities may react differently. How stakeholders react if getting the wrong information is also of importance and should be done carefully, according to Waters (2007), who also highlight actions for handling public relations.

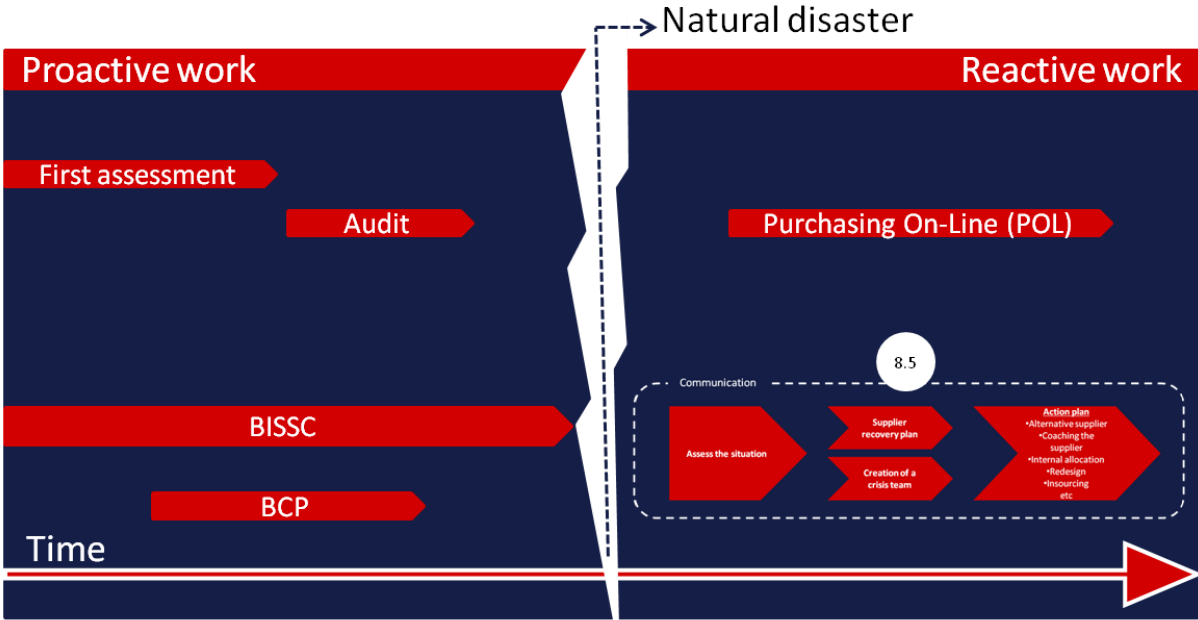
Some interviewees mention how important it is to inform the director within the own department rather than cross functional when allocating resources. The higher in the organization structure the information flows, the easier it is to get the support from other

departments. Cross functional information flow is obviously important especially for solving the problem but not when the purpose is to allocate resources.

Interviews have also shown how the external communication is managed, a topic the literature have not touched. What is more important is the complete mindset of treating the supplier, where communication is just one single part. Everyone in contact with the supplier must have the employees of the affected site in consideration. They might be injured, or even worse killed, due to the catastrophe why the tone of voice and mindset must be adapted for that. The employees of the production site have a lot of things to do when trying to re-build the production site. Interviews show that the best practice is supporting and coaching the supplier the best as possible but also to give them space in order to focus on right things. Another reason, which emerged during the interviews, is that decision makers often are not on the actual site and therefore the supply prioritization cannot be affected by visiting the site. Interview respondents say that Scania were probably prioritized in the three cases, presented in section 6.2 Crisis management, since Scania had a coaching and helping mentality.

**7.2.6 Summary of crisis management analysis**

This section will contain a summary of what has been analyzed and what the authors will bring to the next chapter, which contains the conclusions and recommendations of the study. Figure 27 below shows what the authors have found in the crisis management analysis of this study and which parts of the crisis management framework that can be improved. The improvement is marked with a white dot to show which part of the crisis management framework that need to be improved, and in what section the improvements will be presented.



**Figure 27: A summary of the crisis management improvement found by the authors**

From the crisis management analysis is there only one finding that the authors will highlight. This conclusion is a result of a best practice study and covers a suited framework for how Scania should work in a crisis management situation. The approach but also the favorable

mindset and suggestions of critical considerations is covered in section 8.5 Creation of a crisis management framework.



## **8. Conclusions**

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*This chapter will answer to the purpose of the study, and will therefore include conclusions and recommendations for how improvements can be performed in the risk management work at Scania, but the chapter also includes a recommendation for how Scania's new crisis management framework will be structured and performed.*

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This chapter will answer to the purpose of the study, that is:

“The purpose of the study is to *improve* the *proactive* and *reactive* work at the purchasing department within Scania CV AB in order to reduce the *risks* and the *economic consequences* that occurs due to *natural disasters* affecting their suppliers.”

Figure 28 below illustrates the improvements that the authors have found in Scania’s proactive and reactive work. The improvements are marked in white in the figure, and further information about each improvement will be described in section 8.1 – 8.5 below.

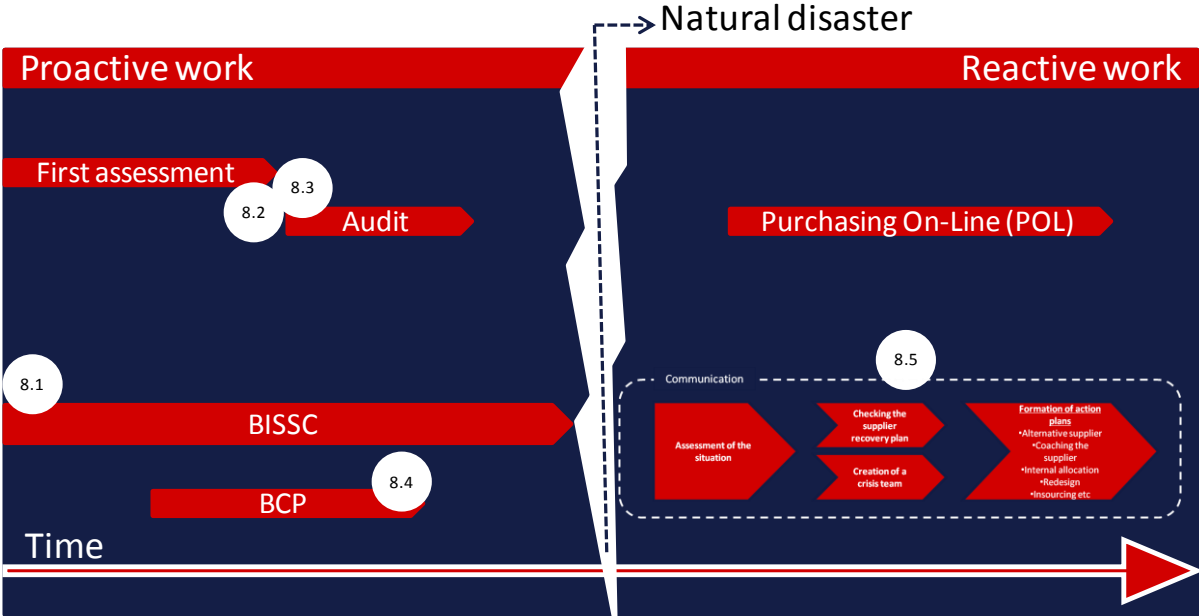


Figure 28: A summary of the improvements found by the authors

**8.1 Improvement of risk awareness**

The study has shown that the awareness around the investigated risks can be improved throughout the purchasing organization. Scania has to be clear with who has the responsibility for continuously improve the work around these risks. If no one has the responsibility, the authors don’t think that the work around these risks will be improved. According to the authors, the risk awareness can be improved by opening a job position which task is to be responsible for this. This position should be within the purchasing organization, where the tasks would be to ensure continuous improvements both with the risk and crisis management tools covered in this study, but also to work with the tools (especially the *BISSC*) and to educate the employees to ensure that the risk awareness is kept high in all the decisions and work performed by every employee in the purchasing organization. The goal with the improvement of the risk awareness is to reduce the number of critical suppliers and components, but also to continuously work with reducing the risks around the existing critical suppliers and components.

Improving the risk awareness by implementing responsibilities in the purchasing organization will improve the risk management at Scania because it will reduce the risks for Scania’s suppliers to be affected by natural disasters. By continuously trying to eliminate critical suppliers and components, while working towards improving the tools, activities and employees, Scania will reduce the risks of a natural disaster affecting their suppliers. In an

event where a disaster affects a supplier, the continuous work around the crisis management framework, together with the improved education of the employees, will also lead to reducing the economic consequences from the outcome of this disaster.

## **8.2 Location of suppliers' production sites**

This study has shown that it is impossible, inside Scania's organization, to find out where their suppliers' production sites are located. In the system, the employees at Scania can easily see where their suppliers have their headquarter, but this is not always the same location as where the component is produced. If a disaster is affecting a supplier, it is therefore very important for Scania to as fast as possible find out which of their suppliers that might be affected by the disaster.

Therefore, the authors suggest that this information is collected from all Scania's suppliers, especially the critical ones. This information (the coordinates) should then be collected to be able to be visually used in a crisis situation. How the information should be used is presented in section 8.5 Creation of a crisis management framework.

## **8.3 Improvement of first assessment and audit**

The study have also shown that the *first assessment* and *audit* can be improved. Today, the *first assessment* is the only tool that is used before choosing supplier. Therefore, it is very important that this tool covers risks regarding natural disasters, which it barely does today. The *first assessment* should also be standardized, which leads to more objective results and the results would then also be easier to estimate and evaluate between potential suppliers.

Improvements can also be performed in the *BAP*, which needs an update with more focus and questions regarding the risks investigated in this study, and therefore the tool will not only focus on product and process risks. This would also lead to improving the following *audit*, which will focus more on the risks investigated in this study.

As stated during interviews, improvements can also be done in the risk management self assessment, that is a part of the *first assessment*. When performing this part it is important to be clear to the supplier why the risk management self assessment is performed, in order to get the results needed from it. This is important to educate the responsible purchasers about, why the solution to this is, according to the authors, to follow the suggestions and conclusions presented in section 8.1 Improvement of risk awareness.

Improving the *first assessment* will improve the risk management work performed at Scania today, since more risks regarding natural disasters will be identified. Being able to evaluate suppliers before choosing them, with natural disaster risks in mind, will also improve the risk management work and hopefully reduce the number of critical suppliers and components.

## **8.4 Standardized BCP**

A business continuity plan shall, in line with *ISO/TS 16949*, be established if being a supplier to Scania CV AB. Since the plans not always cover what they are expected to cover, as heard during interviews, may the misunderstanding of the plan's creation be useless in a crisis situation. Hereafter follows a guideline for how the authors suggest Scania's suppliers to document manufacturing makeup-plans to be the most possible prepared before a disruption event occurs.

The plan should preferably start with a presentation of the disposition, objective and even a glossary of supplier specific words, since it is important for both Scania and the supplier to totally understand the plan. Then, an impact analysis should be included, containing how a disruption of critical business activities affect the company as well as to which extent factors as weather, fire and seismic activity affect the delivery. The next step in the *BCP* guideline would be to have a continuity plan for all potential losses and employees responsible for the different scenarios that may occur. Even triggers that will roll out the plan is important to include in the *BCP*. At last, the continuous maintenance of the plan and the rehearse of the procedures is important to make sure it actually works. The entire guideline of what Scania want the supplier to contain in the *BCP* is attached in Appendix F.

The authors believe that parts of the result of this guideline is the same information as what is demanded when doing the *BISSC* workshop. With this information may the *BISSC* workshop be more credible since more information from the supplier underpinning the outcome of the *BISSC* workshop.

This finding will improve the risk management at Scania since the supplier will be more prepared in case of a disaster, but the supplier’s risk awareness will also be improved because they will continuously identify the risks that their organization is facing.

**8.5 Creation of a crisis management framework**

Regardless of how much resources a company spend on reducing risks with different proactive activities, an organization will sooner or later experience a crisis e.g. a natural disaster. As Booth (1993) confirms there is no way in which an enterprise can vaccinate themselves to become immune to a crisis. Therefore is also preparation of a reactive process important, in order to reduce the economic consequences that a crisis causes. A crisis management framework for how Scania should manage the reactive work together with the affected supplier(s) is therefore one of the authors’ conclusions. The following framework consists of five different elements, which should be included during the process back to normal state in case of a natural disaster affecting Scania’s suppliers. The framework is shown in figure 29 below.

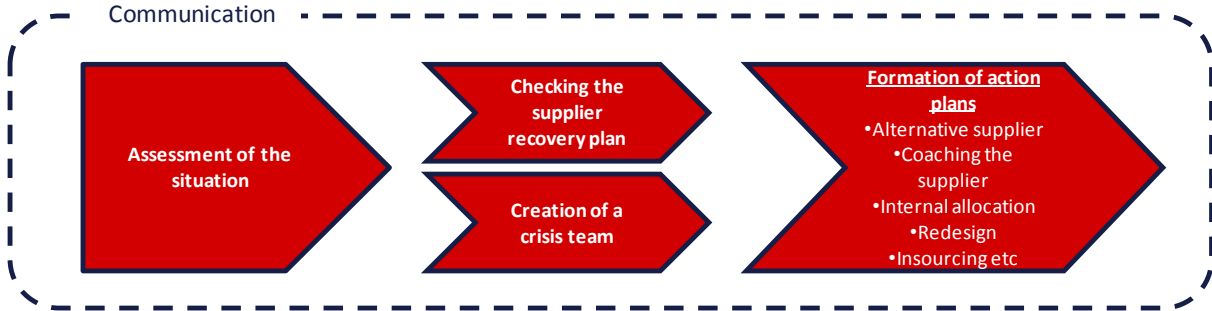


Figure 29: Scania's reactive framework suggested by the authors of the thesis

All four arrows in the framework can be seen as activities that should be performed in the same order in a reactive work process, as shown in figure 29 above. The dashed line symbolizes the meaning of a continuous communication, both internally and externally, and which mindset towards the supplier that is favorable in a crisis situation. The first action after getting notice about the crisis is to assess the situation and find out potential production stops which determines how urgent the situation is. Since the composition of a supplier

recovery plan often is time consuming, the crisis team will be formed parallel to the activity. The team can first be formed when knowing about the current situation and how much resources the supplier is ready to offer. After assessing the situation, it is important to get a plan of how the supplier will be fully recovered, and after the creation of a crisis team, the action plans can be formed. Regardless of the situation, a suited strategy should be formed to reach quickest recovery.

The crisis management framework will contribute to answer a part of the study's purpose by improving the reactive work in order to reduce potential economic consequences. The crisis management framework will hopefully reduce the time it takes to full recovery and it will also help Scania's employees how the recovery work should be performed in case of a natural disaster. The economic consequences will therefore also probably be reduced since the framework helps the employees within Scania to minimize the risks of potential production stops. Also a quicker recovery that the framework may lead to will reduce the economic consequences. The creation of the framework takes directive 4 into consideration.

## **9. Discussion**

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*The last chapter covers a discussion, performed by the authors, around the methodology and results of the study. The authors also discuss problems and other situations that occurred during the study. The chapter concludes with a discussion around the generalizability of the results and suggestions for further research on the subject.*

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## 9.1 General discussion around the study

During the study the authors have seen that the risk management work performed at Scania today is very extensive and covers many risks. At the beginning, the authors believed that it would be difficult to find improvements in the seemingly complete framework, where especially the *B/SSC* tool basically covers everything on the subject.

However, as said by the supervisor at Scania, their weakness was the reactive part, but to understand the crisis management work that needs to be done and to find suitable improvements, the authors had to investigate the risk management activities first. Now after the study, the authors have understood the meaning of that process.

But, as shown by the three cases covered in this study, the crisis management work performed by Scania have shown good result from Scania's side, even though they don't have an established reactive framework for how to act in these situations. But eventually, Scania will face more disasters and it is always good to be as prepared as possible to have the best chance of getting unscathed through the crisis.

The results, conclusions and recommendations found in this study will hopefully help Scania to both lower the risks of being affected by natural disasters, but also reduce the economic consequences when a disaster affects their suppliers. It is impossible to avoid natural disasters from happening, but there are many techniques that can be performed to not be affected by them. These results will, if implemented at Scania, help them to both reduce the risks and reduce the economic consequences of future natural disasters. The authors are however still sure that more improvements can be done. Suggestions for future research on the subject will be presented by the authors in section 9.4 Suggestions for future research.

The authors know that an easy way of handling the problems in this study is to use dual sourcing or at least dual production, but since the study only focuses on products that are developed together with the supplier, using dual sourcing is not an option. Dual production is also difficult in most of these cases since Scania works with small or medium sized suppliers which therefore often only has the ability to produce the component at one factory.

Below follows three sections that the authors want to highlight in the discussion. The first chapter covers method criticism, where the authors want to discuss the methods used and choices made in the study in order to make the study more credible and to make the readers aware of the decisions made. The second section covers the generalizability of the study's results, where the authors discuss how the results can be generalized to a larger area than the study is aimed for, but also discuss if the results can contribute to theories on the subject. The fourth and last subject will contain the authors' suggestions for further research on the subject, which both is good to know for Scania but also for other master thesis students who want to dig deeper and continue on this study.

## 9.2 Method criticism

The authors have performed the study as planned in chapter 5 Methodology, but during the performance of the study it has been shown to the authors that some of the methods used could contribute to lowering the credibility of the study's results. According to the authors, five major parts of the study are important to highlight in this section. The first one is about the lack of theoretical information about some subjects in the frame of reference presented in chapter 3 Frame of reference. The second subject is about the lack of triangulation, both in

chapter 3 Frame of reference and in chapter 6 Collection of empirical information. The third one is about confidentiality and how that have affected the study. The fourth one covers the benchmark study performed by the authors and problems around it. The fifth and last part covers the choice of studied cases and interview respondents and how that affects the credibility of the study. These five subjects will be presented below.

### **9.2.1 Collection of theoretical information**

The frame of reference presented in chapter 3 is divided into three sections, where the first section covers risk management theories, the second one covers theories around common used tools on the subject and the third section covers theories around crisis management.

According to the authors, the risk management section is very extensive and covers many theories on the subject. The chapter starts by explaining risk management in general and then focuses more on details on subjects investigated in the study. However, probably because the subject is rather new, the authors had some trouble finding relevant theories for the study. The purpose of the study is very specific for the work performed by Scania as an organization. Risk management looks very different depending on what situation an organization are in, their strategies and visions, how their supply chain looks like and what type of products they make. Still, the authors think that the theoretical frame have helped a lot during the study, both when formulating questions and analyzing empirical information.

The single most used theory is the one presented by Musa (2012), which covers the five steps in SCRM. This theory is used by the authors throughout the study and is therefore affecting the study and its results. The results may have looked different depending on if the authors had used another theory to work after. However, according to the authors, this theory is very detailed and is also supported by other theories on the same subject. During the study it has also been clear to the authors that the work performed at Scania can easily be compared to the content in this theory. Therefore, the authors believe that this theory is good to use as the proactive base when proceeding with the study.

The second section, that covers theoretical information around common tools used on the subject, was even more difficult to find relevant information about. The first analysis was limited to only improving the existing framework at Scania. Some of the tools used by Scania were also developed by Scania and this made it even more difficult for the authors to find relevant theories for how the tools could be improved. Therefore, not all tools used by Scania are presented in the frame of reference. Both *POL* and the *BISSC* were so specific for Scania's needs that the authors could not find any relevant theories on these tools. Because of the lack of theories around the tools, the authors have not analyzed the tools used by Scania in detail, but have focused more on the overall work with and around the tools.

The third and last part of the frame of reference was about crisis management, and this part was also difficult to find relevant theories on. There were many theories for how to act in crisis situations for example when evacuating a building during a fire or how to take care of injuries and media during a natural disaster, but in Scania's case, the crisis management is more about how to secure supply during a natural disaster. This topic was barely covered at all in the literature, why the authors have put more focus on this part in the gathering of empirical information presented in chapter 6 Collection of empirical information. The theories found were more on an overall level and the chapter therefore never goes into any details for how to act in the investigated crisis situations.



### **9.2.2 Triangulation**

This section will cover the problems that the authors experienced around triangulation, both in the frame of reference and in the collection of empirical information.

When it comes to the frame of reference, the authors have faced the same problem as presented in section 9.2.1 Collection of theoretical information. The lack of information found on the subject has in some subjects made it difficult for the authors to perform triangulation on the information. This has mostly been a problem in the tools and crisis management section, but also when going into details during some subjects.

When collecting empirical information, the methodology was to always interview at least two people from every case and also to ask every question to more than one interviewee. However, during the interviews the authors found out that some details were individual, mostly during the case questions, and therefore it was difficult to hear the same information from two different sources. Even though the authors went back to the interviewees to confirm answers with other interviewees, some information was difficult to confirm. The sourcing managers (commodity) were often the interviewees having the most detailed answers on the questions, since they probably were most involved in the cases. However, the suggestions found in this study have been brought up with other employees to confirm that the motivations behind the suggestions are correct.

### **9.2.3 Confidentiality**

Because the purpose of the study was to help Scania and that the study handles a lot of internal information about Scania and how they work, some of the material handled is considered by Scania to be confidential. The risk management tools used, together with strategies and decisions made in the cases have been the parts of the study where the authors have faced confidentiality-related problems the most. Also details about the benchmark company has not been presented during the thesis because of confidentiality issues. Because of this, the authors think that the interview respondents have been more open and honest with the answers, which is necessary to find improvements in the work performed.

The study is therefore presenting a general view of both Scania's risk and crisis management work, but also when it comes to the crisis management work performed by the benchmark company. The purpose of this study is not to find differences between how the interviewees respond, but more to find a general picture of the situation today.

However, the authors think that the results found in this study have not been affected by the confidentiality. The conclusions and recommendations do not go into details in any of the tools or strategies used by Scania today. The authors feel that during the whole study, Scania has been very open with sharing relevant and necessary information and therefore, the authors do not think that confidentiality is significantly affecting the study.

### **9.2.4 Benchmarking**

In the beginning of the study, the authors were determined to find as many relevant benchmarking companies as possible for the benchmark study, since the reactive framework barely exists at Scania and that it therefore could be difficult to find valuable information inside the organization.

However, during the study it was clear to the authors that it was difficult to find relevant companies that were willing to participate in a benchmark study. When the authors found a relevant company, it was even more difficult to find the contact inside the organization that was working with these kind of risks. At the end, the authors could only get one benchmark interview.

It is reasonable to believe that a benchmark study is better the more companies included in the study. In this study, the authors only found one participating company, but it would probably have been a better benchmark study if the authors had found more companies. However, the authors think that the company that participated was still very contributing to the study, since the work around these risks inside that company is very extensive and very much alike to the work performed at Scania. The benchmark companies' interviewees were also very open and willing to share information and knowledge about the subject. Because of this, the authors still think that the benchmark study contributes a lot to the reactive part of the study.

### **9.2.5 Cases and interview respondents**

At the beginning of the study, the authors were given suggestions for a couple of cases and interview respondents that could be a part of the study. After a discussion with the supervisor at Scania, the three cases covered in the study were considered best suited for the study, together with the interview respondents with most knowledge about the cases.

Now when the results are known to the authors, it would have been good if at least one of the cases ended more different from the others. The authors think that the outcome of the three studied cases were too similar and all of them ended without having to switch supplier for example. If the outcome were more different, the authors would have more empirical information when analyzing different strategies to get back to a normal situation. However, the interview respondents were considered by the authors to be the best suited since they were the employees with the absolute best knowledge about the cases, since they had participated in the crises themselves.

### **9.3 Generalizability**

Because the authors has a system perspective when performing this study, there have been no investigation outside the delimitations and directives of the study. Therefore, in this section the authors will have a discussion around the generalizability of the results and whether they can contribute to the theories on the subject.

When it comes to the directives and delimitation, presented in section 1.5 Directives and delimitations, the authors presents that the study only focuses on risks regarding natural disasters, where fire also is included. However, the authors think that the results are useful for more situations than natural disasters. Especially the crisis management framework presented in section 8.5 Creation of a crisis management framework can, according to the authors, be used in all situations where a supplier has problems with delivering a component with right quality in the right time. The authors also believe that the reactive framework found in this study can be useful for other organizations, since it is not specific for Scania and because the results are found with help from both theories and a benchmark study.

Another directive says that the study will only investigate around components that are developed together with the supplier. The authors strongly believe that the results found can

be used to improve risk and crisis management around other suppliers and components as well. For example, if the product is supplier developed, the risk and crisis management is still very important, but it is also important to quickly assess the situation to be able to choose a strategy even for a standard component, because otherwise other companies will get the remaining components after a disaster before you. Risk management is also important for all components, even though the situations often are not as chaotic if dealing with a standard product.

One directive is that the study will only cover first and second tier suppliers because the three cases only covered first and second tier suppliers. However, the results found does not depend on how far away upstream in the supply chain that the affected supplier is. Therefore, the authors think that the results can be used on all suppliers, regardless of where in the supply chain they are.

As described earlier in the study, it is not easy to find relevant theories on crisis management when it comes to situations covered in this study. Even though this study is performed at Scania, the results found in the crisis management work can contribute to the theory. A benchmark study was performed, that also showed that this way of working also is performed in other organizations. Of course the details are very specific for Scania, but the steps gone through in a crisis are steps that the authors think needs to be done in these situations, even if the organization is not Scania. The purpose is almost always the same for every organization in situations like these, that is to avoid production stops.

#### **9.4 Suggestions for further research**

As earlier presented, the authors are determined that there still are improvements in both the risk and crisis management work at Scania. The next steps, according to the authors, would be to dig deeper into the details of the tools used today. Because this study had a directive that said that the study only focused on the existing risk management framework, further studies could also be done by trying to find new tools that can be used in the risk management work, but also in the crisis management work.

Because crisis management is not a theoretically explored area, the authors also believe that more theories on the subject can be found in the future when more organizations have opened their eyes on this problem, which also could improve the crisis management even more and in more detail. In this study, the authors did not cover any details around strategies that can be used in crisis management depending on what the situation looks like. The crisis management framework could overall be investigated more in detail to help Scania even more around how to act depending on the situation.

## References

### Books:

- Barton, L., (2008). *Crisis leadership now : a real-world guide to preparing for threats. disaster, sabotage, and scandal.* McGraw-Hill. USA
- Björklund, M., (2012). *Hållbara logistiksystem.* Studentlitteratur AB. Lund, Sweden.
- Björklund, M., Paulsson, U., (2003). *Seminarieboken – att skriva, presentera och opponera.* Studentlitteratur. Lund, Sweden
- Boman, G., (2011). *En liten historiebok om Scania – en stor fordonstillverkare.* Trosa tryckeri AB. Trosa, Sweden
- Booth, S.A., (1993). *Crisis management strategy: Competition and change in modern enterprises.* Routledge. London, UK
- Borge, D., (2001). *The book of risk.* John Wiley & Sons Inc. New York, USA
- Breakwell, G.M., Hammond, S., Fife-Schaw, C., (2000). *Research Methods in Psychology.* SAGA Publications Ltd. London, UK
- Churchman, C.W., (1984). *The systems approach.* Dell Publishing Co Inc. New York, USA
- Lekvall, P., Wahlbin, C., (2001). *Information för marknadsföringsbeslut.* IHM Publishing. Göteborg, Sweden.
- Musa, S.N., (2012). *Supply chain risk management : identification, evaluation and mitigation techniques.* Department of Management and Engineering, Linköping University. Linköping, Sweden.
- Paulsson, U., (2007). *On managing disruption risks in the supply chain - the DRISC model.* Department of Industrial Management and Logistics, Lund University. Lund, Sweden
- Persson, G., Virum, H., (1991). *Logistik för konkurrenskraft.* Liber ekonomi. Malmö. uppl. 2:3
- Schneid, T.D., Collins, L., (2000). *Disaster Management and Preparedness.* CRC Press LLC. Florida, USA.
- Steele, P., Court, B., (1996). *Profitable purchasing strategies: A manager's guide for improving organizational competitiveness through the skills of purchasing.* McGraw-Hill. London, UK
- Van Weele, A.J., (2010). *Purchasing and Supply Chain Management.* fifth edition. Cengage Learning EMEA. Hampshire, UK
- Wallace, M., Webber, L., (2011). *The Disaster Recovery Handbook: Step-by-Step Plan to Ensure Business Continuity and Protect Vital Operations (e-book)*
- Waters, D., (2007). *Supply Chain Risk management: Vulnerability and resilience in logistics.* Kogan Page Limited. London, UK

Zairi, M., (1992). *The art of benchmarking: using customer feedback to establish a performance gap*. The Management Centre, University of Bradford. Bradford, UK

### Articles:

Ahmed, A., Kayis, B., Amornsawadwatana, S., (2007). *A review of techniques for risk management in projects*. *Benchmarking: An International Journal*. 14(1), pp 22-36

Baker, N., Writer, F., (2012). *Enterprisewide business continuity*. *Internal auditor* 1 June. pp 36 – 43

Baker, S.M., (2009). *Vulnerability and resilience in natural disasters: A marketing and public policy perspective*. *Journal of Public Policy & Marketing*. 28(1), pp 114-123.

Barlow, R.D., (2012). *Conquering the chaos when disaster strikes: Recovery, rebuilding efforts test supply chain resilience*. *Healthcare Purchasing News*. 36(1), pp 36-40.

Birou, L.M., Fawcett, S.E., (1994). *Supplier involvement in integrated product development: A comparison of US and European practices*. *International Journal of Physical Distribution & Logistics Management*. 24(5), pp 4-14.

Carr, A.S., Pearson, J.N., (2002). *The impact of purchasing and supplier involvement on strategic purchasing and its impact on firms' performance*. *International Journal of Operations and Production Management*. 22(9), pp 1032–1053

Carvalho, H., Barroso, A.P., Machado, V.H., Azevedo S., Cruz-Machado, V., (2012). *Supply chain redesign for resilience using simulation*. *Computers & Industrial Engineering*. 62(1), pp 329-341.

Chopra, S., Sodhi, M.S., (2004). *Managing risk to avoid supply-chain breakdown*. *MIT Sloan*. 46(1), pp 53-62

Christopher, M., Lee, H., (2004). *Mitigating supply chain risk through improved confidence*. *International Journal of Physical Distribution and Logistics Management*. 34(5), pp 288-396

Colicchia, C., Dallari, F., Melacin, M., (2011). *A simulation-based framework to evaluate strategies for managing global inbound supply risk*. *International journal of logistics research and applications*. 14(6), pp 371-384

Hallikas, J., Virolainen, V., Tuominen, M., (2002). *Risk analysis and assessment in network environments: a dyadic case study*. *International journal of production economics*. 78(1), pp 45-55

Handfield, R.B., Ragatz, G.L., Petersen, K.J., Monczka, R.M., (1999). *Involving suppliers in new product development*. *California Management Review*. 42(1), pp 59-82.

Herbane, B., Elliot, D., Swartz, E.M., (2004). *Business Continuity Management: time for a strategic role?*. *Long range planning*. 37(5), pp 435 - 457

Jrad, A., Morawski, T., Spergel, L., (2004). *A model for quantifying business continuity preparedness risks for telecommunications networks*. Bell Labs Technical Journal. 9(2), pp 107-123

Kraljic, P., (1983). *Purchasing must become supply management*. Harvard Business review. 61(5). pp 109-117

Littler, D., Leverick, F., Bruce, M., (1995). *Factors Affecting the Process of Collaborative Product Development: A Study of UK Manufacturers of Information and Communications Technology Products*. The Journal of Product Uvovation Management. 12(1), pp 16-23.

Manuj, I., Mentzer, J.T., (2008). *Global supply chain risk management*. Journal of Business Logistics 29. pp 133-154

Matook, S., Lasch, R., Tamaschke, R., (2009). *Supplier development with benchmarking as part of a comprehensive supplier risk management framework*. International journey of operations & production management. 29(3), pp 241-267

Norrman, A., Jansson, U., (2004). *Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident*. International journal of physical distribution & logistics management. 34(5), pp 434-456

Paton, D., (1999). *Disaster business continuity: promoting staff capability*. Disaster Prevention and Management. 8(2), pp 127–133

Pryor, L.S., (1989). *Benchmarking: A Self-Improvement Strategy*. Journal of Business Strategy. 10(6), pp 28-32

Ragatz, G.L., Handfield, R.B., Scannell, T.V., (1997). *Success factors for integrating suppliers into new product development*. Journal of Product Innovation Management 14, pp 190-202.

Shao, X-F., Dong, M., (2012). *Supply Disruption and Reactive Strategies in an Assemble-to-Order Supply Chain With Time-Sensitive Demand*. IEEE Transaction on engineering management. 59(2), pp 201-212

Virginia, A.J., (2011). *How to Avoid Disaster: RIM's Crucial Role in Business Continuity Planning*. Information management. Nov/ Dec. pp 36–40

Wynstra, F., Van Weele, A., Weggemann, M., (2001). *Managing supplier involvement in product development: Three critical issues*. European Management Journal 19, 157-167.

Zeng, A.Z., (2000). *A synthetic study of sourcing strategies*. Industrial Management & Data Systems. 100(5), pp 219-226

Zsidisin, G.A., Ellram, L.M., Carter, J.R., Cavinato, J.L., (2004). *An analysis of supply risk assessment techniques*. Internation journal of physical distribution & logistics management. 34(5), pp 397-413

#### **Lecture and conference presentations:**

Artero, S., (2012). *APM 133 - First assessment / Process audit*. Internal presentation, Scania. Södertälje, Sweden

Billström, M., (2012). *Global Purchasing Strategy 2012+*. Internal presentation, Scania. Södertälje, Sweden

Bracamonte, V., (2011). *APM 128 – Supplier self assessment*. Internal presentation, Scania. Södertälje, Sweden

Engström, P., (2013). *Escalation model*. Internal presentation, Scania. Södertälje, Sweden

Grubbström, L. Introduction presentation 2013-02-08

Johansson, H. Introduction presentations 2013-02-04 – 2013-03-12

Johnson, E., (2012). *Official Presentation 2012*. Internal presentation, Scania. Södertälje, Sweden

Lagerbäck, Å. Introduction presentation 2013-02-07

Nilsson, K., (2008a). *SH 051 – Sourcing manager, commodity*. Internal presentation, Scania. Södertälje, Sweden

Nilsson, K., (2008b). *SH 052 – Sourcing manager, project*. Internal presentation, Scania. Södertälje, Sweden

Nilsson, K., (2008c). *SH 072 – Supplier quality manager, commodity*. Internal presentation, Scania. Södertälje, Sweden

Vicari, K., (2011). *APM 132 – Business interruption study supply chain*. Internal presentation, Scania. Södertälje, Sweden

## Appendix A

Hereafter follows a glossary of Scania specific or automotive specific words that appear in *italic* during the entire thesis.

BISSC	Business interruption study supply chain, A Scania developed tool for reducing risk
BCP	Business continuity plan, A plan for recovery of exposure to internal and external threats
SCRM	Supply Chain Risk management, A theory and strategy how to manage everyday risks along the supply chain
First assessment	A tool that checks if a new supplier meets Scania's requirements
Audit	A tool that checks if already delivering supplier meets Scania's requirements
Risk management supplier audit	One type of audit including in the BISSC which just focuses on risk management
BAP	Best Audit Practice, a database of question which helps the SQA to form a suited first assessment/audit
SPS	Scania Production System
POL	Purchasing On Line, support team function ready to take over problem cases in order to maintain a deviation free production
SRM	Supplier Relationship Management
ISO/TS 16949	Is an ISO standard for the development of quality management system for supplier in the automotive industry
ISO 14971	An ISO standard which represent risk management requirements for the medical device industry
BS 25999	A business continuity management standard



## Appendix B

Business continuity plan framework (*Waters, 2007 pp 232-233*):

1. Description of the plan, its purpose, scope, assumptions and objectives.
2. Glossary and definitions of terms used
3. Impact analysis to identify
  - a. Critical business activities
  - b. The impact of disruption to these activities in terms of costs, resource, service level, penalties, liability, goodwill, etc
  - c. How the impact changes over time, considering immediate impact to long-term effects.
4. Incident response including
  - a. Triggers that notify managers that something is wrong and action needs to be taken
  - b. Notification that an incident has occurred
  - c. Activation of emergency procedures, including use of this document
  - d. Checklists for immediate responses (evacuation, calling emergency service, contact managers,etc)
5. Roles and responsibilities
  - a. Identification of everyone with a role in the emergency response
  - b. Their primary and secondary locations
  - c. Their membership of recovery teams
  - d. Lists of the specific activities that they should perform
  - e. Make decisions where alternate actions can be taken
  - f. List of key external contacts, including communications
6. Event log showing a list of tasks actually done, by whom and when
7. Recovery plan showing
  - a. Detailed assessment
  - b. Tasks to be done in the longer term to recover from incident
  - c. Resources and funding needed
  - d. Objectives, responsibility and timing
8. Incident recovery checklist, to ensure that all activities have actually been performed.
9. Review of procedures, to see how well the plans actually worked and how they could be improved
10. Maintain and rehearse, to
  - a. Keep plans up to date
  - b. Rehearse the procedures to make sure that they actually work

# Appendix C

Interview guide:

We are two students from the institute of technology, Linköping. Since the beginning of February, we have performed our master thesis within Scania where we are investigating supply chain risks connected to natural disasters. The purpose is, in the end, to improve Scania's proactive work activities and to present a framework how Scania should handle a crisis situation due to delayed or disrupted delivery. We will use a semi-structured interview approach where following questions are going to help us to answer the specified questions mentioned in chapter 4 Specification of task.

General questions

What is your title and responsibilities?

What was your tasks in the case studied?

## **Risk management**

Which activities, connected to risk identification, are used within Scania today?

*Answer how Scania identifies risks in the specific matter.*

Which of the activities were applied on the supplier and which were applied on Scania?

*Answer if risks are identified for a supplier or for a product.*

Which deficiencies can you see in Scania's identification of risks regarding natural disasters?

*Answer if the respondent has any own thoughts about deficiencies in Scania's risk identification regarding natural disasters.*

How are identified risks estimated within Scania?

*Answer which dimensions used for estimate risks within Scania.*

Which deficiencies can you see in Scania's estimation of risks regarding natural disasters?

*Answer if the respondent has any own thoughts about deficiencies in Scania's risk estimation regarding natural disasters.*

How are the identified risks evaluated or prioritized within Scania?

*Answer how Scania prioritize the risks they are facing.*

Which deficiencies can you see in Scania's evaluation of risks regarding natural disasters?

*Answer if the respondent has any own thoughts about deficiencies in Scania's risk evaluation regarding natural disasters.*

Which methods are used by Scania to mitigate the identified risks connected to natural disasters?

*Answer how Scania choose to handle with risks in different ways.*

Which deficiencies can you see in Scania's mitigation of risks regarding natural disasters?

*Answer if the respondent has any own thoughts about deficiencies in Scania's risk mitigation regarding natural disasters.*

How is the follow-up work performed to keep the risk identification, estimation, evaluation and mitigation techniques updated?

*Answer if Scania pay attention to update and follow up their risk management process.*

What parts of these tools and models can be improved?

*Answer if the respondent has any own thoughts about improvements for the specific tools*

When in the product development process are the risk management tools and models used?

*Answer if the risk management is done to late in the supplier integrated development process.*

### **Crisis management**

How did you proceed during the first 24 hour after you had been informed about the potential disruption?

*Answer how the procedure after a disruption threat will look like in the first 24 hours.*

How did you proceed during the first week after you had been informed about the potential disruption?

*Answer how the procedure after a disruption threat will look like in the first week.*

How did you proceed during the first month after you had been informed about the potential disruption?

*Answer how the procedure after a disruption threat will look like in the first month.*

In which order are these operations performed?

*Answer if any specific order exists.*

Which operations are most critical for the consequences of the natural disaster?

*Answer how the prioritization of operations will look like.*

Which operations can be improved?

*Answer if the respondent has any own thoughts about how operations for reducing consequences can be improved.*

Are there typical milestones on the way back to the normal state?

*Answer what kind of interim targets were used in the case.*

Who has the main responsibility for solving the problem?

*Answer who has the liability of the case*

Which employees should preferably be included in the crisis management team solving the situation?

*Answer the respondent's thought about which people are needed for the quickest recovery*

Which of the crisis management operations can be planned proactively?

*Answer if something more than what is planned today can be done in advance*

## Appendix D

Literature search:

Key words	Number of results/ Relevant results	Reference	Contains
<b>Business Source Premier</b>			
Different types of purchasing definitions	777/2	Van Weele (2010)	Sourcing, purchasing, buying?
Purchasing definition		Carr, A.S. & Pearson, J.N. (2002).	Development and application of purchasing
Business continuity planning	608/4	Baker, N., Writer, F. (2012)	The importance of Business continuity planning
		Herbane, B., Elliot, D., Swartz, E.M. (2004)	Definition of business continuity planning
		Paton, D. (1999)	Who can perform a business continuity plan
		Colicchia, C., Dallari, F., Melacin, M. (2011).	Definition of business continuity planning
Sourcing strategies purchasing	2487/1	Zeng, A.Z., (2000)	Mention disadvantages with Supplier relationship management
Business continuity disaster	251/2	Jrad, A., Morawski, T., Spergel, L. (2004)	An approach to do a business continuity plan
		Virginia, A.J., (2011)	What should a business continuity plan contain?
Purchasing supply chains	8108/1	Kraljic, P., (1983)	All of the firms assessing supply risks when evaluating suppliers
Risk analysis assement production	718/1	Hallikas, J., Virolainen, V., Tuominen, M., (2002)	Probability and impact describes risk
Risk assessment techniques supply chains	24/1	Zsidosin, G. A., Ellram, L. M., Carter, J. R., Cavinato, J. L.	Risk assessment techniques
Supplier product development	58/2	Ragatz, G. L., Handfield, R. B., & Scannell, T. V. (1997)	Success facors for intregrate the supplier in the development phase
		Handfield, R. B., Ragatz, G. L., Petersen, K. J.,&Monczka	Early involvement of new suppliers in the development phase
Risk management supplier supply chains	446/1	Matook, S., Lasch, R., Tamaschke, R., (2009).	Supplier risk management framework
Supplier involvement product development	159/2	Birou, L. M., & Fawcett, S. E. (1994).	Comparison in supplier product development between US and Europé
		Wynstra, F., van Weele, A., & Weggemann, M. (2001).	Three critical issues for manage supplier integration in the development process
Collaborative product development	717/1	Littler, D. Leverick, F. Bruce, M	Key success factors for supplier development
Supply chain resilience	60/2	Barlow, R D. (2012)	Recover, rebuild, resolve and resilience of Supply Chain
		Carvalho, H. Barroso, A P. Machado, V H. Azevedo S. Cr	Supply Chain design for resilience
Reactive Strategies supply disruptions	7/1	Shao, X-F-, Dong, M., (2012).	Separating the terms mitigation tactics and reactive strategies
Supply chains risk management	1232/3	Manuj, I. Mentzer, J T. (2008).	Divides Risk management into three categories
		Chopra, S. Sodhi, M S. (2004).	Present nine categories of supply chain risks
		Christopher, M. Lee, H. (2004).	Definition of Supply chain risk
techniques risk management projects	762/1	Ahmed, A. Kayis, B. Amornsawadwatana, S. (2007)	Qualitative risk estimation is preferred without enough data
Ericsson risk management accident	1/1	Norrman, A. Jansson, U., (2004)	Ericsson-Nokia case
Benchmarking strategy	1199/1	Pryor, L S. (1989)	Essential information about benchmarking
<b>Example of non-specific key words</b>			
Risk			
Natural disasters			
Product development			
Purchasing			

## Appendix E

Compilation of methods for answering the specific questions:

Questions:	Methods:
1. <i>How can Scania improve their risk management work for reducing risks regarding natural disasters?</i>	<ul style="list-style-type: none"> <li>Answered by analyzing question 1A-1L</li> </ul>
2. <i>How should the crisis management work be performed by Scania in order to minimize the consequences after an event of a natural disaster?</i>	<ul style="list-style-type: none"> <li>Answered by analyzing question 1 and question 2A-2H</li> </ul>
1A. <i>Which activities, connected to risk identification, are used within Scania today?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1B. <i>Which of the activities, mentioned in the answer to question 1A, are applied on the supplier and which are applied on Scania?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1C. <i>Which are the deficiencies in the risk identification activities regarding natural disasters?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1D. <i>How are the identified risks estimated?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1E. <i>Which are the deficiencies in the risk estimation activities regarding natural disasters?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1F. <i>How are the identified risks evaluated or prioritized?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1G. <i>Which are the deficiencies in the risk evaluation activities regarding natural disasters?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1H. <i>Which methods are used by Scania to mitigate the identified risks connected to natural disasters?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1I. <i>Which are the deficiencies in the risk mitigation activities regarding natural disasters?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1J. <i>How is the follow-up work performed to keep the risk identification, estimation, evaluation and mitigation techniques updated?</i>	<ul style="list-style-type: none"> <li>Case interviews with R&amp;D engineers, SQA managers and sourcing managers (commodity)</li> </ul>
1K. <i>What parts of the risk management tools and models used at Scania today can be improved?</i>	<ul style="list-style-type: none"> <li>Interviews with SQA managers</li> </ul>
1L. <i>When in the product development process are the risk management tools and models used?</i>	<ul style="list-style-type: none"> <li>Interviews with SQA managers</li> </ul>
2A. <i>What operations are included in a typical crisis management process in an event of a natural disaster that delays the delivery of the product?</i>	<ul style="list-style-type: none"> <li>Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>
2B. <i>In which order are these operations performed?</i>	<ul style="list-style-type: none"> <li>Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>

2C. Which operations are most critical for the consequences of the natural disaster?	<ul style="list-style-type: none"> <li>• Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>
2D. Which operations can be improved?	<ul style="list-style-type: none"> <li>• Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>
2E. Are there typical milestones on the way back to the normal state?	<ul style="list-style-type: none"> <li>• Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>
2F. Who has the main responsibility for solving the problem?	<ul style="list-style-type: none"> <li>• Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>
2G. Which employees should be included in the team solving the situation?	<ul style="list-style-type: none"> <li>• Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>
2H. Which of the crisis management operations can be planned proactively?	<ul style="list-style-type: none"> <li>• Interviews with R&amp;D engineers, sourcing managers (commodity) and benchmark company</li> </ul>

## Appendix F

### Supplier continuity plan framework

A business continuity plan shall, in line with *ISO/TS 16949*, be performed if being a supplier to Scania CV AB. The preparedness in case of a disruption is also an activity that can reduce tremendous damage to the entire supply chain in a disaster situation. Hereafter follows what Scania suggest the plan should contain when documenting of manufacturing makeup-plans to be the most possible prepared before a disruption event occurs.

1. A short description of the plan with disposition, its purpose, scope and assumptions,
2. Glossary and definitions of company specific terms used
3. Impact analysis should include:
  - a. Mention of critical activities for delivering to Scania, e.g. within production, logistics, sub-suppliers etc.
  - b. A statement of the disruption impact to these activities in terms of costs, downtime, resource, service level, penalties etc.
  - c. A discussion how the impact changes over time, considering immediate impact to long-term effects.
  - d. A description of and to which extent other factors such as weather, fire, equipment/ tooling/ manpower capacity constraints, political unrest, quality-related items, labor and bankruptcy issues together with planned downtime is affecting the production and delivery.
4. Incident response should include:
  - a. A statement of which triggers that notify managers action needs to be taken
  - b. How managers start the recovery procedures of getting a normal delivery flow to Scania, which is a part of this document's result.
5. Roles and responsibilities should include:
  - a. Identification of everyone with a role in the recovery of normal delivery flow to Scania
  - b. A statement of the specific activities that they should perform
  - c. A list of key external contacts, specific to Scania
6. Continuity plan should include
  - a. A detailed plan for every potential loss of critical activities or environmental factors affecting the delivery stated in "impact analysis"
  - b. Tasks to be performed in the longer term to recover to a normal delivery flow to Scania.
  - c. Resources and funding needed
7. Keep plans up to date and rehearse the procedures to make sure that they actually work