Returnable Packaging in the Automotive Supply Chain
From a supplier’s perspective

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Abstract

Problem

Little research has been conducted on how packaging and returnable packaging are managed within suppliers in the Scandinavian automotive supply chain. Sources also propose that returnable packaging is dealt with inefficiently within the automotive suppliers.

Purpose

The purpose of the thesis is to explore and analyze how packaging and returnable packaging are managed within suppliers in the ASC. It also aims to identify perceived important factors for efficient returnable packaging management from the perspective of suppliers, sub-suppliers and OEMs.

Method

The research is based on a holistic single case study. Further, it adopts the inductive approach and exploratory purpose. Data collection is facilitated by qualitative methods, using ten semi-structured interviews and four on-site observations.

Conclusion

Packaging was found to be managed somewhat differently in the internal, outbound and inbound flows. Non-returnable and returnable packaging was found used in all flows at different ratios. Further, several factors were regarded important for efficient returnable packaging management. These were found specific for the internal, outbound and inbound flows and further divided into fundamental and efficiency factors.
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List of Abbreviations

AIAG - Automotive Industry Action Group
ASC - Automotive Supply Chain
CLSC - Closed Loop Supply Chain
ER - External Return
ERP - Enterprise Resource Planning
JIS - Just In Sequence
JIT - Just In Time
KA - Kongsberg Automotive AB
KPI - Key Performance Indicator
MOQ - Minimum Order Quantity
NPV - Net Present Value
OEM - Original Equipment Manufacturer
RFID - Radio Frequency Identification
RPA - Reusable Packaging Association
RQ - Research Question
RTI - Returnable Transport Item
SC - Supply Chain
SCM - Supply Chain Management
VDA - Verband der Automobilindustrie (Association of the Automotive Industry)
VSM - Value Stream Mapping
Introduction

This chapter consists of the background, problem statement, purpose, research questions, delimitation and thesis disposition. Its aim is to provide the reader with a broad background of the automotive industry and the function of returnable packaging, as well as the concrete problem statement and the purpose sought to answer through the research questions. Delimitation and the thesis disposition are also included in this chapter, in order to illustrate the limitations and visualize the structure of the thesis.

1.1 Background

Since the invention of the car at the end of the 19th century, the automotive industry has become one of the biggest industries in the world. The automobile has conquered every corner of the planet and is present in the everyday lives of most people in developed countries. As cars have become more eco-friendly over the years, the pressure on companies has increased to make their production processes more ecological as well. The overall goal is to reduce the waste that is caused by the industry during the life-cycle of a car, from conception to recycling (Adén & Barray, 2008; Smith, 2012). Due to the fact that packaging material is responsible for a large share of the waste produced in the automotive supply chain (ASC), returnable packaging could be the answer to address this problem. In order to provide the reader with more of a context, a brief description of the current trends in the industry follows in this section.

Countries like Brazil, Russia, India and China have now developed a large demand for cars and are experiencing strong growth in sales. Due to this development, China took the title of largest automobile market from the US in 2009 (Ying, 2010). Since then, the Chinese market has extended the lead and has reached a volume of almost 22 million cars sold in 2013 (Savadove, 2014). In contrast to the development in China, the growth rates in developed countries is significantly lower or even stagnant. These countries are currently facing market saturation with very little growth (Becker, 2006). Nevertheless, due to the situation in other markets around the world, the number of cars produced reached a new record in 2014, with more than 67 million cars built. This output is equivalent to a global turnover of €1.9 trillion. In other words, if car manufacturing was a country it would be the sixth largest economy in the world (OICA, 2015a). In addition, this is also a significant factor when it comes to the number of jobs offered. More than 5 million people are employed directly by the car manufacturers and it is estimated that the number of jobs connected indirectly to this business via suppliers and other supporting companies reaches 50 million worldwide (OICA, 2015b). In Europe alone the sector employs 12.9 million people, which is more than 5% of the jobs in total (ACEA, 2015).

The manufacturing process itself changed when Just-In-Time (JIT) production was adopted by most Original Equipment Manufacturers (OEM) around the world (Boysen, Emde, Hoeck & Kauderer, 2015). With supplies arriving JIT when needed to the production line, OEMs were able reduce inventory cost significantly and lower the prices. Nevertheless, cars were still highly standardized and customers did not have many options to choose from in this era (Eckermann, 2001). The latest trend in this context follows the customers wish for more individualization. Consumer needs and wants are now satisfied through tailored customization of the individual car (Gunasekaran, 2005). For many luxury brands, this might involve the customer being able to make changes up until 6 days before delivery (Gunasekaran & Ngai, 2005).

Going from highly standardized to highly customized production has also influenced the ASC as a whole. In addition to the increasing number of cars produced, the companies have
to handle the growing complexity of the product. Currently an average car consists of more
than 10,000 parts which are then assembled by the OEM. This means more uncertainty re-
garding parts needed, and reduces the planning cycle in the logistical flow. Furthermore, the
amount of parts arriving every day in a production facility is vast (Battini, Boysen, & Emde,
2013). This complexity might increase even more in the future. Several studies and forecasts
come to the same conclusion: the automotive industry will benefit from a steady growth of
the markets until 2025 (Kalmbach, Bernhart, Kleimann, & Hoffmann, 2011; Eckl-Dorna,
2012; Funda, 2014).

In the big picture of the ASC and in terms of the components reaching the OEM's produc-
tion line undamaged and in the required condition, packaging serves a key role. Hence,
amongst the fundamental functions of packaging, protection, containment and preservation
are found (Johansson, Lorentzon, Olsmats, & Tilander, 1997). Further, with pressures
from both a sustainable and financial perspective, improving the efficiency of packaging is
an important strategic goal for organizations (Gnoni, Felice, & Petrillo, 2011). In addition,
this goal can lead to improved environmental performance (Hollos, Blome & Foerstl, 2012).
Several regulative legislations have forced firms to rethink their packaging operations (Euro-
pean Commission, 2015). With this in mind, many actors in the ASC have made use of re-
turnable packaging systems. Returnable packaging material can be classified as a Returnable
Transport Item (RTI) and is usually part of a closed loop supply chain (CLSC) (Hellström &
Johansson, 2010). In the automotive context, examples of returnable packaging can be return-
able pallets as well as all forms of reusable crates (ISO, 2005).

1.2 Problem Statement

Awareness of the need for an investigation within returnable packaging management was
initiated due to a proposal from Odette and Kongsberg Automotive AB (KA) in Mullsjö,
Sweden. This proposal was concerned with the integration and improvement of returnable
packaging systems. It also suggested that suppliers in the automotive industry face inefficient
packaging processes, since they have to deal with numerous different returnable packaging
systems.

Odette has lead several projects with focus on the packaging processes amongst the actors
in the ASC. Conclusions from these state that there is a need for further investigations within
the topic of returnable packaging, and projects concerned with the development of standards
around this are also ongoing (Odette, 2015). In addition to the experience of both Odette
and KA, the topic of returnable packaging has been discussed in the literature in the context
of several industries (Martínez-Sala, Egea-López, García-Sánchez & García-Haro, 2009;
Silva, Renó, Sevgnani, Sevgnani & Truzzi, 2013; Barrera & Cruz-Meija, 2014). Although it
has been investigated in the ASC as well, most of the studies concerned the perspective of
the OEM (Rosenau, Twede, Mazzeo, & Singh, 1996; Twede & Clarke, 2004; Hallberg &
Uhrbom, 2008).

Additionally, copious research papers have highlighted the need for future research of re-
turnable packaging in the ASC. White, Wang & Li (2014) indicated that research needs to be
conducted in terms of efficiency of green packaging, especially returnable packaging, and
collaboration between the parties in the ASC. Chan (2007) concluded that a reengineerin-
g process regarding returnable packaging is reliant on a good relationship and collaboration
between the parties. Also, Hellström & Johansson (2010) stated that there is a general need
for further investigations of RTIs in the automotive industry.
To the authors' best knowledge, no specific studies of how packaging is managed within a supplier in the Scandinavian ASC was found. The authors seek to add to this research gap by investigating packaging and returnable packaging operations within a supplier in the automotive industry and seek insights from other parties involved in the operation. Thus, contributing to theory by providing a clear picture of how packaging and returnable packaging is managed. As well, the authors want to illustrate perceived important factors for returnable packaging from the perspective of the supplier and the parties involved.

1.3 Purpose and Research Questions

The authors introduce the following purpose:

The aim of this thesis is twofold. First, to explore and analyze how packaging and returnable packaging are managed within suppliers in the ASC. Second, to identify perceived important factors for efficient returnable packaging management from the perspective of suppliers, sub-suppliers and OEMs.

To reflect the purpose, two research questions have been developed and are presented below.

RQ 1: How is packaging and returnable packaging managed within suppliers in the automotive supply chain?

RQ 2: What are the perceived important factors for efficient returnable packaging management, from the perspective of suppliers, sub-suppliers and OEMs?

1.4 Delimitations

Several delimitations have been considered in order to keep the scope and time-frame of the thesis. First, empirical data is based on information gathered from one focal company, a sub-supplier and an OEM. Thus, the data is contextually based in these respective companies. Further, this implies that other actors in the ASC are not considered in this thesis.

The authors have strived to have an open mind and let factors emerge through the process. However, a starting point was made based on current literature on packaging and returnable packaging. In regard to the influencing factors, it is clear to the authors that several might be present. Initially in the process, power relations and collaboration were considered. This is due to their important role in the ASC, as illustrated by several research papers. Theory was later used to interpret the empirical results in the analysis. Further delimitations regarding the methodological aspects will be elaborated in the methodology chapter.

1.5 Thesis Disposition

In order to give the reader an overview of the thesis disposition, Figure 1.1 highlights the content of each of the following chapters.
Figure 1.1: Thesis Disposition.

Chapter 1 • The background, problem statement, purpose and research questions are presented here. In addition, initial limitations are outlined in this chapter.

Chapter 2 • Relevant theory for the background and empirical findings are presented. The included theory serves as a facilitator for interpretation of the empirical findings.

Chapter 3 • Concerns the research philosophy, purpose and approach. Further, the data collection methods are discussed and conducted interviews and observations are outlined. Lastly, credibility is assessed through reliability and validity.

Chapter 4 • The empirical findings gathered from the interviews and observations are presented in a structured matter. Findings are further categorized in line with the purpose and research questions.

Chapter 5 • In the analysis chapter, empirical data is interpreted with relevant theory from the frame of reference. The section is structured to assess the overall purpose and both research questions respectively.

Chapter 6 • The conclusion chapter sums up the findings and analysis and concretely answers the purpose and both the research questions in a systematic manner.

Chapter 7 • The discussion chapter consists of concluding remarks, managerial implications and proposed future research.


2 Frame of Reference

In this chapter the frame of reference with relevant theory for the purpose and RQs is presented. The starting point is a description of the ASC and its actors, followed by packaging, packaging logistics, the concept of returnable packaging, closed loop supply chains and control systems. Also, theory of collaboration and power relations is considered here to grasp the influencing factors of packaging operations.

2.1 Automotive Supply Chain

In this section the ASC is described together with its main actors, namely the OEM and the supplier.

Sople (2012, p.6) defines a general SC as a "link connecting a set of facilities, companies, demand and supply points, and service providers. This chain links the upstream suppliers and downstream customers with the flows of products, services, finances and information from a source to a customer". The ASC in particular follows this structure as it is illustrated in Figure 2.1.

Figure 2.1: Simplified outline of the ASC.

The ASC is a global production and distribution network which starts with the mining of raw materials. Further it continues with the processing of these in order to produce the processed material, which is needed by the suppliers. Subsequently the suppliers can manufacture single parts, more complex components or entire modules. Before the final product is sold to the customer, the OEM is assembling all the parts from the supplier into the final vehicle. In the end of the chain, and after the depletion of the product, a recycling process starts (Kerkow et al., 2012).

Further, the ASC is characterized as multiplex. Turner and Williams (2005) named complexity of the product, complexity of the network, consumer behavior, demand seasonality and ageing of stock as factors contributing to this. To exemplify, a modern car typically consists of between 10,000 and 40,000 parts (Pereira, Sellitto, Borchardt & Geiger, 2011; Kerkow et
al., 2012). Moreover, the product can be configured by the customer in numerous ways, further increasing this complexity (Turner & Williams, 2005). The production, therefore, requires expertise and know-how from several fields, both in-house and outside the OEM.

Due to this complexity, the automotive industry creates a large flow of products and parts along the SC. For example, the German car producer BMW has more than 13,000 part bins delivered by about 600 suppliers on more than 400 trucks each day at its plant in Dingolfing, Germany (Battini et al., 2013). The spread of production has also led to a high degree of specialization of the actors along the SC. These actors continuously seek to create and acquire capabilities that would help generate a sustainable competitive advantage over their rivals (Kotabe & Murray, 2004). In terms of the network itself, these externalizing tendencies and divestment of ownership has brought the OEMs to organize their suppliers into structured tiered networks (Bennett & Klug, 2012). To illustrate this, the OEM and the supplier will be further elaborated below.

2.1.1 Original Equipment Manufacturer

An OEM in the ASC is a company which acquires a product or component and reuses or integrates it into a new vehicle with the brand name of the OEM (Diehlmann & Häcker, 2010). Hence, the major OEMs are now explicitly focusing on core competencies. This means that the OEMs have shifted their focus from handling a large number of parts towards the assembly of entire modules, which are delivered directly from a significantly smaller number of suppliers than before (Doran, 2005). Further, the OEMs have divided their suppliers into primary (first-tier), secondary (second-tier) and tertiary (third-tier to n-tier) subcontractors (Pereira et al., 2011).

In combination with the higher cost pressure on the OEMs, outsourcing of production and R&D have become increasingly more important (Veloso & Kumar, 2002). Consequently the production depth of OEMs around the world has decreased to 25% on average. This means by implication that suppliers are now responsible for 75% of the value that is created in the ASC (Krcal, 2007; Kerkow et al., 2012).

In 1992 a Japanese car was built in 17 hours whereas the assembly of an American car would take 25 hours, and a car from European OEMs would spend as much as 36 hours on the assembly line (Eckermann, 2001). According to Dudenhoefer (2006) an average compact car now only spends 15 hours on the main assembly line of the OEM. As an effect, this trend puts more pressure on the different suppliers in terms of shorter planning time and delivery cycles (Boysen et al., 2015). Specialized firms located third-tier and below are needed for cost-efficient production, while first and second tier suppliers are pooling the technological competencies and manage the integration of more complex processes. The OEMs themselves have the core competency in development of the vehicle, assembly and worldwide distribution (Kerkow et al., 2012).

2.1.2 Supplier

Based on the trend of focusing on core competencies, suppliers have an increasingly more important function in the ASC. Veloso, Henry, Roth, and Clark (2000) have classified four main roles, where suppliers can be a systems integrator, global standardizer/systems manufacturer, component specialist or raw material supplier. These are further defined below.
**Systems Integrator**

The systems integrator role is suitable for suppliers which have the ability to design and integrate components, subassemblies and systems into modules that are shipped directly by the supplier to the OEMs assembly plants. These modules can for example be the chassis, doors or the interiors (Veloso et al., 2000).

**Global Standardizer/Systems Manufacturer**

Global standardizer/systems manufacturer are companies which sets the global standard for a component or system. They design, develop and manufacture these systems and supply the OEMs directly or indirectly via the systems integrator (Veloso et al., 2000). This can be tires, ABS-systems or electrical control units (Veloso & Kumar, 2002).

**Component Specialist**

The component specialist is concerned with designing and manufacturing a specific subsystem or component for a given vehicle (Veloso & Kumar, 2002). This role is also known as a modular component manufacturer, as reported by Sako and Murray (1999). Further, these suppliers can also be process specialists like metal pressers, die casters, injection molders or forging shops (Veloso et al., 2000). An example of a component or subsystem is a complete seating assembly which is delivered to the OEM directly (Doran, 2004).

**Raw Material Supplier**

The raw material supplier serves the role of supplying raw materials to both the OEMs and their suppliers. These materials can be steel coils, aluminum ingots and polymer pellets. Some of these companies are also moving into the role of component specialists in order to add more value to their products (Veloso et al., 2000).

The OEM is reliant on all its required parts and components reaching the assembly line in time and in the required condition. If the indispensable component should fail to reach the production line of the OEM, production might be stopped, the assembly workers are forced to be idle and every 60-90 seconds the profit of one car is lost. In addition, if the OEM is expecting a delay of key components special transport might be used to get in emergency supplies, further impacting the cost (Boysen et al., 2015).

To address the issue of getting the parts and components from the suppliers undamaged to the OEMs, packaging will be discussed in the next section.

### 2.2 Packaging

According to Saghir (2004, p. 6) packaging is a “coordinated system of preparing goods for safe, secure, efficient and effective handling, transport and distribution, storage and retailing, consumption and recovery, reuse or disposal combined with maximizing consumer value, sales and hence profit”.

This definition also takes into consideration the aftermath when the packaging material and containers have been used and thus includes the reverse flows of the SC. Moreover, this definition makes clear that the perception of packaging has changed towards more environmentally friendly solutions. Accordingly, researchers in the recent years have focused on the green initiative and sustainability aspect of packaging (Nordin & Selke, 2010; White et al., 2014; Garrido et al., 2014) as well as the implementation of new technologies like radio-frequency identification (RFID) into the packaging system (Hellström, 2009). The main
driver for these initiatives are governmental institutions such as the EU introducing new guidelines for reducing waste (European Commission, 2015) and an increased awareness of the end consumer (Coyle, Langley, Novack, & Gibson, 2013).

Packaging is a significant element in the logistics system and widely discussed in the literature. Stock and Lambert (2001) have, therefore, listed packaging amongst the key logistical activities. Packaging has a considerable impact on logistics costs and performance, especially for transport and warehousing (Ebeling, 1990; Tweede, 1992; Bowersox, Closs, & Cooper, 2002). Johansson et al. (1997) are proposing three main functions for packaging known as logistics, commercial and environmental, whereas other authors stress the fundamental functions of packaging in more detail. Examples are protection, containment, preservation, apportionment, unitization, convenience, information transmission and communication, physical and barrier protection as well as security (Paine, 1981; Robertson, 1990; Livingstone & Sparks, 1994; Farahani, Rezapour, & Kardar, 2011). Further depending on the function, packaging is divided into primary, secondary and tertiary levels. The primary level concerns packaging which is in direct contact with the product. Secondary level packaging is containing and protecting several primary level packages. Moreover, a pallet or a roll container is an example of tertiary level of packaging, which is containing a number of primary or secondary packages (Emblem & Emblem, 2012). Hellström and Saghir (2006) use the term packaging system in this context. By utilizing the system approach towards packaging, the natural interaction and interdependencies between the different levels are highlighted.

As the main functions of packaging have been described, the next section concerns the cost aspect of packaging and the term packaging logistics.

### 2.2.1 Packaging Logistics

Due to the fact that packaging impacts several areas in the SC, the term packaging logistics has been introduced. Packaging logistics can be defined as "the interaction and relations between the logistics and the packaging system that improve 'add on’ values to the whole supply chain from raw material producer to end-user" (Chan, Chan & Choy, 2005, p. 1088). It has further been found that looking at packaging narrowly and departmentally can cause higher costs in physical distribution. Furthermore, researchers argue that packaging should not just be a cost-driven center, but focus on its role as a value-added function in the SC (Chan et al., 2005).

As packaging is seen as a coordinated system, Chan et al. (2005) propose a systematic approach which involves packaging as a facilitator for accomplishing a capability that affect all involved logistical functions in a beneficial way. In organizations, packaging costs mainly refer to the actual packaging material and labor costs associated with administrating it (Lee & Lye, 2003). These expenses usually account for a substantial portion of a product's cost, so it is naturally desirable to minimize them (Chan et al., 2005).

Other aspects of logistics costs are affected by packaging too, such as damages, cargo handling and resources used for control. In addition warehousing costs are dependent on quality and performance of the packaging material, as well as information carried by the packages themselves. Furthermore, risks in packaging are dependent on the packages being used and the packaging design directly affects freight rates, warehousing and handling cost. Thus, unnecessary costs can be eliminated by improving the efficiency and effectiveness of the packaging design (Chan et al., 2005).

Reducing costs also comes as a part of lean logistics, which originated from the Japanese automotive industry. Lean philosophy in packaging involves identifying and eliminating the
possible elements that are regarded as waste in the physical transportation process (Jones, Hines & Rich, 1997). Waste is not regarded as environmentally related in this aspect, as waste is concerned with any cost that does not add value to the product (Chan, 2007).

Key Performance Indicators (KPI) can be used as a control mechanism for the packaging system’s performance. One can measure the overall cost of packaging, as well as the market satisfaction level (García-Arca & Prado-Prado, 2008). In addition, costs that need to be considered before implementing the use of RTIs are manifold. Rosenau et al. (1996) state these as packaging material, damage reduction, inbound transport, outbound transport, solid waste reduction, sorting, ergonomics and safety, cubic efficiency, tracking, labor, cleaning and repair, and line layout changes. It is argued that a net present value (NPV) calculation is most feasible for estimating the cost and potential savings of a returnable packaging system.

To further assess the most cost efficient packaging system, Dominic, Johansson, Lorentzon, Olsmats, Tiliander and Weström (2000) point out transport distance and seasonal variation in demand as factors which should be taken into account. Figure 2.2 is illustrating these factors and indicates when returnable/non-returnable packaging is applicable.

Figure 2.2: Factors influencing the packaging system decision.

(Source; translated from Dominic et al., 2000).

In case the transport distance is relatively long and the season variation is high, the most suitable packaging type is one-way packaging. This is due to the assumption that the cost for the return transport of empty RTIs would be too high. A close proximity of the involved parties combined with a constant demand for deliveries facilitate the use of returnable packaging (Dominic et al., 2000).

As opposed to this, Mollenkopf, Closs, Twede, Lee and Burgess (2005) show that transport distance and variations in daily volume movements play a less important role for determining
the costs of a packaging system. According to this study the average daily volume is considered more important. It is also stated that a returnable packaging system becomes more economical when the average daily volume increases, because the packaging can be continuously reused in the system. Furthermore, the 'container cost ratio' was found to be an influential driver, suggesting that non-returnable packaging is more feasible for smaller goods while returnable packaging is more economical with larger parts.

The following section features returnable packaging, as well as the role of returnable packaging in the automotive industry.

2.2.2 Returnable Packaging

The Reusable Packaging Association (RPA) (2015) defines reusable packaging as follows:

“In its broadest sense, reusable packaging includes reusable pallets, racks, bulk containers, hand-held containers and damage that move product efficiently and safely throughout the SC. Reusable packaging is typically used by manufacturers/processors and their suppliers/customers in a well-organized SC, with very tightly managed shipping loops. The packaging is constructed of durable materials such as metal, plastic or wood and is designed to withstand the rough handling of a typical logistics system.”

Furthermore, the RPA (2015) lists several economic, social and environmental benefits for the use of reusable packaging at all levels of the SC. From a cost point of view it can for example, reduce the overall costs for packaging and damaged goods, since the containers are purpose-built and robust. It also reduces warehousing costs due to improved handling and less required space. Amongst the social advantages of reusable packaging are the improved workplace safety and efficiency. Naturally the use of reusable packaging is beneficial for the environment since it reduces the greenhouse gas emission, requires less energy and prevents waste from entering the solid waste stream in the first place.

In the context of packaging the terms 'reusable' and 'returnable' are often used interchangeably in the literature (Soroka, 2008). Returnable packaging can also include returning packages or components for other reasons than reuse such as recycling, disposal and incineration. Managing returnable packaging systems require more than just the transportation back to the sender. It also involves the cleaning and maintenance of containers, as well as the storage and the administration (Kroon & Vrijens, 1995). A returnable packaging system is also known as a 'returnable packaging pool' and having the general features of returnable packaging in mind, returnable packaging used in the automotive industry is further described below.

2.2.3 Returnable Packaging in the Automotive Supply Chain

The global automotive industry holds a leading role in the development of new packaging solutions. The Automotive Industry Action Group (AIAG) in the US developed returnable package management guidelines in the early 1990s. Since then returnable packaging has been widely adopted in the US automotive industry for domestic material handling in order to reduce waste, costs, transport damages and for enabling JIT deliveries (Witt, 2000). The German counterpart Verband der Automobilindustrie (VDA) has worked on recommendations about the implementation of RFID into the German ASC since 2008 (VDA, 2015). RFID enables full tracking function of the containers in the returnable packaging system. Figure 2.3 shows the most commonly used containers in the automobile industry, which is based on the guidelines by VDA.
Further, returnable packaging in the ASC typically consist of standardized shipment materials, like the EUR-/EPAL pallets and specialty bins for certain types of parts (Boysen et al., 2015). Several OEMs are also experimenting with new customized returnable transport racks. Figure 2.4 shows a EUR pallet and examples of purpose-built racks from Ford.

Figure 2.4: EUR-/EPAL pallet and Ford's conceptual returnable transport racks.

(Source; based on Coia, 2013).
Actors in the ASC have found the operational benefits of returnable packaging to be reduced purchase and disposal costs of packaging materials, as well as improved productivity at the assembly line since the reusable containers are customized for the specific production. In addition, enhanced cleanliness and tidiness are experienced with standardized reusable containers (Twede & Clarke, 2004).

Even though these RTIs are critical for production and distribution, high value and vulnerable to theft and misplacement they are often managed with limited visibility and control (McKerrow, 1996; Witt, 2000). To address this issue, literature on CLSCs and control systems are presented below.

### 2.2.4 Closed Loop Supply Chain

CLSCs constitute activities from the traditional SC in combination with additional reverse SC activities (Guide Jr., Jayaraman, & Linton, 2003). In the context of returnable packaging, CLSCs can be found in returnable packaging systems operated by one or several actors in the chain (McKerrow, 1996). Furthermore, most returnable packaging systems are part of a monitored CLSC. In terms of control systems for the chain, these are found to have major impacts on both the investments and operating cost of the CLSC. The type of return also has a significant impact on the CLSC management and design, i.e. which type of RTI is handled within the chain (Hellström & Johansson, 2010).

In terms of the return flows in this system, Boysen et al. (2015) define two potential return pathways, known as External Return (ER) 1 and 2. ER1 describes the return path to some nearby return station or cross-company deposit, while ER2 describes the path back to the supplier of the respective packaging container. Concerning the physical flow within this chain, Boysen et al. (2015) state three main methods of transport logistics, known as the point-to-point network, the milk-run system and the cross-docking system. Point-to-point networks are typically illustrated by a supplier who delivers directly to an OEM. Space utilization is not optimal when using this method, so it is mostly used for high value Just-In-Sequence (JIS) components to the OEM. In a milk-run system, the process begins with an empty truck starting at one supplier. The truck then follows a route, picking up supplies from several other suppliers on the way to the assembler. The cross-docking system has the same objective as the milk-run system, but incorporates additional nodes on the route to consolidate the transport. Moving the supplies at these cross docks are time consuming, hence it increases the lead time (Boysen et al., 2015).

To monitor the operations, several control systems for CLSC exist. These are described in the next section.

### 2.2.5 Control Systems for Returnable Packaging

Although the concept of CLSC is increasingly adopted by the industry, the literature about the management of this kind of SC is still scarce (Fleischmann, 2001; Daugherty, Myers & Richey, 2002; Kärkkäinen, Ala-Risku & Herold, 2004). Furthermore, Kärkkäinen et al. (2004) states that despite the age of the article, the study of Kroon and Vrijens (1995) remains the only work that has described and categorized return logistic systems. Even the more recent article by Carrasco-Gallego and Ponce-Cueto (2010) is referring back to this work.

Kroon and Vrijens (1995) classify three different control systems known as the switch-pool system, and systems with and without return logistics. This is illustrated in figure 2.5.
**Switch-Pool Systems**

In the switch-pool system every participant has its own allotment of containers and is responsible for these. There are two variations of this kind of system. In the first variant, only the sending and receiving companies are keeping containers in their facilities. Moreover, the transfer of containers takes place when goods are delivered to the recipient. There is a carrier in place who is either taking the containers filled with goods from the sender to the recipient or is bringing empty containers from the recipient back to the sender. In this variant the sender has to guarantee that in the long run, the number of returned containers equals the number of containers sent. In the second variant the carrier also has a number of containers available and is responsible for exchanging the correct amount of containers when picking up or delivering filled containers. Thus no further administration is needed for the return flow.

**Systems with Return Logistics**

In a system with return logistics the containers are owned by a central agency and this institution is also responsible for the return of the containers after they have been unloaded by the recipient. In order to make this system work, the recipient has to bundle the empty containers until there have been gathered enough for a cost-effective collection. Furthermore, Kroon and Vrijens (1995) mention two alternatives: the transfer-system and the depot-system. In the transfer system the sender is always using the same containers and the focus is only on the return of the containers from the recipient to the sender. In this case all the responsibilities are with the sender, such as cleaning, maintenance, tracking & tracing, administration and storage. As indicated by the name, in the depot system, a depot is used to store all the containers which are not in use. The sender receives the needed number of containers and after the transport to the recipient, the empty containers are collected and returned back to the depot. The depot is responsible for cleaning and maintaining the containers. Kroon and Vrijens (1995) further distinguish two variants of the depot system: the book system and the deposit system.
The focus of the book system is on the detailed control of the flow of containers by the central agency. Sender and recipient both have accounts with the agency and every transport leads to a credit and debit in the account of the involved parties. When the sender is transferring containers to the recipient the quantity is credited to the senders account and deducted from the recipient’s. In order to allow the agency to monitor all the container movements the sender of each shipment has to send all the relevant information about recipient and quantity to the agency.

In contrast to the book system, in the deposit system the sender pays the agency a deposit for every container used. The deposit equals at least the value of the containers. The sender debits his recipient for this deposit, who does the same with his recipient, and so on. The moment the containers reach their final destination, they are collected by the agency. At this point, the agency refunds the deposit to the party from which the containers were collected. The deposit finances loss and theft of the containers. Therefore, a tracking and tracing system in order to control the flow of containers is not necessary. Finally the deposit also stimulates the quick return of the containers, so the rate of circulation is high.

**Systems without Return Logistics**

In this case the sender is renting the containers from a central agency and is responsible for all activities concerning the containers including the return logistics. If the sender does not need the containers any more, he can return them to the agency. This way the sender can reduce his fixed costs by renting the required number of containers when needed.

The different RTIs in the flow can range from a price of ten to thousands of euros, however, the use of proper control systems is rare (Hellström & Johansson, 2010). A control system is crucial to monitor the inventory and flow of RTIs. Studies regarding RTI shrinkage are scarce, however, in research conducted by Aberdeen Group (2004), 233 consumer-oriented enterprises were surveyed regarding shrinkage of RTIs. One quarter of the respondents reported more than 10% of their RTI fleet to be lost annually, further 10% of the respondents reported over 15% lost. This indicates that shrinkage could be a problem for actors dealing with RTIs.

### 2.3 Influencing Factors

Turning to the implications of returnable packaging, previous research has shown that the operation of a returnable packaging system is affected by influencing factors from the outside. Particularly collaboration (Chan, 2007; White et al., 2014) and power relations (Hyun, 1994; Wells & Rawlinson, 1994; Veloso & Kumar, 2002; Dicken, 2003; Doran, 2005) were pointed out in the literature. Since this shows the importance of these factors in the ASC, they were considered a good starting point for the research process. Collaboration and power relations are elaborated further in section 2.3.1 and 2.3.2.

#### 2.3.1 Collaboration

Simatupang and Sridharan (2002, p.19) define collaborative relationships in Supply Chain Management (SCM) as "two or more autonomous firms working together to working jointly to plan and execute supply chain operations with greater success than acting in isolation". Maloni and Benton (1997) name the characteristics of collaborative relationships as trust, interaction, mutual responsibility, mutual risks and benefits, autonomous problem solving capabilities of the involved partners, and a proactive approach towards managing new challenges. Concerning this, the main motive for building such relationships is to achieve efficiencies, flexibility and sustainable competitive advantage (Nyaga, Whipple & Lynch, 2010).
Effective collaboration has been proven to lead to collaborative advantages and higher firm performance (Cao & Zhang, 2011). Collaborative relationships can yield other benefits like sharing of risk (Kogut, 1988) and access to complementary resources (Park, Mezias & Song, 2004). In terms of differences between buyers and suppliers in collaborative relationships, Nyaga et al. (2010) propose that buyers should build interest in collaborative activities, such as information sharing and joint effort to signal commitment to suppliers. Suppliers should focus on demonstrating trust and commitment as these improve performance and buyer satisfaction in the collaborative relationship (Nyaga et al., 2010). In addition, Wiengarten, Humphreys, McKittrick and Fynes (2013) found interaction and integration applications in e-business to have a significant positive effect on buyer-supplier collaboration in the automotive industry.

2.3.2 Power Relations

Dahl's (1957, p. 203) definition of power states that “A has power over B to the extent that A can get B to do something that B would not otherwise do”. El-Ansary and Stern (1972, p. 47) have applied the power concept to marketing channels and come to the conclusion that “the power of a channel member is his ability to control the decision variables in the marketing strategy of another member in a given channel at a different level of distribution.” It should be different from the influenced member’s original level of control over “one’s own marketing strategy”. This power concept can also be transferred to a SC setting where different members on different levels are working together (Maloni, 1997).

The power and influence that one member of the SC can exercise over other members can have several bases. There is an extensive literature about the bases or sources of power (Benton & Maloni, 2005; Krajewski, Wei & Tang, 2005; Crook & Combs, 2007; Gulati & Sytch, 2007). These are known as reward, punishment, referent, legitimate and expert. The term reward power indicates that one member of the SC has the ability to reward another member for certain behavior. Punishment on the other hand means the opposite: One company can punish the other, if it does not comply the agreement. In case a company wants to maintain the identification with another firm, this member possesses referent power. Legitimate power is based on the status of a company; therefore, it is also necessary that this natural power is acknowledged by the other firm. The fifth and last source of power is described as expert power and refers to the ability of a member of the SC to control special knowledge, which can be market, technology or process information (French & Raven, 1959).

Maloni (1997) has shown in his research that expert, referent and reward power have significant positive influence on the buyer–supplier relationship. Punishment and legitimated power sources on the other hand have significant negative impact. Strong SC relationships were found to have a positive impact on supplier satisfaction as well as supplier, buyer and overall SC performance. Emerson (1962) added another aspect to the power relations within a SC when he concluded that power is a direct result of dependence. Companies have power if others depend on them for resources. Resources lead to dependencies, if they are important, the control over the resources is relatively concentrated or both (Pfeffer & Salancik, 1978). Nevertheless, the dependency of one company on another firm rather indicates compliance because of a lack of choice than cooperation based on trust and goodwill.

The power distribution between supplier and OEMs in the automotive industry has historically been in favor of the car manufacturers. They could choose from a broad base of suppliers for every part and consequently the relationships were rather short term and transaction driven. This left the suppliers with hardly any bargaining power. Over the last decades this has changed fundamentally due to increased globalization and the pressure to reduce
costs. The number of suppliers has been reduced drastically and rather strategic partnerships have been developed. This results in shifts of the power relations towards the suppliers. Substituting a supplier and changing to another company becomes more and more difficult and costly for the OEMs (Hyun, 1994). Especially since first-tier suppliers have taken a greater role in R&D and are now supplying complete modules rather than single parts (Wells & Rawlinson, 1994; Doran, 2005). The OEMs are still in the dominant position in the SC since they are positioned closer to the end customer and have more resources available. The automotive industry can be seen as producer-driven value chain in which the big OEMs play a central role in coordinating the production network (Dicken, 2003).

Moreover, design, brand management and customer relationships have gained increasing importance for OEMs. The assemblers, therefore, have clearly set their strategic focus on the part of the value chain that links them with the final customer, including dealerships and services. In order to be able to manage this shift of focus and the immense costs for new modules and products, the OEMs are becoming less involved in manufacturing and assembly. They pass the responsibility of developing, manufacturing and assembling entire modules of the car further down the supply chain to their suppliers (Veloso & Kumar, 2002). Furthermore, the strategic goal of the OEMs is towards working with a smaller number of larger suppliers. Nevertheless, Veloso and Kumar (2002) describe the cases of Renault and Volkswagen on one side and Ford on the other, which pursue this strategy differently. While Renault and VW are relying on two key suppliers and one supplier as a backup for each major module, the strategy of Ford is considered far more aggressive and includes only one supplier for a large module rather than individual components. The (theoretical) goal is to have a single company supplying modules, for example, the complete interior for a given car around the world. This means that Ford will eventually give up a lot of power over their SC and the power relations will shift towards the supplier, since Ford is then depending on this single company (Veloso & Kumar, 2002).

### 2.4 Summary

Starting with current research of the ASC, the frame of reference has clarified the actors involved and their function. The OEM was described, as well as the recent trends in the industry. Furthermore, suppliers have been discussed illustrating different roles a supplier can occupy in the modern ASC. Having presented the actors involved, the concept of packaging was introduced. The elementary functions of packaging were discussed before the concept of packaging logistics, returnable packaging and returnable packaging in the context of the ASC was elaborated. Moreover, the relation between returnable packaging systems and CLSC were presented with current research on these. In addition, the controlling aspects of the returnable packaging systems were explained. To assess the proposed influencing factors of the returnable packaging system, literature on collaboration and power relations was included.
3 Methodology

This chapter consists of the research philosophy, purpose and approach applied for the thesis. Further, the research strategy and the data collection procedures are described. Methods are also outlined together with overviews of conducted interviews and observations. In addition sampling and the data analysis process is described. Lastly, credibility is assessed by discussing reliability and validity of the research process.

3.1 Research Philosophy

Research philosophy is concerned with development of knowledge and the nature of that knowledge. Therefore, the choice of research philosophy involves important assumptions of how one views the world. Three main aspects regarding research philosophy exist, namely ontology, epistemology and axiology (Saunders et al., 2012).

We believe that the people involved in the topic serve a key role, and that their actions and perceptions are central as important factors for the packaging operations. As a result, the subjectivist ontological view is most fitting. Ontology involves the nature of reality which can be viewed either objectively or subjectively. Furthermore, since the purpose of this thesis is to gain deep insight in a business phenomenon, we agree with the interpretivist epistemology. Saunders et al. (2012) argue that rich insights into the business world would be lost if the complexity is reduced to law-like generalizations, such as the positivist approach induces.

The interpretivist states that it is necessary for the researcher to understand differences between humans as social actors. This involves emphatically understanding the research participants and their perception of the world, which might include discovering irrationalities rather than rationalities. We believe that the human actors will be central for how packaging is managed and, therefore, argue that the interpretivist epistemology is the most fitting for this thesis (Saunders et al., 2012). Further, as described by Burrel & Morgan (1982), an interpretivist study is value bound as the researcher is part of the study conducted. Thus, it is argued that the study will be subjective from the researchers view. We believe that our choice of topic is bound by our own values and, therefore, accept that the axiology of the research will be subjective from our own point of view.

3.2 Research Purpose

With the developed purpose and RQs, this thesis is investigated from an exploratory perspective. We argue that the exploratory purpose will be the best fit, since the literature on the topic is scarce and we seek to gain deeper insight in the current state of the packaging and returnable packaging operations. In addition, there was a need to keep an open mind as several factors were revealed throughout the research process. As stated by Robson (2011) an exploratory study serves the purpose to find out what is happening, to seek new insights, to ask new questions and to assess phenomena in new light. We also concerned the descriptive purpose for this thesis, in order to accurately provide a clear picture of the particular phenomena, through accurately portraying persons, events or situations (Robson, 2011; Saunders et al., 2012). The descriptive purpose was still kept in mind, but this thesis is mainly investigated from an exploratory purpose in order to not lose any potential new insights through the process.
3.3 Research Approach

In order to best fulfill the purpose of this thesis three main research approaches were considered. Further, depending on the reasoning adopted to support or justify the conclusion, the type of research can be classified as either deductive or inductive (Saunders et al., 2012). Hugh (2003, p.160) concludes that "deduction reasons from the mind to the world, whereas induction reasons from the world to the mind". Deduction is the dominating approach in the natural sciences, where laws are the base of explanations (Collis & Hussey, 2003). In other words, deduction is concerned with testing theory. Since the purpose of this thesis is to explore the topic, and what we might find is somewhat unknown - we argue that deduction would not be the right approach. This leads to induction, which works the opposite way. Here, a certain phenomenon in real life is studied and theory is derived from these observations. Thus, this makes induction the commonly used approach in social science (Saunders et al., 2012). In addition, many authors favor the inductive approach for case studies since it enables themes, categories, activities and patterns to be extracted from the empirical data (Eisenhardt, 1989; Dyer & Wilkins, 1991; Fox-Wolfgramm, 1997). Further, induction does not exclusively have to start without any base in theory, and concepts from prior research can be used when analyzing the data (Eriksson & Kovalainen, 2008). For this thesis we chose to adapt relevant theoretical elements in the frame of reference, and still keep an open mind regarding the research process - allowing theory to emerge from the results and not be tied to a certain framework or theory. This left us favorable towards induction, as there were concerns that deduction would get us stuck in a particular direction and steer our research in a certain way.

To sum up, the inductive approach was chosen for this study - this is due to its proven suitability towards the case study strategy and the explorative purpose. The case study approach will be further explained in the next section.

3.4 Research Strategy

As stated in the purpose, the aim of this thesis is to gain a deeper understanding of packaging and returnable packaging in the context of a supplier. Thus the case study strategy has been chosen, as it provides a suitable framework to gain rich understanding of the context and the processes being enacted (Eisenhardt & Graebner, 2007). Yin (2009, p. 18) defines a case study as "an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Additionally Robson (2011) emphasizes that a case study uses multiple sources of evidence for the research on a contemporary phenomenon. Further, a single case was preferred over a multiple case study. This gave us the opportunity to study the particular case in greater detail, within the set timeframe and scope (Yin, 2009). Besides, it was found that a holistic approach to the matter as suggested by Yin (2009) would further improve the understanding of the topic. The holistic case study includes the point of view of actors involved in the SC and not exclusively the perspective of the focal company (Saunders et al., 2012).

In order to increase the precision and support the validity of the empirical research, it is important to take multiple perspectives towards the studied object. This approach is known as triangulation (Saunders et al., 2012; Runeson, Höst, Rainer & Regnell, 2012). Stake and Savolainen (1995) makes a distinction between four types of triangulation. Three types were found applicable for this thesis, known as data, observer and methodological triangulation. Data triangulation means that data from several sources is used in order to eliminate bias. We have ensured that by including different departments within the supplier as well as the OEM and the sub-supplier in the interviews. Observer triangulation suggests that several
researchers with a different background analyze the data. Since we are from different countries and have different work experiences this form of triangulation is established as well. In order to achieve methodological triangulation several methods need to be applied in a study. We have, therefore, included interviews and observations in the data collection.

To sum up, this thesis utilizes the interpretive and subjective research philosophy together with an inductive research approach. Further, the research purpose is mainly exploratory and a holistic case study strategy was utilized. Data, observer and methodological triangulation were also used to increase the validity and precision of the data collected. Lastly, qualitative methods are applied - these are further explained below in the data collection section.

3.5 Data Collection

This section is divided into three parts. First the company profiles of KA, Odette, the sub-supplier and OEM are presented. The aim is to give the reader an insight of each of the companies, which further helps putting everything into context when the findings are discussed. The second part outlines the process that has been applied in order to collect the data. Additionally the time horizon of the study is mentioned.

3.5.1 Company Profiles

*Kongsberg Automotive AB*

KA is a global supplier of gear shift and fluid handling systems as well as interior components for passenger cars and commercial vehicles. The company started as a part of Kongsberg Våpenfabrikk, originally a Norwegian defense and weaponry company, which started to produce brakes and drive shafts for Volvo in 1957. In 1987 the automotive division became a separate enterprise. Since then KA has developed into a global leader in the automotive industry. Currently the company operates 32 production facilities in 20 countries around the globe and can thus supply its worldwide customers with high quality products due to the proximity to all major automotive markets. About 10,000 employees have created a turnover of 979 million EUR in 2014 (Kongsberg, 2015a).

KA is the focal company in this thesis. The study is based on the Mullsjö plant and the facilities FA1 and FA2, which is part of the driveline and interior division. From this point we will refer to it as ‘the supplier’, meaning KA Mullsjö and not the whole KA enterprise Kongsberg, 2015b).

*Odette*

Odette is an impartial non-profit organization that creates standards, develops best practices and provides services in logistics management, e-business communications and engineering data exchange for the whole automotive industry in Europe (Odette, 2015).

*Sub-Supplier*

The sub-supplier considered in this thesis is a Swedish manufacturer of turned and milled components. The company puts emphasis on high quality products for the automotive, telecommunications and white goods industry. During the interview the respondent stated that the name of the company should not be revealed. Therefore, we will refer to it as the ‘sub-supplier’ from this point.
The OEM considered in this thesis is Scania AB. It will later be referred to as 'the OEM'. This company is one of the largest producers of heavy trucks and buses as well as ship and industry engines in the world. With more than 42,000 employees the company created a turnover of over 9.8 billion EUR in 2014. Scania AB was founded 1891 and has since then developed into a global company with production facilities in Europe and South America (Scania, 2015). In the context of this thesis the focus lays on the relationship between the supplier and the production plant in Zwolle, Netherlands, since the interview partner is working at this facility.

3.5.2 Data Collection Process

The data collection involved an extensive literature research in the databases of the library at Jönköping University, which formed the background for a pilot interview with the initial contact person at the supplier. Conducting the semi-structured pilot interview helped us gain valuable background knowledge. Further, on-site observations of the inbound and outbound flows in the warehouses of the focal company were carried out early in the research. The purpose of the observations was to further aid the understanding of the packaging processes. As stated earlier in the delimitations, the literature search was concerned with topics around 'packaging' and 'returnable packaging'. In addition, the influencing factors were limited to 'power relations' and 'collaboration' in the beginning, as these was stated relevant by a majority of research papers.

Based on insights from the observations and the literature research, the interview guide was developed. In collaboration with the contact person at the focal company we assembled a list of potential participants for the interviews. The contact person then scheduled interviews with internal and external partners. Subsequently the data from the observations, internal and external interviews was collected. Figure 3.1 gives an overview of the data collection process.

Figure 3.1: Data collection overview.
The next section starts with describing the data considered, the sources of data and the time horizon for the thesis. Further the actual methods used are presented together with conducted interviews and observations, as well as the sampling of participants for the data collection.

### 3.5.3 Qualitative Data

Research can be classified as either quantitative or qualitative. In regard to definition, Eriksson and Kovalainen (2008) argue that this most often is done by contrasting qualitative and quantitative approaches to each other. The main differences of the two, is that qualitative research is non-numerical while quantitative research is concerned with data in numbers (Robson, 2011). Since the purpose of this thesis is to gain in-depth knowledge about the topic, qualitative data has been used. Qualitative data is described as ideal to understand reality that is socially constructed as well as for interpretation and understanding of a particular phenomenon (Eriksson & Kovalainen, 2008). Qualitative data can also give insights rooted in the perceptions and thoughts of the respondents, and such data would be unfeasible to collect through quantitative methods.

### 3.5.4 Sources of Data

Primary data is defined as data that have been collected for the first time and are, therefore, original. Whereas data that has already been collected by someone else for some other purpose is known as secondary data (Kothari, 2004). For the data collection in this thesis, a multi-method approach for collecting primary data has been adapted. Boyer and Swink (2008) advocate the use of multiple complementary approaches in order to develop a holistic understanding of operations and the SCM phenomena. In addition, Rohlfing and Starke (2013) recommend a multi method approach as it provides a great variety of ways in which empirical data can be collected. In contrast to using only one data collection technique, this approach strengthens the results by broadening the understanding and providing a wider perspective of the phenomena which is studied.

In terms of primary data for this thesis, interviews and observations have been utilized. Secondary data has been included by reviewing internal company and external documentation from Odette. The methods themselves are further described in their own respective section below.

### 3.5.5 Time Horizon

The time horizon of case studies can be categorized into two parts, cross-sectional and longitudinal. Cross-sectional studies feature information gathered over a shorter period of time, to form a 'snapshot' of a particular phenomenon, while the longitudinal form a series of 'snapshots' over a longer period of time (Saunders et al., 2012). In this study, the cross sectional time horizon is adapted, since information is gathered through interviews and observations over a shorter period of time. This time aspect also goes along with the scope, delimitations and given timeframe of this thesis.

### 3.6 Methods

This section is concerned with the data collecting methods for the empirical material used in this thesis. Interviews, observations and sampling are imposed here.
3.6.1 Interviews

In an exploratory qualitative study, interviews can help to understand processes and the context. Interviews can be conducted in a standardized and non-standardized way (Saunders et al., 2012). King (2004) refers to non-standardized interviews as in-depth and semi-structured. In-depth, semi-structured interviews give the interviewed person the opportunity to share personal knowledge and experiences and thus providing more detailed information compared to a standardized interview (Saunders et al., 2012). Hence, in-depth semi-structured interviews were utilized in this thesis. The interviews have been created following the question sequence suggested by Robson (2011). Thus, questions have been divided into five categories, namely introduction, warm-up, main body, cool-off and closure. These can be classified into three types known as closed, open and scale questions. Combinations of these questions have been used and are further found in the interview guide in Appendix 1.

With the exception of the interview with the OEM over telephone, all interviews were conducted face-to-face in a suitable, quiet office environment with both of us present. In addition, one group interview was pursued with purchasing and warehouse workers constituting a total of three respondents. All interviews conducted for this thesis are illustrated in Table 3.1.

Table 3.1: List of interviews conducted.

<table>
<thead>
<tr>
<th>Company</th>
<th>Position of Respondent</th>
<th>Time (min)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier</td>
<td>Logistics System Consultant</td>
<td>30</td>
<td>05.02.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Lean Coordinator</td>
<td>45</td>
<td>07.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Purchasing</td>
<td>35</td>
<td>09.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Purchasing &amp; Warehouse FA1</td>
<td>60</td>
<td>09.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Lean Champion</td>
<td>50</td>
<td>10.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Warehouse FA2</td>
<td>35</td>
<td>13.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Logistics Manager</td>
<td>45</td>
<td>13.04.2015</td>
</tr>
<tr>
<td>OEM</td>
<td>Material Planner</td>
<td>45</td>
<td>16.04.2015</td>
</tr>
<tr>
<td>Sub-Supplier</td>
<td>Key Account Manager</td>
<td>45</td>
<td>16.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Warehouse FA1</td>
<td>35</td>
<td>28.04.2015</td>
</tr>
</tbody>
</table>

For this thesis eight interviews were conducted at the supplier, one interview with a sub-supplier and an OEM respectively, making a total of ten interviews.

3.6.2 Observations

In order to get a hands-on experience of how packaging and returnable packaging are managed, four observation sessions were conducted for this thesis.

Since the actions and behavior of people are central aspects in any research enquiry, observation is the technique of watching what these people do, record it, describe, analyze and
interpret what has been observed (Robson, 2011). Advantages of observations are the directness of the technique, which is seen as one of its strongest points. In addition, data from direct observations contrasts with, and can be used complementary with virtually any other technique for data collection (Robson, 2011). Observations are further divided into participant and structured observation (Saunders et al., 2012). For this study the participant observations have been used, due to the qualitative nature of the research. Moreover, we have taken the role as observer-as-participants, as further interaction with the employees during the observation resulted in a deeper understanding of the process. The purpose of the observations was communicated to the participants involved, which is another key attribute of this kind of observation (Saunders et al., 2012).

During a participant observation several types of data are collected. Delbridge and Kirkpatrick (1994) distinguish between primary and secondary observation as well as experimental and contextual data. In this thesis primary and secondary observation and contextual data were seen as most relevant. This means observations made by the researchers are classified as primary and statements from observers of what happened or was said are defined as secondary. Whereas contextual data is related to the research setting that help interpreting the data, like organizational structures and communication patterns (Delbridge & Kirkpatrick, 1994). The advantage of a participant observation is that it gives the researcher the opportunity to experience the reality and the flow of processes in real time. Furthermore, the events can be covered in their context as well as personal behaviors and motives can be understood.

For this thesis, the observation method served as a base for further understanding of the packaging and returnable packaging operation. We went on site and had the responsible personnel walk us through the particular packaging processes. This gave us a first-hand look on how this actually is carried out, which proved valuable for the understanding of the topic and support in the analysis. The carried out observations are shown in Table 3.2.

<table>
<thead>
<tr>
<th>Company</th>
<th>Department</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier</td>
<td>Warehouse FA1</td>
<td>05.02.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Warehouse FA2</td>
<td>05.02.2015</td>
</tr>
<tr>
<td>Sub-Supplier</td>
<td>Production and Warehouse</td>
<td>16.04.2015</td>
</tr>
<tr>
<td>Supplier</td>
<td>Warehouse FA1 and storage area</td>
<td>28.04.2015</td>
</tr>
</tbody>
</table>

Three observations at the supplier and one at the sub-supplier were conducted. An observation of the process of the OEM were not possible due to geographical constrains.

### 3.6.3 Sampling

Early in the research process it became clear that not all involved parties could be included in the study to achieve census, therefore, sampling was required. This can be done in two main ways, which are probability sampling and non-probability sampling (Saunders et al., 2012). For a qualitative case study, non-probability sampling is most applicable as there is no sampling frame to base probability sampling on. Further, to assess the sample size in this context Patton (2002) proposes that one should take into account what one wants to find
out, what will be useful, what will have credibility and what can be done within the set timeframe.

Moreover, there are several variants of non-probability sampling. Purposive sampling has been utilized in this thesis, as it was found most fitting. This form of sampling enabled us to use our own judgment to select the sample and answer the RQs in the best way possible (Saunders et al., 2012). As we knew the supplier early in the process and wanted to get a holistic overview, it felt reasonable to include participants from both the internal operations and some of the other external parties involved in the packaging operations. Having this in mind, the participants were selected from both internally in the supplier, from a sub-supplier and an OEM. Respondents were further selected based on our assumption of involvement in packaging operations. This further meant that we chose heterogeneous sampling, which implies that the sample might have cases that are completely different. In order to ensure maximum variation, Robson (2011) suggests identifying diverse characteristics. This has been accomplished in this thesis by going through theory of both suppliers and OEMs’, as well as descriptions of the suppliers departments before selecting respondents for interviews.

3.7 Data Analysis

As mentioned earlier, the research process started with a comprehensive search in relevant literature. This highlighted themes that later was used to form the interview guide. After each interview, the recording was summarized and notes of both researchers consolidated. Further, data was grouped according to the existing themes and new themes that emerged. This was also done for the observation, where the notes of both authors were merged and reflected on, in order to create a common understanding.

After the data collection process had been completed, all data from the interviews and observations were sorted and organized together. Further, main sentences and statements were highlighted. These were then connected so that patterns could be identified, and these were linked to form themes in order to provide the base for the analysis (Seers, 2012). Thus more encompassing themes can be developed to describe the data in a form which summarizes it, but still contains the in-depth information of the original data. Saunders et al. (2012) refer to the initial process of coding as ‘open coding’. The search for relationships amongst these codes and the outline of categories is in this context called ‘axial coding’. Thus, both open and axial coding was used in this thesis.

3.8 Credibility

In order to address the credibility aspect of the thesis, reliability and validity are explained in this section. Here, several pitfalls regarding these two elements are outlined and how we sought to avoid them is explained. This contributes to ensure that the research process was as scientific as possible, by assuring transparency and clearly outlining the factors considered.

3.8.1 Reliability

According to Easterby-Smith, Thorpe, Jackson, & Lowe (2008, p.71) three important questions can be asked when concerning reliability in the study. Firstly, "will the measures yield the same results on other occasions?", secondly, "will similar observations be reached by other observers?" and thirdly "is there transparency in how sense was made from the raw data?". In order to address these questions the methodology chapter provides a detailed description of the steps taken during the research process. Furthermore, the interview guide is attached in Appendix 1. Thus, this chapter should give other researchers the opportunity to achieve similar results in a comparable setting. To further assess the reliability Robson (2011)
names four main threats, two of which are concerned with the subject for information and the other two with the researcher.

Subject Bias

Subject or participant bias is concerned with whether the participants’ opinions are shaped by other influences than themselves. In an autocratic organization, subjects might be reluctant to expressing their own opinions in fears of repercussions from the boss. If this should be the case, the data gathered will be biased. No indication of this was experienced in this thesis, since the company itself made us aware of the current problem in packaging operations and formulated the research proposal. In addition the corporate contact person from the supplier was highly supportive of interviews and observations being conducted in the organization. Further, the participants were offered confidentiality and it was always pointed out that participating in the study was voluntarily. This was done in the beginning of every interview and during the observations, hence, barriers for participants stating their own and unbiased opinion were removed. In regard to the observations, people may be biased and act differently or manipulate events, if they know that there is an observer present (Yin, 2009). For the aforementioned reasons this is also not likely in this case. Moreover, the workers were informed beforehand about the observation or even suggested the observation themselves, as in the case of the sub-supplier.

Subject Error

Subject or participant error is related to the data collection methods. For the interviews, this implies that if the participant should feel particularly positive or negative emotions it could shape the way the questions are answered. To avoid such errors the setting should be relaxed and neutral. We ensured this by conducting interviews in a meeting room or other quiet office environments. The time of the interview might also play a role. Friday afternoons could yield more positive responses than Monday mornings for example (Saunders et al., 2012). In this thesis such days were avoided, with a few exceptions where the interview time was dictated by the schedule of the respondents.

Researcher Bias

In regard to researcher bias, researchers should keep an open mind and not stick to a pre-conceived position, as well as be open to contrary findings (Robson, 2011). We ensured this by asking open and probing questions in the interviews, allowing the respondent to elaborate on the issues that were seen as important by them. The interviewer himself also needs to be unbiased and have a good understanding of the issue being studied (Yin, 2009). We addressed this issue by building profound knowledge about the topic through a literature research before we conducted the interviews. Thus we were able to ask expedient questions to the topic.

Researcher Errors

In terms of researcher error, this relies on consistency when collecting the data. For example interviewers might have different styles of asking questions. This could form the responses of the questions into a particular direction, and biasing the data. In order to address these concerns the interview guide was used as a base for the interviews, and both researchers were present during the interviews. The interview summaries were sent to the respondents for revision. This way misinterpretations and partiality of the researchers could be corrected and avoided.
3.8.2 Validity

Validity is concerned with whether the findings are actually about what they are stated to be about (Saunders et al., 2012). Maxwell (1992) provides three main types of threats to validity in qualitative research. First, a proper description of the data is required, in other words the data needs to be accurate. Second, the data needs to be interpreted properly. Lastly, one should consider alternative considerations and understandings to the studied phenomena. This means also seeking data that is not consonant with the theory considered (Robson, 2011). To assess these factors, we have made the following precautions. First, to assure that the data is accurately described, we recorded all interviews and made sure to take comprehensive notes during the observations. Also, summaries of each interview were compiled from the recordings. Furthermore, notes were taken during and after the interviews. In regard to the second threat imposed by Maxwell (1992), our inductive approach meant that we did not force through any theoretical framework to analyze the data collected. Rather, the previously gathered theory served as guidance for the thesis process. This also touches the last threat mentioned. We made every effort possible to let the participants speak freely and did not limit them to emphasize themes they regarded as important in relation to our research purpose.

3.9 Delimitations

This section will concern the methodological limitations applicable for this thesis. When researchers decide on a certain methodology it is important to take into account which limitations might be present and how this can affect the research as a whole. The limitation with the inductive approach and exploratory purpose roots in the general information it produces. A deductive and explanatory study would be able to go more into detail, and thereby test concrete hypotheses. Another limitation is the case study strategy. In this study, one case is conducted to provide the data. Thus, the information was gathered from one focal company and two involved actors in the up and down stream. Due to the uniqueness of every company and the perceptions of the human actors, considering other companies and respondents might yield different results. Further, we were reliant on the respondents’ perceptions of processes and factors revealed in the interviews. Although we have taken precautions to prevent biases and errors, one cannot guarantee an avoidance of this completely.

3.10 Summary

This chapter started with discussion regarding the research philosophy, subjective ontology and interpretivist epistemology. Further, the research purpose has been classified as exploratory together with an inductive research approach. As for the research strategy, a holistic, single case study has been chosen. Moreover, the data collection strategy utilizes qualitative methods consisting of semi-structured, in-depth interviews and participant observations. Also, the companies included in the case have been presented in the data collection section. To select respondents for the data collection, non-probability and purposive sampling was used. For data analysis, open and axial coding has been discussed and chosen to organize the data. Lastly, aspects of credibility have been brought up clearing out the issues of reliability and validity, as well as delimitations for the thesis methodology.
Findings

In this chapter the findings from the data collection methods will be presented. To make this easier for the reader, the section has been divided into two main parts, each concerning their respective RQ. First the current state of the packaging and returnable packaging operations within the supplier is explained. Subsequently, findings are connected to RQ2 by specifying the important factors for returnable packaging management.

4.1 Packaging & Returnable Packaging Operations

Findings in this section are portrayed to best reflect the first RQ of this thesis: “How is packaging and returnable packaging managed within a supplier in the automotive supply chain?”. This is done by first going through the respondents and secondary data's presentation of a supplier. The different department roles in packaging management within the supplier are elaborated. Packaging processes for the internal, outbound and inbound flow are described together with areas of responsibility.

4.1.1 The Supplier’s Role in the ASC

The supplier produces several different products in its two facilities, FA1 and FA2, ranging from the manufacturing of gear-shifters and head-rests to simpler injection molded parts. A gear shifter can consist of 100 different materials, which the supplier assembles to a complete component on site. For the supplier’s plant, most of the customers are in Europe with some exceptions being in other parts of the world. In terms of customer and supplier relationships, long-term relationships were stated as most common and favorable. Examples are Swedish OEMs, which have been customers dating back to the 1960s. Suppliers for the production were stated to be over a 1,000 in total, with both long and short-term relationships in place.

Produced components and parts vary in the way they are used by their customer. For the gear-shifter, this is a finished component that goes directly in the car. The headrest on the other hand, goes to another supplier which assembles the whole seating array and delivers this JIS to the OEM.

Figure 4.1: Overview of the SC.

To further illustrate, Figure 4.1 shows the supplier’s position in the SC. Findings indicated that it occupied both a role as a supplier and first-tier supplier in the chain.
4.1.2 Departmental Roles in Packaging

The operations within the supplier concerning packaging are manifold, and directly and indirectly involve several departments. Findings suggest that no specific department is responsible for packaging exclusively, but that rather several are involved in terms of making suggestions for packaging or adopting current packaging systems.

To clarify, each of the involved actors in packaging operations that has been included in this thesis are further described.

*Warehousing*

The job of the warehouse involves handling packaging on an operational level. Main responsibilities include receiving goods and recording these in the Enterprise Resource Planning (ERP) system, as well as the reordering process of packaging material from the customer. Warehouse workers also deal first-hand with the returnable packaging systems. Related tasks include inventory checks, registration of outgoing returnable packaging and the confirmation of received packaging material.

*Purchasing*

Purchasing is concerned with the inbound flows of material to the supplier’s plants. Main tasks involve overseeing all materials that go in to the plant, quality management and price optimizing. It also includes managing and monitoring supplier related issues and solving disruptions of deliveries together with the logistics function. In regard to packaging this is normally not tailored specific, although it is included in the standard sub-supplier contracts.

*Lean Management*

The lean department strives for continuous improvement, and works to make strategies implementing lean principles in the supplier. These professionals deal with packaging in the bigger context and not exclusively isolated. One of their key activities is Value Stream Mapping (VSM) where packaging is part of the ‘big picture’. In other words, packaging is a function that is part of a bigger optimizing strategy.

*Logistics Management*

Amongst other things, logistics is responsible for the warehouses, as well as for the material planners and the project planners at the plant. In regard to packaging, logistics is only involved on packaging matters at the beginning of a new project or with the introduction of a new part. The logistics department is also looking at lean production and improvements to the flow.

4.1.3 Processes

In order to give the reader an overview of how packaging and returnable packaging is managed within the supplier, findings for the packaging processes for internal, inbound and outbound flows will be described below. These sections include returnable and non-returnable packaging, as well as a description of the current working process handling these different materials. To illustrate the flow of goods within the supplier, a proposed model based on the findings is shown below in Figure 4.2.
As described earlier, the considered plant of the supplier consists of two parts, FA1 and FA2 with its own production line in each. Both handle separate inbound and outbound flows.

### 4.1.4 Internal Flow

The supplier overall has plants in 32 locations around the world. Some of those plants are not only producing components for customers, but also parts for other plants within the organization. As a result of this, the supplier is part of an internal packaging system which flows between three different locations and is also used internally for material handling in the plant. This is illustrated in Figure 4.3.

The intra-organizational flow for the considered plant consists of the internal handling between its two parts, FA1 and FA2, as well as the plants in Poland and Slovakia. For these flows a returnable packaging system of grey plastic containers is in place, which is used for a variety of appliances. Some parts can be oily, therefore, plastic bags are put in the containers to prevent contamination. This solution was regarded advantageous, since the cleaning of the containers was too costly.

According to the respondents the system was introduced about ten years ago. The transport between these locations is carried out by a scheduled milk-run. Besides containers filled with
parts also empty containers are transported. The respondents from the warehouse have confirmed that the supplier is receiving and sending finished products to both of the other sites. Findings indicate that there is no tracking system for these containers, and inventory is done once a year. Containers are signed out as they leave the respective plant. However, none of the respondents indicated that there have been any problems such as under/over stock or depletion related to these containers. However, the respondents stated that there has been significant shortage of containers five years ago, due to shrinkage in the loop. This problem was then solved by replenishing a large number of additional containers.

4.1.5 Outbound Flow

The outbound flow from the supplier’s plant is concerned with sending off finished products to the supplier’s customers. This is done from both production facilities, FA1 and FA2. As described earlier, these products range from gear-shifters to head-rests and injection molded parts, in other words different products with specific demands for packaging. Packaging used for the outbound flow was found to be a combination of returnable and non-returnable packaging material. On the outbound side returnable packaging materials are used in greater numbers, with respondents stating it to be used in the majority of the occasions. The remaining goods are shipped using non-returnable materials. Both packaging solutions used in the outbound flow are further described below.

Non-returnable packaging

As noted by the warehouse respondents, the non-returnable packaging materials consist of cardboard boxes ordered directly from a supplier. This is only loosely connected to the production schedule and most of the orders based on the experience of the staff. In the outbound flow, this form of packaging is used for smaller items as well as goods that are sent long distance. Non-returnable packaging for example was used for shipping parts to the Chinese plant of a customer as stated by a respondent from the warehouse. In addition, cardboard is preferred when the item is electro discharge sensitive. The received cardboard boxes are partly stored in a tent outdoors and bought into the main building when needed. Due to the temperature differences between the warehouse and outside during winter time, the material of the cardboard boxes get negatively affected and sometimes have a tendency to break. Overall there is a KPI connected to the amount of non-returnable packaging that has been disposed through the year. This is part of the environmental ISO14001 initiative.

Returnable packaging

For returnable packaging, the supplier participates in several packaging systems together with key customers. The systems are described as the customer supplying returnable containers, and these flow between the supplier and the customer.

In FA1 and FA2 respectively one person is responsible for coordinating and sending the parts to the different customers in each of the warehouses. Customers own and operate their own systems of returnable packaging. This means that the supplier has to deal with separate packaging systems for every customer. Furthermore, these use different types of containers, reordering and control systems.

To give the reader an overview, the different returnable packaging systems are listed in the Table 4.1.
### Table 4.1: Overview of packaging pools.

<table>
<thead>
<tr>
<th>Customer</th>
<th>Fees</th>
<th>Reorder Process</th>
<th>Lead Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scania</td>
<td>No</td>
<td>Manual</td>
<td>Online</td>
</tr>
<tr>
<td>DAF</td>
<td>No</td>
<td>Manual</td>
<td>E-mail</td>
</tr>
<tr>
<td>JCI</td>
<td>No</td>
<td>Automatic</td>
<td>According to orders</td>
</tr>
<tr>
<td>Volvo Car</td>
<td>Yes</td>
<td>Manual</td>
<td>Online</td>
</tr>
<tr>
<td>Volvo Truck</td>
<td>Yes</td>
<td>Manual</td>
<td>Online</td>
</tr>
<tr>
<td>Renault</td>
<td>No</td>
<td>Automatic</td>
<td>According to orders</td>
</tr>
<tr>
<td>BMW</td>
<td>No</td>
<td>Automatic</td>
<td>According to orders</td>
</tr>
<tr>
<td>Magna St.</td>
<td>No</td>
<td>Automatic</td>
<td>According to orders</td>
</tr>
<tr>
<td>Husqvarna</td>
<td>No</td>
<td>Manual</td>
<td>Online</td>
</tr>
<tr>
<td>Daimler</td>
<td>No</td>
<td>Automatic</td>
<td>According to orders</td>
</tr>
<tr>
<td>Ford/DHL</td>
<td>No</td>
<td>Automatic</td>
<td>According to orders</td>
</tr>
</tbody>
</table>

The materials ordered are different types of boxes and pallets. In this context Scania was highlighted by the respondents as particularly complex due to a very large number of different packaging materials. These range from different sizes of pallets and boxes as well as frames and lids.

Six systems are automated and controlled by the OEM, while the rest requires a manual reorder process from the responsible warehouse worker at the supplier. This is mainly carried out through online portals, whereas DAF needs to be notified by e-mail. Furthermore, the received quantity of packaging material needs to be confirmed back to the customer via the portal. The online portals also show the stock of packaging material that the supplier currently possesses, which needs to be verified by periodical physical inventory checks.

In regard to cost, the usage of the pools is free with the exception of Volvo. Volvo charges its suppliers for using their packaging material. Having an optimal inventory was, therefore, considered very important by the respondents. Further costs are incurred by the supplier as a result of the storage requirements of the different packaging materials. Hence, three large halls are present in order to store the inventory of packaging material for the different customers. The customer require the supplier to store the packaging indoors and dry, thus these storage halls were a necessity.
The typical lead-time is around 1-2 weeks with an exception of Husqvarna, which is located within close proximity. The respondent from the warehouse FA1 further added that they do not receive a notification when the packaging materials from the automatically replenished pools are sent. Outbound transport of finished goods is booked by the supplier according to guidelines of the customers. Should the supplier happen to be short on packaging material due to the wrong ordering or customer replenishment process, emergency packaging must be used. Normally this problem is tackled by utilizing non-returnable packaging materials for the shipment.

4.1.6 Inbound Flow

In order to feed the production, supplies continuously arrive through the inbound part of both FA1 and FA2. The majority of incoming shipments are packed in non-returnable packaging such as cardboard boxes and one-way pallets. According to the respondents around one third of the goods arrive in returnable packaging. However, this concerns to a large extent the aforementioned intra-organizational flow of plastic boxes. The size and contents of each package is agreed upon before delivery. The supplier is further able to make suggestions for the packaging materials to the different sub-suppliers, but most of the time the goods come packaged by the sub-suppliers’ preference. Packaging is contractually regulated, but there is no standardization of packaging regulations in place as stated by the respondents of all included departments. This makes it necessary to repack a substantial number of shipments every week. Respondents from the warehouse pointed out that this takes a lot of time and, therefore, causes considerable costs.

Further, from the warehouse side, there are also reactive follow-ups if the packaging should be faulty. If this is the case, it is reported from the warehouse to the operational purchasing which then initiates contact with the particular sub-supplier for correction. Respondents in the warehouse described this dialogue as good and unwanted situations are quickly corrected.

Non-Returnable Packaging

Several different forms of non-returnable packaging can be found in the inbound flow. These are ranging from half pallets and disposable pallets to cardboard boxes of different sorts. Plastic bags and wrapping are also present on most inbound shipments. The disposable elements of the packaging cause a significant amount of solid waste as could be seen during the observations in the warehouses.

Returnable Packaging

For the returnable packaging found in the inbound flow, the majority concerns the internal plastic boxes. Additionally some of the Swedish sub-suppliers use EUR-pallets with frames, which are part of the pool of EUR-pallets. Goods can also come packaged in the form of combined returnable and non-returnable materials. The base can for example be a pallet, while the contents on it are packed individually in cardboard boxes and wrapped in plastic. The transport is organized as a milk-run by the supplier for local sub-suppliers. Goods coming from longer distances are shipped by various forwarding companies. Transportation is booked by the sub-suppliers, according to specified rules set the supplier. In addition, the supplier is paying for the transportation cost.
4.2 Important Factors for Returnable Packaging Management

Findings from the interviews highlighted several important factors for returnable packaging management. In order to structure these findings, initially each of the companies’ basic involvement regarding returnable packaging is outlined. Subsequently, perceived important factors for returnable packaging management are explained. This section has been divided into fundamental and efficiency factors to keep it in line with the findings. Fundamental factors need to be in place for a returnable packaging system to be implemented. Whereas efficiency factors refer to a returnable packaging system that is already in place.

4.2.1 Current Returnable Packaging Management

Sub-Supplier

In the examined case of the sub-supplier there was no particular preference for using returnable packaging in the outbound flow. So far only one customer has introduced returnable packaging. However, the company has developed own trays which are utilized in the production and serve as packaging for shipping products. Thus, the firm has developed and implemented its own pool of returnable packaging.

OEM

The company is operating its own packaging pool, with several different forms of returnable packaging. The containers are designed and developed according to the needs of the company’s processes, and range from standardized plastic boxes to larger racks used to transport big items such as engines. Every supplier worldwide is contractually obligated to use this packaging. However, every plant can arrange separate solutions with the suppliers if this serves the plant’s specific needs better.

The handling of the packaging has been outsourced to a service provider which is operating a central warehouse. All empty packaging materials are stored there after they have been used at the different plants. The service provider is then responsible for cleaning and maintaining the containers. Further, when packaging materials is needed, the suppliers order it through an online portal. A transport company then carries out the shipment to the suppliers.

4.2.2 Fundamental Factors for Returnable Packaging

The findings indicate a general interest in returnable packaging. However, respondents made clear that it might not be applicable in all situations. Table 4.2 gives an overview of the different fundamental factors for returnable packaging that have been found. These are further elaborated below. This has been organized through the findings from the supplier, the sub-supplier and the OEM.

In total six different factors were considered as fundamental. Power relations and proximity were mentioned by respondents from all the companies. However, lean management was only mentioned by interviewees of the supplier and sub-supplier.
Table 4.2: Overview of fundamental factors.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Sub-Supplier</th>
<th>OEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability</td>
<td>Lean Management</td>
<td>Power Relations</td>
</tr>
<tr>
<td>Organizational matters</td>
<td>Proximity</td>
<td>Proximity</td>
</tr>
<tr>
<td>Lean Management</td>
<td>Power Relations</td>
<td></td>
</tr>
<tr>
<td>Power Relations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume &amp; Frequency</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.2.1 Supplier

Sustainability

The majority of respondents from the focal company have named waste reduction as a fundamental factor for the usage of returnable packaging. Disposable packaging creates a lot of waste and in the opinion of the interviewees this can be significantly reduced by using returnable packaging.

Organizational Matters

It was stated that a returnable packaging pool requires a whole organization to operate, and one needs to keep track of the inventory of containers as well as maintaining these. The supplier does not have this kind of organization in place at this moment.

In addition, reasons for why the supplier has not yet implemented an own returnable packaging pool together with its sub-suppliers were listed by one of the respondents. The initial investment to create the packaging pool was seen as the main problem. Further, using standard pallets with frames was preferred, as they can be used for several sub-suppliers/customers. Transport costs to the sub-suppliers were also highlighted as a disqualifying reason. However, in the respondents’ opinion, the area of southern Sweden could be used as a test-run for the implementation of a returnable packaging pool. It was proposed to implement a pool with a smaller number of close sub-suppliers. Since most of the non-returnable packaging comes from the sub-suppliers, there is big potential for improvement if the returnable packaging should be successful.

Lean Management

Another element that was mentioned by the respondents was the presence of lean thinking and the necessary mindset in order to incorporate this into the everyday business. It was stated by the respondent from the lean department that it would be critical to understand "how important the logistics flow is and how it influences the effectiveness of the company's whole operation". However, this awareness is missing in the supplier at the moment. The lean champion stated that the SC as a whole is "not in the focus". Packaging has been described by this respondent "as something that is on the side and not like a part of production". A lack of knowledge about SCM in general, as well as short term thinking was mentioned as reasons.
Power Relations

During the interviews the respondents also talked about the power relation in the SC from their point of view. The employees see the supplier in the position that it has to accept to handle the different packaging pools of the customers. Consequently the customers were seen as dominant. The interviewees did not think that the supplier could make demands to the customer.

Proximity

A close distance between the involved parties has been mentioned as a fundamental factor for the introduction of returnable packaging. The lean coordinator stated that "frequent deliveries within reasonable proximity favor plastic returnable containers". The main argument mentioned by the respondents was that only if the transports between the parties are relatively short the number of turnarounds can be as high as possible. This is necessary because the benefits of the containers can only be facilitated if they are used as frequently as possible. Furthermore, the respondents mentioned two factors which were seen as tightly interconnected. These factors were volume and frequency of deliveries.

Volume and Frequency

This concerns the volume of goods purchase from a supplier or delivered to a customer. The respondents stated that only if the volume is big enough it is economical to use returnable packaging. This was further explained to be closely connected to the frequency with which the parts are transported. As established beforehand, the number of turnarounds needs to be as high as possible in order to justify the investment. Only if the components in question are delivered frequently the containers are optimally utilized, hence the volume needs to be sufficient.

4.2.2.2 Sub-Supplier

Lean Management

During the observation in the facilities and the interview with the respondent of the sub-supplier it became evident that lean management plays an important role. As a result, the firm has developed and implemented a packaging pool with metal trays. These are used internally in order to enable efficiencies in the production. Moreover, they are used as returnable packaging for deliveries to customers.

Proximity & Volume

Having suppliers and customers nearby was mentioned as a fundamental factor for the introduction and usage of the firms packaging pool. Considering the volume of deliveries between the involved parties was regarded as central. According to the respondent this is necessary to achieve low transport costs and the necessary number of turnarounds.

Power Relations

The respondent of the sub-supplier stated that the company is aware of its position and size within the ASC. According to the respondent it is not easy to replace the company as a supplier due to their high quality and complex products. Nevertheless, the company was open to discussions if "the customer needs a special packaging solution in order to improve his processes".
4.2.2.3 OEM

Returnable packaging is regarded as a necessity due to the scale of the customers operation. As mentioned earlier, the OEM has a whole organization in place to handle the operations of returnable packaging.

Dimensions of Parts

For some of the supplies needed for the final assembly, returnable packaging materials are fundamental. This is basically due to the size and form of the components sent. Hence, it would not be feasible to send it with any form of non-returnable packaging. An example item mentioned was the cabins for the trucks. Due to the bulkiness of this item, it requires a big metal frame for securing transportation. This frame is also collapsible, in order to utilize the space in the return flow. The packaging materials used are designed to go directly into the production of the OEM without repacking. However, the design is only developed by Scania and the suppliers are not included in this process.

Power Relations

It became evident during the interview with the OEM that the company is very well aware of its powerful position in the SC. The respondent further stated that the supplier has to follow the OEMs packaging demands.

Proximity

Close proximity between the OEM and the suppliers is not necessarily a prerequisite for implementing returnable packaging. However, it was emphasized that neither the OEM nor the suppliers have unlimited warehouse space for storing packaging material. With longer distances more packaging material and a buffer is required to prevent disruptions.

4.2.3 Important Factors for efficient Returnable Packaging

Table 4.3 gives an overview of the factors mentioned. These are further systematically presented through the input from the supplier, sub-supplier and OEM.

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Sub-Supplier</th>
<th>OEM</th>
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</thead>
<tbody>
<tr>
<td>Standards</td>
<td>Complexity of Pools</td>
<td>Collaboration</td>
</tr>
<tr>
<td>Holistic View</td>
<td>Collaboration</td>
<td>Quantity</td>
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<tr>
<td>Quantity</td>
<td></td>
<td></td>
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<tr>
<td>Efficient Handling</td>
<td>Collaboration</td>
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In total six different factors were considered as important for efficient returnable packaging. Collaboration was mentioned by respondents from all the companies. Quantity, however, was only mentioned by the supplier and OEM.
4.2.3.1 Supplier

Standards

According to the respondents in the supplier, the number of different forms of packaging material needs to be limited. The introduction of standards, of which every supplier has to follow, was proposed by several interviewees. Moreover, the current implications for the production were pointed out. Thus, as for the current state, the equipment needs to be adapted for the different packaging. This is very costly and time consuming and could be avoided by using standardized packaging materials.

Adapting the holistic view

The lean department raised awareness about adopting the holistic view across departments. Accordingly inbound and outbound should be connected, and, it was pointed out that the returnable containers should flow through the entire production process. These should be reused as much as possible. However, this is not the case at the moment. As stated by a respondent from the lean department the term ‘logistics’ is currently only connected to the thinking of how the goods get from the suppliers to the plant, but it does not go further. How packaging is used inside the supplier is not considered, and it was stated that it is not managed efficiently as of the current state. What’s more, it has not been considered if the packaging fits the products and if it can be used in other plants as well. If the requirements from the departments were included from the beginning there would be a better chance of the best solution being found.

Quantity

This was especially emphasized in the context of the optimal quantity of parts being ordered. Thus, a Minimum Order Quantity (MOQ) constitutes a part of every contract with a sub-supplier. While purchasing is mostly focused on cost-related KPIs, the logistics department is mainly working with flow-related KPIs. With this in mind, purchasing is aiming for a high MOQ since this leads to lower costs per piece, while logistics prefer a MOQ that fits production and reduces the capital bound in the warehouse.

Efficient Handling

According to the logistical department, handling of packaging material in the warehouse is the biggest issue especially when the goods need to be brought into the production. It was stated that the MOQ is too high, meaning that the quantity of parts in each inbound shipment is too large. This makes it necessary for the parts to be repacked into smaller boxes before they can enter the production. Further, this process is very time consuming, costly and it was stated that this kind of repacking occurs every week.

In terms of handling, the warehouse workers state that the form of packaging has to be simple and easy to store. Some contrasting opinions of packaging between the departments emerged, for example the half pallet which is difficult to handle in the warehouse, but easy to fit in the production.

In addition, the issues of dirty and broken containers were seen as a concern for efficiency. Containers have been found to break during transportation because the duration of their use is too long. For this reason, the maintenance procedures of the containers were stated as not optimal. There is no tracking system in place that counts how often a container has been used on the internal side. However, this could be supervised by the OEM operated packaging system in some cases.
Collaboration

The respondents had different opinions on the importance of collaboration. While the logistics manager acknowledged the importance to keep a good relation with sub-suppliers and build up trust to be able to meet on the same level. The respondent of the lean department had the opinion that collaboration would "not play a central role". On the other hand it was described as a good way of evolving projects with the customers and sub-suppliers by the majority of respondents.

4.2.3.2 Sub-Supplier

As mentioned previously, the internal pool of returnable packaging was implemented to enable efficiencies in production. For the outbound side, efficient returnable packaging management is threefold for the sub-supplier.

Complexity of Pools

The sub-supplier does not want to participate in a large number of different pools, but at the same time the respondent stated that the company wants to "keep the customer happy" in order to ensure good cooperation. Complex administration and complicated handling were seen as the biggest potential problems if the firm should be involved in numerous returnable packaging pools. In addition, the space occupied by the different packaging materials was also considered a problem. The respondent was convinced that standardized returnable packaging materials would be successful, since these can be used across companies with little effort.

Quantity

The respondent mentioned the example of an order from a customer which created problems with the packaging. A lid could not be closed due to the amount of parts ordered. After adjusting the order-quantity the problem could be solved. This was possible because it was suitable for the production of the customer as well. In this context the importance of collaboration between the parties was also emphasized by the respondent.

Collaboration

The respondent was convinced that collaboration plays a big role in returnable packaging management. The firm had previously worked together with a customer to solve the aforementioned problem with a specific container. Communication was usually facilitated through phone, but physical meetings were preferred. Solving problems established a closer relationship between the companies according to the respondent.

4.2.3.3 OEM

The way the parts are packed are influencing the efficiency of the returnable packaging system according to the respondent.

Collaboration

In regard to collaboration, the respondent stated that they mostly enforce their returnable packaging system on their suppliers. This goes mainly for the smaller standardized packaging materials. For bigger specialty racks, it is necessary to collaborate with the supplier to get the best possible outcome. Further, the racks need to be built to achieve the highest possible level of quality.
Quantity

The responses to this factor were twofold. On the one hand, the interviewee stated that the aim is to have sufficient parts at the assembly line so that production can continue for four hours. This uses the space in the production in the most efficient way and reduces the capital bound in the warehouse according to the respondent. As a consequence the packaging is designed to carry the needed quantity of parts.

On the other hand the respondent named the factor of quantity in the context of the returnable packaging pool. It, therefore, needs to find the right amount of packaging material used in the pool for the optimal balance between containers in stock and in the flow. The reason is twofold. The OEM wants to keep the capital bound in stored packaging materials at a minimum, but it is crucial that the suppliers have enough packaging material available to carry out their shipments.

4.3 Summary

The findings connected to the current operations have shown that the supplier plays two roles in the ASC. Moreover, several departments are involved in the packaging operations, which are concerned with internal, outbound and inbound flows and related to supplier, OEM and sub-supplier.

In the context of important factors for returnable packaging, several have been stated by the respondents. These have been separated into fundamental and efficiency factors depending on their relevance. Amongst fundamental factors are sustainability, organizational matters, lean management, power relations, proximity, volume and frequency. For efficiency factors standards, holistic view, quantity, efficient handling, collaboration and complexity of pools have been mentioned.
5 Analysis

This chapter will discuss the findings together with relevant literature which has been described in the frame of reference. Its structure is twofold, where RQ1 and RQ2 are addressed in their own respective sections. The current management headline encompasses the analysis for RQ1, while factors for returnable packaging management addresses RQ2.

5.1 Current Management

The current state of packaging and returnable packaging operations within the supplier is outlined in this section. The role of the supplier is first described together with the aspect of packaging management. Further, packaging operations in the internal, outbound and inbound flow is analyzed.

5.1.1 Supplier

As noted in the literature by Krcal (2007) and Kerkow et al. (2012) value creation has been moved from the production line of the OEM towards the suppliers. Findings support this theory, as the supplier makes parts and components that are vital for the final assembly of the product of other first-tier suppliers and OEMs. It also became clear that the supplier does not serve the role as an OEM, as they purely supply parts and components that are used in the assembly by other companies. The case company, therefore, holds the role as a supplier in the ASC. Pereira et al. (2011) further state that OEMs have classified suppliers into first, second and n-tier. The position of the supplier was found to be both first and second tier in the SC, since they supply both to OEMs and other first-tier suppliers. To further address the concept of the supplier, it was found to occupy the role of the component specialist, in accordance to Veloso et al. (2000).

5.1.2 Packaging Management

Findings delineated that packaging is not treated as one of the key logistical activities in the supplier. This opposes the literature, which suggests it to be treated as one of the key logistical functions (Stock & Lambert, 2001; Chan et al., 2005). Within the supplier, packaging is treated as something on the side and it is not integrated in the different overall processes as stated during the interviews. Hence, there are no designated roles responsible for packaging exclusively, but rather several departments dealing with it as part of their operation.

Also, both non-returnable and returnable packaging materials are used throughout the different flows. These materials are used on primary, secondary and tertiary levels as stated by Emblem and Emblem (2012). This follows Hellström and Saqir (2006) packaging system concept, where these levels are interconnected. Overall, packaging materials were found to be a combination of levels in the internal, inbound and outbound flows. Theory suggested that returnable packaging would be used throughout the entire ASC (Witt, 2000; Boysen et al., 2015). However, the empirical findings showed that returnable packaging is only used in certain parts of the SC.

Where returnable packaging is present, these pools consist of RTIs of different sorts, ranging from specialty containers to returnable pallets. In regard to utilizing RFID for control system support (Hellström, 2009; VDA, 2015), this was found neither in the internal nor in the outbound returnable packaging pools, further indicating that no direct tracking of the different containers are in place.
In general there is a high focus on cost regarding the packaging operations. Findings indicated targeting on material cost within packaging as stated by Lee & Lye (2003). However, there is no measurement of directly associated labor costs towards packaging, nor towards the value that packaging specifically can contribute throughout the chain as pointed out by Chan et al. (2005).

With regard to the sustainability perspective, a KPI is in place to measure the amount of waste recycled from the non-returnable packaging materials. This is part of the ISO14001 environmental management standard. In addition, the supplier participates in several returnable packaging pools which further reduce waste. Some customers also demand the use of returnable materials as a prerequisite for doing business. This supports the studies of Nordin and Selke (2010), White et al. (2014) and Garrido et al. (2014) regarding the increasing sustainability focus in the SC.

In order to further analyze the packaging operations, the different flows are gone through systematically below.

5.1.3 **Internal Flow**

As mentioned in the findings, the plant of the supplier and two other locations within the organization are part of an internal packaging pool where plastic boxes circulate between the sites. Thus, there is a CLSC as described by McKerrow (1996), as well as Hellström and Johansson (2010) in place. In accordance with Emblem & Emblem (2012), the standardized plastic boxes are used as secondary packaging material. Plastic bags in every box act as primary packaging material in order to prevent the box from any potential contamination by oily parts or spillage.

The transport within this CLSC is carried out by trucks which run between the sites on a fixed schedule, both picking up and dropping off boxes. This concept was described as a milk-run by the respondents and fits the description of the milk-run transport system by Boysen et al. (2015). Further, this type of system was found to be simple and to reduce complexity of the CLSC. Laden and empty boxes could be transported simultaneously which reduces the chance of unavailability and provides efficient return transport.

The control system in place for the internal returnable packaging stands out as basic. Each plant is equipped with an allotment of plastic boxes, and it is the plants responsibility to keep a sufficient stock and send required boxes back. All boxes sent out and received are signed in manually at the respective plant. The number of boxes needs to be monitored by stock-taking, which is done once a year. In other words, the control system is somewhat insufficient to give a proper overview of the RTIs in the flow.

5.1.4 **Outbound Flow**

In most cases products in the outbound flow are sent in returnable packaging materials through customer owned packaging pools. There are also non-returnable packaging present which is used in special cases. The role of these materials in the outbound flow is further analyzed below.

*Non-Returnable Packaging*

As stated in the findings, non-returnable packaging materials mostly consist of cardboard boxes and one-way pallets on the outbound side. This form of packaging is chosen when the distance to the customer is great, it was for example used for goods shipped to a customer's Chinese plant. According to theory, this supports the model of Dominic et al. (2000), which
states distance to customer as a factor for choosing between non-returnable or returnable packaging materials. Additionally, non-returnable packaging was used if there was a shortage of returnable packaging for a particular customer.

Non-returnable packaging was found to be used on primary, secondary and tertiary levels on the outbound side. Products were typically wrapped in plastic, put in cardboard boxes and then placed on a one-way pallet. Consequently, representing all three levels as suggested by Emblem and Emblem (2012).

**Returnable Packaging**

The packaging pools listed in the findings and discussed during the interviews appear to fulfill the features defined by Saghir (2004). They prepare the goods for safe, efficient and effective handling, transport, distribution and storage. However, the advantages of efficiencies are mostly in favor of the OEM. The packaging material and the involved processes are tailored for the specific needs of each customer, and not particularly the needs of the supplier.

On the outbound side the supplier is contractually obliged to handle a variety of different packaging pools. Each of these pools represents a separate CLSC with an own control system and separate RTIs in accordance with McKerrow (1996). This also goes along with the model of Dominic et al. (2000). The pools are in place since the demand is somewhat stable and the distance is moderate since customers are located within Europe.

Moreover, every customer is using specialized containers, pallets and boxes in different sizes. These containers are used throughout the OEMs operations, and are sometimes specifically tailored for their production. As a result the packaging material cannot be used interchangeably between OEMs. The variety of different packaging materials makes the management of the pools complex. Especially because of a wide range of different requirements of the OEMs, in regard to operation, handling and reordering. Only about half of the pools are operated automatically by the OEM. The rest requires manual administration including the confirmation of received packaging. Hence, this process occupies man-hours and, therefore, are costly for the supplier. There is also no information available regarding the shipments of packaging material from the automated packaging pools.

**Control Systems**

Based on the findings during the observations and the interviews it can be stated that the control systems that are in place for the returnable packaging pools are switch-pool systems, as described by Kroon and Vrijens (1995). Both parties, the OEM and the supplier, have an allotment of packaging material available at their site. The supplier sends full containers to the customer and the stock of packaging materials is replenished whenever needed.

A deeper analysis of the applied control systems as mentioned by Kroon and Vrijens (1995) has been done for the case of the OEM. This returnable packaging pool is controlled by a depot-system. As the name implies, the unused packaging material is stored in a central depot. Additionally Kroon and Vrijens (1995) distinguish between book and deposit system. In the case of the OEM a book system is in place. The amount of different packaging materials are added or deducted from the supplier’s account, but no deposit needs to be paid. Furthermore, the supplier has to guarantee that in the long run the amount of packaging material received equals the amount sent. This needs to be confirmed with periodic manual stock-taking.
5.1.5 Inbound Flow

As projected in the findings, the inbound flow is mainly concerned with non-returnable packaging materials. Returnable packaging holds a minor role, consisting mostly of the internal returnable boxes. The usage of non-returnable and returnable packaging materials is further analyzed below.

Non-Returnable Packaging

Non-returnable packaging was found in primary, secondary and tertiary forms at the supplier, as described by Emblem & Emblem (2012). In general, non-returnable packaging materials consisted of cardboard boxes and plastic bags as well as one-way pallets. The general packaging functions were stated to be mostly fulfilled in the inbound flow, namely safe and secure transport of the products. However, the aspect of efficient and effective handling of the packaging materials seemed to be somewhat overlooked.

There are no standardized guidelines for packaging in place. Products come packaged in a way that requires re-packing into suitable containers for the supplier’s production. This is both time-consuming and resource demanding. Hence, some of the packaging principles of Saghir (2004) were not seen as fulfilled from the supplier’s perspective.

Returnable Packaging

RTIs in the inbound flow consist of EUR-pallets and frames in addition to the internal flow of plastic boxes. The international pool of EUR-pallets is an example of a deposit system as described by Kroon & Vrijens (1995) and the ER1 system as described by Boysen et al. (2015). Recipients of the shipment are obliged to pay a fee per pallet. The same amount is compensated when the pallet is shipped to a customer or delivered to a deposit site. The EUR-pallets function as tertiary packaging material for incoming goods. These are also reused for shipments to the customers on the outbound side.

5.2 Important Factors for Returnable Packaging Management

Concerning the empirical findings, all factors regarding returnable packaging management are rooted in the overall goal to reduce costs. These factors were found to be classified into fundamental and efficiency factors by the respondents. Fundamental factors are concerned with the factors that need to be considered before the returnable packaging system can be implemented. Efficiency factors concerns optimizing a returnable packaging system that is already in place. To systemize the analysis, the internal, outbound and inbound flows are discussed in separate sections below.

5.2.1 Internal

In order to assess the important factors regarding returnable packaging in the inbound flow, factors behind introducing the system and efficiency factors have been analyzed. These are found in the following sections.

5.2.1.1 Fundamental Factors

Power Relations and Collaboration

As discussed earlier, power relations and collaboration have been proven to be factors influencing the type of returnable packaging system used. However, for the internal flow between the plants of the supplier power was not found to play a significant role. The same applies
for collaboration as a fundamental factor, as this is facilitated between intra-organizational communications between the three plants.

Proximity and Volume

Two factors mentioned for the internal flow were proximity and volume of transport. This reflects the model of Dominic et al. (2000), where a short transport distance and a low seasonal variation in demand are requirements for the use of returnable packaging. The production has been described as interconnected between the three plants. Hence, the seasonal variation of the demand is very low.

As most customers with returnable packaging pools are located within Europe, it could be argued that the transport distance is not close and would disqualify the use of returnable packaging. However, Dominic et al. (2000) show that returnable packaging can be an option for longer distances, illustrating a grey area between the selection of the form of packaging. Therefore, indicating that other factors also should be taken into account. Mollenkopf et al. (2005) disprove that transport distance and variation in seasonal demand play a major role for the determination of the most cost efficient packaging system. Instead they point out the average daily volume and packaging size as key factors, which somewhat fits the case of the supplier’s internal pool. The issue of sufficient volume of boxes is solved by including three plants in the milk-run, since all of them are exchanging full and empty boxes between each other.

Control System

The basic control system is supported by the milk-run transport system which ensures that the balance between boxes coming in and going out stays roughly the same. Manual signing in and out of boxes also help the plants keep track of their current stock of returnable material. In addition, the milk-run is following a fixed schedule between the plants and does not, therefore, consume many administrative resources.

Sustainability

By implementing the internal returnable packaging system, the supplier has also reduced waste, costs and transport damages that non-returnable packaging would cause, similar to the US automobile industry as described by Witt (2000). It also contributes to the sustainable mindset, which has been named as an important factor by the interviewees.

5.2.1.2 Efficiency Factors

Standardization

The empirical findings highlighted standardization of the plastic boxes used in the internal flow as a key factor for efficiency. This simplifies the processes and considers the impact that packaging has on handling and warehousing as mentioned by Bowersox et al. (2002), Ebeling (1990) and Twede (1992). Respondents also stated that changes of production equipment can be avoided by using a standardized RTI in the flow.

Control System

The interviews have revealed that the supplier does not have proper control system in place for the internal flow of containers. This is described by Witt (2000) as a common problem for returnable packaging and can lead to the boxes being misdirected, inappropriately used or lost as reported by McKerrow (1996). Hellström & Johansson (2010) also state that a lack of containers in the system can be both costly to replace and negative for the efficiency of
the SC. Respondents in the warehouse stated that there was a shortage of boxes five years ago, and that this problem was solved by replenishing a large number of them.

By cause of shrinkage, a lack of containers could be a problem again in the future due to the absence of a proper control system. As stated by the Aberdeen Group (2004), one quarter of the respondents experienced a loss of more than 10% of their RTIs annually. This, together with the previous experienced shortage, could indicate that a new shortfall of internal returnable packaging is likely for the supplier ahead in time.

5.2.2 Outbound

In the outbound flow several returnable packaging pools are present. However, these are owned by the customers and thereby operated on their terms. In this section the authors seek to analyze why this is the case as well as efficiency factors to improve the current state of the returnable packaging operations.

5.2.2.1 Fundamental Factors

Power Relations

Literature paints a picture of the ASC, where the OEM occupies dominant position because of the proximity to the final customer as stated by Dicken (2003). However, Wells and Rawlinson (1994) and Doran (2005) suggest a shift of power from the OEM to the suppliers, because the value created by the manufacturer is decreasing and more functions are covered by the suppliers. This differs from the empirical results, where the customer seemingly possesses the power.

The power of the OEM was found to be based on different sources of power discussed by French and Raven (1959). It has the ability to reward or punish the supplier by giving new projects to the company or terminating the collaboration. Furthermore, the supplier wants to be recognized as a partner of the OEM which gives the manufacturer referent power. In this case, the OEM has legitimate power, because the natural power is acknowledged by the supplier.

From the findings it is clear that the OEM pushes its respective returnable packaging system on its suppliers. Accepting the packaging system is mandatory if the goods can be transported by the OEM's standardized containers, boxes or pallets. However, if the supplier provides a more complicated product the OEM is open for collaborative forming of the RTI.

Returnable Packaging System

Standardized returnable packaging is necessary for the operations of the OEM. Otherwise the complexity of the product as described by Turner and Williams (2005) and the large number of parts as mentioned by Pereira et al. (2011) and Kerkow et al. (2012) cannot be handled.

Hence, the returnable packaging system is tailored for the OEM with own control systems, special containers and packaging materials as described by the respondent. This suggests a previous cost and system evaluation has been in place before implementation. Empirical findings indicate that the current returnable packaging system has been chosen because the sum of factors like packaging material, damage reduction and inbound transport, sorting and line layout changes is lower compared to a system with one-way packaging. Besides, the labor intensive activities like cleaning and maintenance have been outsourced to a 3PL provider in
the OEMs system to further enable efficiencies. This is supported by Twede and Clarke (2004) as a key factor favoring the use of returnable packaging.

5.2.2.2 Efficiency Factors

As the returnable packaging systems are operated by the OEMs and not the supplier, efficiency factors rooted in the system itself are analyzed from the OEM's perspective. Furthermore, both supplier and OEM are considered in terms of efficiency factors regarding operation of the system.

Proximity and Volume

Proximity was not considered important by the respondent from the OEM, however, it was stated that the amount of containers circulating in the system must be carefully balanced. This is only possible if the company is able to track the packaging material and has the required visibility as described by Hellström & Johansson, (2010). As a result, the OEM shows that a returnable packaging system can work over a longer distance if the company is operating an effective tracking system for the RTIs.

Operating Process

The efficiency factors regarding the operating process differ from the perception of supplier and OEM. On the OEM's side the system is standardized and the organization deals with one common packaging system. For the supplier, however, this involves being part of several packaging pools from different OEMs. These have individual operating procedures which require specific knowledge and are time consuming. Thus, excess resources are spent on managing the different returnable packaging pools. No specific solution for this emerged from the empirical data, and theory for this problem is yet to come.

Costs

In terms of indirect costs associated with participating in the returnable packaging pools, several factors were revealed through the empirical results. From the observations of the warehouses it became evident that the packaging material takes up a lot of physical space at the supplier. Such inventory brings extra costs, as storage tents have to be put up and sometimes rented. Particularly costly is the participation in the pool of Volvo, which in addition to the indirect costs charges for the usage of the packaging materials.

5.2.3 Inbound

As shown in the findings, with the exception of the standardized EUR-pallets and frames, there are no returnable packaging pools present in the inbound flow. However, empirical findings revealed several ideas regarding implementing a returnable packaging pool in the supplier towards the inbound flow. These findings are analyzed with relevant theory to show important efficiency factors that are needed for a potential returnable packaging pool.

Power Relations and Collaboration

In accordance with the theory on power relations, the supplier should be in a situation which allows them to bargain and impose solutions with their sub-suppliers. However, the empirical findings have shown that the sub-supplier indeed are confident as well. They feel that they are hard to replace due to their high degree of specialization, which is described as expert power by French and Raven (1959). From the respondent at the sub-supplier it also became clear that there is willingness to collaborate and take into account the customers’ needs and wants. In addition, the sub-supplier focus on trust, thus indicating the factors required for
effective collaboration as stated by Nyaga et al. (2010). This suggests that both parties should be considered when implementing a returnable packaging pool, thus creating a win-win situation for both the firms. The sub-supplier has shown general interest in the findings to collaborate with customers in order to find solutions that are beneficial for all parties involved.

**Costs**

The initial investment of the returnable packaging system was seen by the respondents as a main problem for the implementation. However, not only the initial investment for the purchase of the packaging material should be in focus. Twede and Clarke (2004) suggest the firm to investigate potential savings through package purchase costs, disposal costs and operational benefits. Furthermore, Rosenau et al. (1996) elaborate on several factors that need to be considered before implementing a returnable packaging system. Some of these factors were stated by the respondents, emphasizing adopting the holistic view of the packaging operations. By this it was meant that packaging material should be standardized and compatible through all departments in the plant. If the supplier should implement a returnable packaging pool, the option of tailoring the packaging to operations would be possible. This could further trigger efficiency factors such as reduced handling cost, damage reduction, increased ergonomics and safety, as well as cubic efficiency.

The logistics manager of the supplier gave priority to the goal of optimizing the amount of parts per packaging unit in the inbound flow. This includes finding the optimal MOQ. If a returnable packaging system with the sub-suppliers should be implemented, this factor should be in focus. Rosenau et al. (1996) further propose applicable factors to be considered when developing a NPV analysis to predict potential cost savings of the system. Overall, the implementation of a returnable packaging system is very complex and influenced by numerous factors. Therefore, the supplier might not only consider transport distance and direct costs, but include all factors mentioned to be able to determine the value add of the returnable packaging system. What’s more, it should be a goal to incorporate both the needs of all internal departments and the input of the actors further upstream in the SC in order to improve the inbound flow. Thus, not looking narrowly and departmentally at the packaging operations as emphasized by Chan et al. (2005).
6 Conclusion

This section concerns the final conclusion of the thesis. Here, the purpose itself and both RQs derived will be answered in a systematic manner.

In regard to the purpose of this thesis, exploring and analyzing how packaging and returnable packaging are managed within suppliers in the ASC were seen as fulfilled by the authors. Further, perceived important factors regarding a returnable packaging system were outlined and analyzed. Concrete answers to the RQs are presented below.

6.1 RQ 1

How is packaging and returnable packaging managed within suppliers in the automotive supply chain?

Non-returnable and returnable packaging is dealt with throughout the supplier. However, packaging is not considered a key logistical activity. In general, packaging considers the main functions known as protection and quality assurance. On the other hand, factors such as efficient and effective handling are less considered according to the findings. Packaging operations further differ from the internal, outbound and inbound flow, hence these are explained systematically below.

The Internal, Outbound and Inbound Flow

The internal flow consists of a returnable packaging pool between three plants suppliers enterprise. It is managed through a manual system which involves signing in and out RTIs in the form of plastic boxes at the respective plant. Hence the control system is basic, and cannot directly track the RTIs in the system. The outbound flow mostly concerns returnable packaging. These packaging pools are owned by customers, and are imposed on the supplier due to the power situation in the SC. Each packaging pool consists of different materials and operating procedures. From the supplier’s perspective, this brings complications in terms of operating procedures and management. Non-returnable packaging is used when the distance is great to the customer or for emergency packaging, and usually consists of one-way pallets and cardboard material. In the inbound flow, non-returnable packaging represents the majority of packaging used. The form of packaging is loosely managed within the supplier, and there are no standardized packaging guidelines in place. As the packaging used is not particularly defined, goods sometimes arrive packaged in a way that is not favorable for the supplier. This brings implications through re-packing which again affects efficiency. In regard to returnable packaging there is willingness to implement such a system in the future, but lack of a holistic view and specific knowledge prevents this from happening.

6.2 RQ 2

What are the perceived important factors for efficient returnable packaging management, from the perspective of suppliers, sub-suppliers and OEMs?

Internal, Outbound and Inbound Flow

For the internal returnable packaging pool, three fundamental factors emerged. First, it was stated that the proximity and volume, needed to be sufficient. Hence, the three sites’ productions are interconnected and thereby ensures a steady flow of parts between them. Second, a basic control system is in place, which is further facilitated by a milk-run transport system. This is needed to ensure the flow of RTIs between the plants. Third, sustainability was pointed out by the respondents as a fundamental factor for implementing the system. In
terms of efficiency factors, the factors of standardization and control system were highlighted. Standardization was seen as an efficiency factor to facilitate efficient handling both in the production and the warehouse. The basic control system was seen as a barrier for efficiency. The lack of proper control was proven to be related to a shortage of containers five years ago. With a control system in place, such shortages could be avoided and shrinkage could be properly monitored and dealt with.

As for the outbound flow, the fundamental factors for returnable packaging being in place were explained by power relations and the capabilities of the system itself. The power the OEM possesses allows them to impose their respective packaging system on the supplier. Furthermore, the returnable packaging system has been tailored from the OEM side with outsourced handling and specialty containers. Efficiency factors were different for the supplier and the OEM. Here, three main factors emerged. First, regarding proximity and volume, it was stated from the OEM that close proximity was not a necessity. However, a proper control system was required to ensure a good balance of containers in the system and to minimize inventory. This was also stated as a main challenge for efficiency of the system. Second, the operating process was seen as a barrier for efficiency by the supplier. Dealing with several different returnable packaging pools involves different operating procedures which all consume more resources compared to a common system for all the pools. Third, cost was stated as an efficiency factor. Cost savings were optimized in the case of the OEM, but not for the supplier - direct and indirect costs for the supplier were brought up, such as storage space required for the returnable packaging materials of the OEMs'.

The inbound flow does not include operation of any returnable packaging pool other than the standardized EUR-pallets and frames. For this reason, only the fundamental factors are presented to assess the RQ. Power relations and collaboration were stated as a fundamental factor. Findings indicated that the supplier is in the position to bargain, however, the sub-supplier is also confident due to a high degree of specialization. In terms of collaboration, both parties are willing to cooperate and find mutual solutions. This shows that perceived fundamental factors are in place for a potential returnable packaging system.
7 Discussion

This section includes a discussion of the results of the research process in this thesis. Here, the conclusion is discussed, together with the authors’ reflections of the thesis process. Strengths and weaknesses are further outlined and put into context. Lastly, managerial implications are brought up, identifying potential new areas that can be further researched.

7.1 Concluding Remarks

Overall when reflecting back on the process of this thesis, it is clear that a lot has been learned along the way. The inductive and explorative type of study indicated that investigating the topic of packaging and returnable packaging would include new aspects, which it did throughout the process. The conclusion illustrates that packaging and returnable packaging operations are complex because of the system itself and the actors involved. Further, important factors are numerous and interconnected with different impacts, depending on the actor in the ASC. In addition to the purpose and RQs being fulfilled several interesting insights from the respondents within the supplier and sub-supplier emerged. These were concerned with the inbound flow and the potential implementation of a returnable packaging system.

Using non-returnable packaging in the inbound flow proved to be inefficient due to several factors. With the overall aim to save cost, theory highlighted factors that should be considered for a returnable packaging system. Cost was seen as the main barrier for a returnable packaging system in the inbound flow. However, theory highlighted the importance of considering all factors affected and taking these into account when performing a NPV analysis for the returnable packaging system. Having returnable packaging to facilitate MOQ was also put as an important factor, and it was proposed to introduce such a system between close-proximity sub-suppliers and the supplier in Southern Sweden. Findings indicated the need to look at the value add packaging can bring to the whole organization, and not treating it narrowly and departmentally.

7.2 Managerial Implications and Future Research

This thesis could be of interest for other actors in the ASC which are in a similar position as the three included companies. In particular, suppliers who seek to improve their packaging and returnable packaging operations. Also, it can be valuable to OEMs who are interested in learning about the packaging process of their suppliers, and the implications an imposed returnable packaging system might bring. Thus, improving the base for collaboration and utilizing efficiencies in the ASC. Although the research took place in the ASC it could also provide valuable suggestions for companies in other industries and SC’s. This can be any company that supplies goods and are dependent on packaging in various forms. It also provides a basis of factors that should be considered for firms which are thinking about implementing a returnable packaging system.

Using the applied methodology provided a broad overview of the current state of packaging and returnable packaging in the ASC, however, on the cost of not being able to dig deeper into the individual factors found. This study might be fruitful for future research within the topic. The authors of this thesis propose future research of returnable packaging operations within other suppliers, OEMs and sub-suppliers. By doing this, more factors can be outlined and compared to our findings. In addition, an in depth research on each of them is needed in order to establish them as actual factors and outline their concrete influence on the packaging system.


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Appendix I
Interview Guide

General introduction

Our names are Thomas Fleckenstein and Eirik Pihlstroem, we are two 2nd year MSc. International Logistics and Supply Chain Management students at Jönköping International Business School. This Interview is conducted to contribute to our Master Thesis.

Further, the aim of this thesis is to explore and analyze how packaging and returnable packaging are managed within a first tier supplier, as well as identifying important factors for efficient returnable packaging management from both the focal company (KA) and key parties perspective.

First we would like to ask you about recording and note-taking during the interview, is this ok for you? Second, we would like to raise the issue of confidentiality and discuss this with you.

Warm-up section

Details about respondent

Here we would like to hear a brief presentation of the respondent, and his/her function in the organization.

1. What is your name?
2. What is your professional background?
3. What is your position and main responsibilities in the job?
4. How are you involved in packaging management in your organization?
5. What packaging related projects have you been involved in?
6. How long have you worked here?

Automotive Supply Chain

Here we will ask a few questions about your firm and its position in the automotive SC. This will contribute to the context of the thesis.

1. What role does the company serve as? (Supplier, OEM etc.)
2. How many customers does the company have?
3. Category of customers?
   - Small/big? Long term/short term?
4. With how many suppliers is the company working together with?
5. Describe the relationship with the suppliers?
   - Small/big? Long term/short term?
6. What is the company's position in the supply chain?
7. Is the company directly delivering to the OEMs or is there another tier 1 supplier in between?
8. Who is organizing the transport of the products?
   - OEM/suppliers?
9. What kind of ERP system is the firm using?

**Main body**

**Packaging**

*This section concerns the (non-returnable) packaging operations in the firm.*

**Overhead context**

1. How is packaging managed (general current state)?
   - For inbound flow?
   - For outbound flow?

2. Is the way products are packaged contractual/agreement based?
   - Do you control how the received items are packaged?

3. Is there a collaborative dialogue with ex. the warehouse to get the most efficient form of packaging on inbound/outbound products?

4. Are there any key performance indicators rooted in packaging?

5. Are there any improvement programs for packaging?

6. Why is non-returnable packaging preferred?

**Operational context**

7. How are outbound items packaged before they leave the plant?
   - What factors are determinant for this?

8. How do received items come packaged?
   - What factors are determinant for this?

**Returnable packaging**

*Here, we want to know more about the returnable packaging operations in the firm.*

**Overhead context**

1. How is returnable packaging managed (In general)?
   o What is the percentage of returnable packaging compared to non-returnable used in the outbound process?
2. How many returnable packaging pools is the company involved in?
   - Please name the different pools and the companies involved (Inbound and out-
     bound pools).

3. Are the pools different for every customer?
   - Agreements, terms and conditions, ?
   - How are these agreements and t&c developed?

4. How are the pools controlled?

5. Was the focal company included in the development of the different returnable
   packaging systems?

6. Are there any key performance indicators for returnable packaging?

7. Are there any improvement programs in place for returnable packaging?

8. Has the company tried to improve the flows and deliveries of the suppliers on
   their own? Is the customer supporting those activities?

**Operational context**

Describe the currently used packaging pools (systematically go through each of the pools)

**General**

1. Describe the current flow of the pool

**Details about the pool (for table comparison)**

2. Which returnable packaging containers are used?

3. Who controls, monitors and maintains?
   - System in place for this?
   - Who pays?

4. Terms and conditions/contract based?
   - Responsibilities / Costs of mismanagement

5. How does the order/reorder process of packaging material work?

6. How is the physical (outbound and inbound) flow organized?
   - by the OEM or a 3PL?
   - What kind of system is used here? (Point to point, milk-run etc.)

**Influencing factors**

_In this section we seek to find out the influencing factors which facilitate efficient return-
able packaging management._
1. What do you see as important factors of efficient returnable packaging operations?  
   - Please elaborate further on these factors.
2. Which of these do you see as most significant?

**Power relations**
3. Do you think power relations, i.e. who possesses the most power, has an effect on how returnable packaging is managed?
4. Describe the current power situation in the Supply Chain.
5. Is the focal company able to make demands and own suggestions?
6. Is the focal company depending on single suppliers / customers?

**Collaboration**
7. Has there been any collaborative initiatives between the operators of the packaging pool? Collaborative initiatives for improvement, integration of systems or appliances?
8. Which role do you think collaboration plays for efficient returnable packaging management?
9. How is communication facilitated between the involved parties of the packaging pool?
10. Is a close dialogue being kept between the involved parties of the packaging pool?
11. Is technology/IT systems used for collaboration?

**Closing questions**

*Here we would like to further hear your opinions on efficient returnable packaging management.*

1. Do you think it is room for improvement of the returnable packaging system?
2. How do you think it can be optimized?
3. Do you see any immediate problems with the current state of operation?
4. Which initiatives would be most effective to facilitate better returnable packaging management in your opinion?

**Ending words**

*Thank you for participating in our interview.*
The process ahead will be as follows: The notes from the interview will be structured and the recording will be used to further clarify. Results from all interviews and observations will then be analyzed and discussed in the thesis, and a conclusion will be drawn to answer the research questions and reflect the purpose. If you want, a final copy of the thesis can be sent to you upon completion. If you wish, the recorded interview can be deleted when the thesis is finished.

Thank you again for your cooperation, it is much appreciated.