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Reverse logistics assessment in the automotive industry: A case study at Volvo Group

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ABSTRACT

The world is facing an era of extreme competitiveness regarding business environments. Actors in the Supply Chain networks do not scape to this phenomenon. Firms can no longer compete as individuals to be profitable. To be competitive, the different players within a Supply Chain (i.e. suppliers, manufacturers, dealers) have to share goals and objectives, acting as one player. Supply Chains have the necessity to shift to what is known as Closed-Loop Supply Chain, where the product life is extended even after the selling. The recovery of these products and their further treatments (i.e. remanufacturing, repairing, etc.) play a massive role in firms´ total revenues. In the automotive industry, companies do not seem to be managing their reverse logistics in a proper way, and this constitutes a big problem. Reverse logistics has to be further take into consideration, as it ensure the end-customer satisfaction, as well as it ensure the availability of products in the aftermarket.

This thesis was performed in the Logistics Service Development department under the Volvo Group Trucks Operations division, in Gothenburg, Sweden. Volvo Group is a global and multinational company, considered a leading transport solution manufacturer. The firm wanted to study how the reverse logistics were managed, which led to the following aim: *assess the reverse logistics systems that are currently being employed in the focal company and suggest improvements.* To fulfill the requirements set by the purpose, the actual practices of the company were studied, the key factors influencing the returns were identified and suggestions were provided. Semi-structured interviews both internal (within the company) and external (3PL and Dealers), internal documentation, direct observations and collection of operational data served the author to assess the purpose. The study of the current situation led the author to identify that there was a lack of steering decisions regarding reverse flows, as well as high returns rates and poor systems steering the returns. Five key factors were identified to be the root of the flaws of the current situation: Communication, Dealer´s experiences; Returns planning and policies; Lead times; and Performance measurements. Improvements were suggested regarding these five factors: Enhance communication (e.g. workshops with dealers); Improve Dealer´s Experience through building a new system; Change the returns planning and policies; Improve lead times (e.g. Stabilize lead times, same day deliveries); and Establish performance measurements (e.g. Track and Trace; KPIs). Thus, this case study provides a replicable framework to enhance the performance of the reverse logistics in the automotive industry.

Keywords: Supply Chain, Closed-Loop Supply Chain, Reverse Logistics, Performance measurements, Product recovery, Supply Chain Management, Automotive industry.

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LIST OF ABBREVIATIONS

ASC – Agile Supply Chain
BB – Buy-Backs
BS –Balanced Scorecard
B2B – Business to Business
B2C – Business to Customer
CDC – Central Distribution Center
CLSC – Closed-Loop Supply Chain
C72 – Code 72
DC – Distribution Center
DO – Day Order
D2D – Dealer-to-Dealer
EOL – End-of-Life
EOU – End-of-Use
FL – Forward Logistics
KPIs – Key Performance Indicators
OE – Original Equipment
OEM – Original Equipment Manufacturer
OLSC – Open-Loop Supply Chain
PP – Performance Prism
PRM – Product Recovery Management
RDC – Regional Distribution Center
RL – Reverse Logistics
RM – Returns Management
SC – Supply Chain
SCM – Supply Chain Management
SDC – Support Distribution Center
SM – Strategic Management
SO – Stock Order
SOP – Standard Operating Procedure
VBC – Volvo Bus Corporation
VTC – Volvo Truck Corporation
3PL –Third Party Logistics

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1. INTRODUCTION

This chapter serves as an introductory approach of what this thesis is about. Firstly, theoretical background regarding reverse logistics is presented. Secondly, the purpose of the thesis is motivated, together with the research questions and the delimitations of the study.

1.1 Background

The world is entering the era of "Supply Chain competition" (Christopher, 2005), where competing as individual entities is no longer profitable (Christopher, 2000; Christopher, 2005, p. 28). In fact, modern business management has thoroughly changed its way of working (Lambert, Cooper, and Pagh, 1998). To gain competitive advantage, entities need to link each other to all the players within a Supply Chain (SC) (Christopher 2000), to be able to increase the responsiveness to quick markets changes, and the robustness and the reliability of delivery processes (Christopher, 2005, p. 29).

The Closed-Loop Supply Chain (CLSC) concept has become a relevant topic within the literature (Guide Jr and Van Wassenhove, 2009). The traditional Supply Chain is considered as Open-Loop Supply Chain (OLSC), as products enter at one point of the Supply Chain and leave at another point (Fleischmann, 2000, p. 50). Contrary to the Open-Loop Supply Chain concept, CLSC does take bidirectional relationships into account, in which flows do not exit the network at any moment, since they are cycling in the network. Consequently with Fleischmann (2000), Guide Jr, Harrison and Van Wassenhove (2003) stated that in a forward supply chain (i.e. OLSC), customers are the end of the process, generally speaking. Manufacturers enter CLSC in an attempt of gaining additional value (Guide Jr et al., 2003).

Firms have to be more service-focused than product-focused to be competitive (Christopher, 2005, p. 30). According to Bundschuh and Dezvane (2003), the service market can end up being four or five times more powerful than the products market. In addition, the service market might constitute between 40% and 50% of a firm´s total revenue (Gaiardelli et al., 2007). However, almost 50% of the companies surveyed in a set of different sectors, in which automotive industry was included, get to manage their Forward Logistics (FL), but just 20% of them get to manage their Reverse Logistics (RL) (Deloitte, 2014). According to Rubio, Chamorro, and Miranda (2008) most of the companies do not know how large reverse logistics costs are, which constitutes a big problem. A statement from a client of PricewaterhouseCoopers stated that "Reverse Logistics is really perceived as a cost driver but it is strange to observe that we don't have insight in our Reverse Logistics costs. In general, I have no idea how we perform in comparison with our peers" (PricewaterhouseCoopers, 2008). Chan, Chan and Jain (2012) stated that reverse logistics costs accounted from 4% to almost 9.50% of the cost of total logistics. In a study conducted by Counterman Magazine (2009) to 126 aftermarkets workers, it was published that the average return rate was 9.7% in the automotive aftermarket.

Within the automotive industry, the Volvo Group is a worldwide leading manufacturer, providing transport solutions in several areas. The firm manufactures trucks, buses, construction equipment, and marine and industrial engines, and it is present in more than 180

markets, possessing 18 producing facilities around the globe. The Volvo Group has also two other business areas in which it focuses: Governmental sales and Volvo Financial services. *Quality*, *safety*, and *environmental care* are the three core values in which the company relies on for having a leading position and becoming the most desired company regarding transport solutions. (Volvo Group, 2016a)

In 2016, Volvo Group Trucks delivered a total of 190,424 trucks, where net sales accounted for 200,7 SEK billion (Volvo Group, 2016b). At present, the return flows from the automotive company in focus are represented by both spare parts (day and stock orders) and returnable packaging. Return flows are flows that start at the dealers and are sent back to the company distribution centers, i.e. the company´s expenses. However, there are no strict controlled processes established or any type of management of these transports. Thus, the quality and cost of these transports cannot be in any manner improved.

1.2 Purpose

Since the actual situation deals with uncontrolled systems, there was no source of data that could provide an overview of the as is situation. Thereby, the purpose of this study was:

To assess the reverse logistics systems that are currently being employed in the focal company and suggest improvements.

1.3 Research questions

In order to fulfill the requirements set by the purpose, there was first a need of describing the current state (also referred as "*as is situation")*. There was a need of identifying the impacted parties and mapping the work methods. It was important to get to know the current practices within the focal company in order to be able to analyze the current set-up. Thereby, it was crucial to find a consistent answer to the first research question, stated below:

RQ 1: What are the actual practices regarding returns within the focal company?

At this stage, negative aspects of the current situation were studied and analyzed. To improve the reverse logistics actual systems and based on the current situation, it was important to identify the key factors and the mechanisms driving the return flows. Data extracted from the focal company and from the third party logistics (3PL) service company regarding the return flows such as weights, transport costs, and lead times was studied, as well as their procedures and the interaction "focal company-dealers" in the operation procedures of the return flows. The answer of the next research question sought to provide relevant information concerning those matters.

RQ 2: What are the key factors influencing the flow of returns at the focal company?

Once the drivers of the return transports had been identified, potential improvements of the actual practices regarding returns were analyzed. The focal company expressed its concerns about having a high return flow. Therefore, it was crucial to identify these drivers and further

investigate how the focal company could improve in its practices to better handle return flows. The third research question proposed in this study was therefore the following:

> *RQ 3: How can the focal company improve the control and the performance of its return logistics set-up?*

1.4 Delimitations

Within the Volvo Group coexist a large number of different brands, present in different markets with different policies. Due to time limitations, the scope of the thesis was reduced both to the Swedish market and to the Volvo Truck Corporation (VTC) and the Volvo Bus Corporation (VBC). This thesis was performed in the Logistics Service Development for Europe, Middle East, and Africa department under the Volvo Group Trucks Operations division, in Gothenburg, Sweden. There were mainly two reasons behind the election of these two brands. The first reason was that these two brands are an important part of the Volvo Group, which means that there was a special interest in analyzing these brands. The second reason had more operational implications. VTC and VBC are two dominant brands in the Swedish market within the Volvo Group. Therefore, due to time limitations, it was of special interest to be able to perform the best possible data collection. In fact, choosing these two brands allowed the author to personally visit some dealers and interview them within the Swedish territory, and this would not have been possible, or at least not with the available resources, if different brands were chosen. Furthermore, within the Swedish market, dealers operate with both VTC and VBC products to some extent, which implies that returns flows embrace goods for both brands, independently. The thesis was thereby performed considering VTC and VBC as a whole, since the data that was gathered combined both brands.

In addition, within the returns products, there exist different product categories. This work will be particularly focusing on three of them, although both qualitative and quantitative findings are presented regarding other categories:

- *Buy-backs* (BB). Dealer Inventory that is bought back by the firm and shipped back mainly to a Central Distribution Center (CDC).
- *Core returns*. Replacement parts that are shipped mainly to a firm core hub.
- *Wrongly ordered parts* (C72). Wrongly ordered parts that are returned to a shipping DC.

These three categories were considered to be the most critical categories, since they represent most of the total product returns within the firm. Moreover, the three categories were considered to be different enough so the overall market behavior was covered.

1.5 Disposition of the thesis

This section presents the disposition that is followed throughout the thesis.

1. Introduction
This chapter aims to present an overall view of the thesis. First, an introductory background of the reverse logistics is presented, as well as an introduction of the focal firm. Secondly, the purpose of this study is presented, followed by the research questions that will help to fulfill the requirements set by the purpose. Finally, delimitations of this work are presented.

2. Research Methodology
This chapter presents the methodology and thus the workflow that this thesis has followed. First, both the research approach and process are presented. Thereafter, both data collection and data analysis are covered. Last, reliability and validity is presented.

3. Theoretical Framework
This chapter presents the relevant literature regarding reverse logistics – such as the reasons why companies enter the reverse logistics, the drivers of RL, and the procedures of returning products – and performance measurement – such as the balance scorecard, and key performance indicators – used to analyze the empirical findings.

4. Empirical Findings
This chapter presents all the findings that were collected from the empirical world. The data was collected both qualitatively and quantitatively, through interviews (both internal (within the focal company) and external (external players such as 3PL service company and dealers), and direct observations.

5. Analysis
This chapter presents the results of matching and combining together both chapters 2 (*Research Methodology*) and 3 (*Empirical Findings*).It provides the answers for the three research questions, since it address the current practices of the focal company regarding reverse logistics, the key factors of the RL, and suggests possible improvement based on the two previous research questions.

6. Conclusions
This chapter addresses the key findings of this master thesis. It addresses the found issues of the current systems employed within the focal company and provides the recommendations suggested to improve the current set-up.

7. Future Research
Finally, this chapter aims to suggest future recommendations and future topics of investigations in order to improve the current lay-out of the return transports within the focal company.

2. RESEARCH METHODOLOGY

This chapter provides the methodology that has been applied throughout the thesis. It describes the research approach and the research process that have been chosen for this study, followed by a presentation of both the collected and analyzed data. Finally, this chapter assesses the reliability and validity of the data collected.

2.1 Research approach

Previous to this thesis, reverse logistics practices within VTC/VBC were quite unknown. Depending on the aim of the study, different research approaches should be considered (Bryman and Bell, 2011). This is in accordance with Sahu (2013), who stated that there are several methods to perform a research, and that is of a great importance to properly choose the research methodology that will be used. Choosing the methodology is an essential task, since it will guide the researchers throughout the process on how to approach the problem (Blessing & Chakrabarti, 2009).

According to Bryman and Bell (2011), theory and empirical data and their correlation is a key factor when deciding which research methodology to use. When combining theory with empirical findings, there are two different approaches that can be used (ibid):

i. *Deductive approach.* It consists in making hypotheses from the theory that has been studied, and testing afterwards if these hypotheses are verified or not in the empirical world. Therefore, in the deductive approach, theory studies are studied; hypotheses are made and then confronted with the empirical findings.
ii. *Inductive approach*. It consists in studying the empirical world and to extract some founded theory from it. Previous theory study is not required. Therefore, theory is not followed by empirical data, but rather the opposite.

Additionally, another approach is frequently used:

iii. *Abductive approach*. This approach is a combination of both the deductive and the inductive approach. In this approach, both theory and empirical data are used from the beginning, and theory is matched back and forth with the empirical findings. The main difference between the abductive approach and the other two is that the former approach is bidirectional, so the matching phase between theory and empirical data is continuously done. (Kovács and Spens, 2005).

An illustration of the different processes within the abductive approach is presented below:

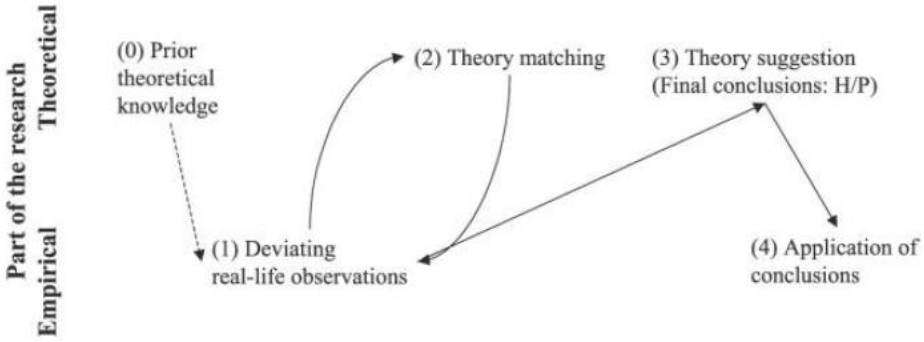

Figure 1: The abductive research process (Kovács and Spens, 2005).

According to Kothari (2004), choosing the most suitable method for data collection relies on four different factors: *Nature, scope and object of enquiry; Availability of funds* (not applicable in this thesis)*; Time factor; and Precision required.* Regarding data collection, there are two main research strategies to rely on: Qualitative and Quantitative approaches (Bryman and Bell, 2011; Yilmaz, 2013):

i. *Qualitative approach*. Data collection in the qualitative approach is based on interviews, observations and focus groups. The form of the data obtained is normally textual, graphical and/or pictorial. (Yilmaz, 2013)
ii. *Quantitative approach*. Data collection in the quantitative approach is based on measurable and quantifiable data (Kothari, 2004). According to Yilmaz (2013), this approach is based on "systematic measurements involving numbers."

According to Bryman and Bell (2011), qualitative approach corresponds to an inductive approach, which is a "generation of theory approach", and the quantitative approach corresponds to a deductive approach, which is a "testing of theory."

According to Dubois and Gadde (2002) "the main objective of any research is to confront theory with the empirical world". In this thesis, the approach that is used is the abductive approach. The reason behind it is that this thesis studies VTC/VBC particularly. Therefore, theory and empirical world are constantly reviewed. There is a need of matching the existent theory with the current empirical data, in a cycling process. In addition, both quantitative and qualitative data is studied.

Case studies are exhaust and deep analysis that are suitable for gaining an intensive understanding of the current practices through systematics interviews (Bryman and Bell, 2011). According to Kothari (2004), the case study approach consists in an in-depth investigation, aiming to provide and locate the different "factors that account for the behavior-patterns" of the corresponding firm/case. In fact, this is what this thesis is about. First, there is a need of investigating the current practices of the company regarding reverse logistics. This in-depth investigation, together with the current theory regarding reverse logistics, will aim to provide the indicators that best represent the behavior of the firm, in order to improve them. In fact, the use of the abductive approach is very common in case studies (Dubois and Gadde, 2002). Defined by da Mota, Näslund, and Jasmand (2012, p. 276), the case study research

approach "typically uses multiple methods and tools for data collection from a number of entities by a direct observer(s), in a single, natural setting that considers temporal and contextual aspects of the contemporary phenomenon under study, but without experimental controls or manipulations." Bryman and Bell (2011) stated that case study is suitable for the study of one or more case. Therefore, case study has been chosen as the approach to follow.

2.2 Research process

In order to fulfill the purpose of this thesis, which consists in the assessment of the reverse logistics systems that are currently being employed in VTC/VBC and in the suggestion of improvements, and to able to answer properly the research questions, a number of different activities were carried out. Both internal (within VTC/VBC) and external (3PL company and Dealers) interviews were made. Internal interviews, as well as internal documentation helped mainly to gain knowledge about the current practices regarding both forward and backward flows. External interviews with the 3PL service company were necessary to collect the quantitative data for this thesis. The quantitative data collected was tremendously important since it gave really useful indicators such as lead times, transport costs, amount of returns, etc. Interviews with dealers were also extremely beneficial for this thesis. They gave a big picture of the performance of VTC/VBC and it was an ideal opportunity to evaluate the customer satisfaction (dealers). Literature study was necessary to be able to evaluate the current practices of the firm, as well as the key factors that influence the reverse logistics in the actual supply chains. This knowledge gained through literature review was also crucial at the time of suggesting improvements. The following figure illustrates the research processes.

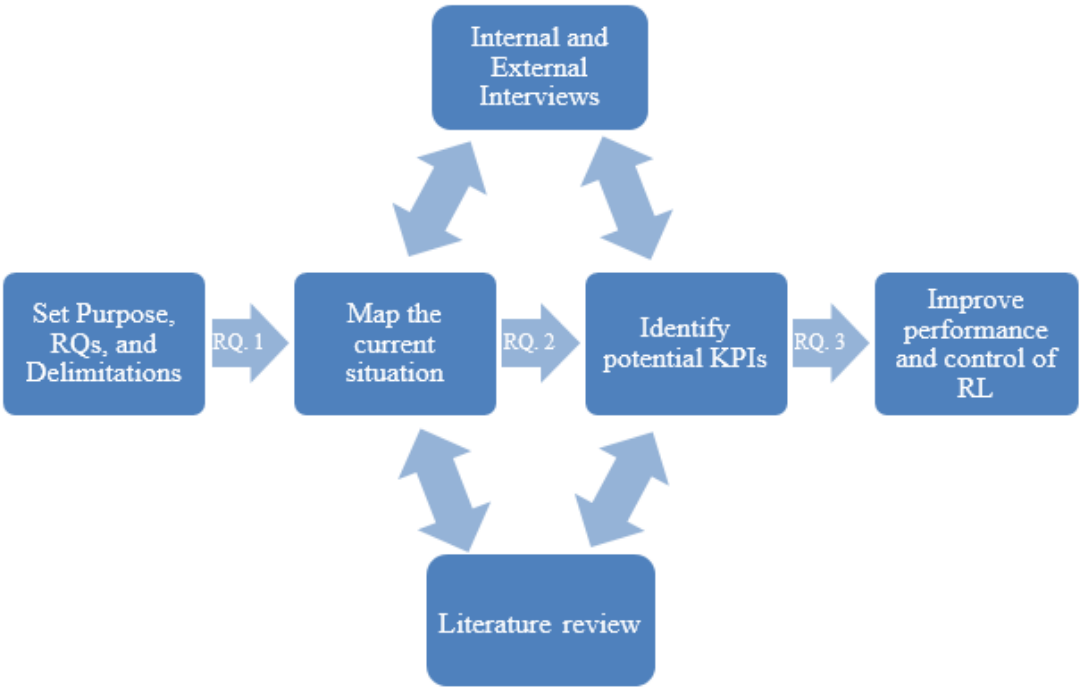

Figure 2: Master Thesis Research Process.

2.3 Data Collection

Data collection was done through two main sources of information: Primary data and Secondary data. Saunders, Lewis, and Thornhill (2007) stated that primary data corresponds to material collected in raw form, which means that primary data is collected through interviews, observations, etc; while secondary data corresponds to material collected from the literature review, such as from books and articles. In this thesis, primary data was collected through interviews both internal (within the firm) and external (with 3PL and dealers) and direct observation, and secondary data was gathered through literature review.

2.3.1 *Literature review*

The aim of the literature review in this thesis was to strengthen the knowledge regarding both forward and reverse logistics. An extensive and in-depth literature review was carried-out. The main sources of literature were the library of the Chalmers University of Technology both physical and online database (Summon; lib.chalmers.se), as well as Google Scholar.

Although the focus of this thesis was RL, it was also considered really important to gain knowledge regarding traditional supply chains (FL). The reason behind it was to be able to assess and embrace a bigger picture. Since the reverse flows and the systems currently employed within the firm were not as controlled as desired (that is why this thesis was made for), it was considered essential to understand why. It was important to keep in mind that reverse logistics exist in the first hand because forward flows exist. Put in other way, reverse flows are direct consequences of forward flows. Therefore, the keywords that were used in search engines also include keywords regarding forward flows. In addition, the more knowledge was acquired, the more keywords were examined. The collection of literature was supported by the following keywords: *Supply chain; Logistics; Reverse supply chain; Reverse logistics; Product recovery; Return to supplier; Product life-cycle; Open and Closed loop supply chain management; Industrial networks; Sustainability; Stakeholder theory; Strategic posture; Remanufacture; Recycled products; Reuse; End-of-life product management; Global market trends; Lean. Agile and Leagile Supply Chain.*

2.3.2 *Interviews*

The different position of the people that were interviewed within the focal company and the 3PL service company is presented in Appendix 1. At the beginning of the thesis, since the knowledge about the current reverse logistics practices within the firm was limited, interviews were held with the only objective of learning as much as possible. Further on, several of these interviews were repeated to ask more specific questions about the corresponding topics. All the interviews, i.e. internal and external interviews, were semi-structured interviews. This type of interviews gave the interviewees the possibility to interact with the interviewer, and to freely and openly discuss new subjects. Thus, questions were asked also based on the answers received from the interviewees. According to Bryman and Bell (2011), semi-structured interviews give the possibility to cover more subjects during the interviews and give therefore flexibility to the interviews.

Internal interviews were held both formally and informally. Formal interviews were held through face to face meetings or via Skype. Topics of the interviews were already established

before the interviews. However, informal interviews were conservations such as conversations with the tutor or with people within the department during a normal day at the office (e.g. lunch times). External interviews were held both with the 3PL service company and the dealers. Interviews with the 3PL service company were held in order to get valuable data regarding the transportation flows. Operational data from the 3PL service company was essential for this thesis. Information regarding the transportations of the returns was gathered and also current practices of these returns were discovered. External interviews with the dealers were held to discover possible weaknesses and suggestions regarding the returns procedures carried-out by the focal company. A template of the questions asked (although they were semi-structure interviews) is presented in Appendix 2.

Since the interviews were semi-structured interviews, interviewees sometimes went to themes of conversation that were of special interests for them, but were completely out of the scope of the master thesis. Therefore, being able to redirect the flow of the conversation, by asking the right questions, was seen crucial. Peter Drucker was known as "the founder of modern management" (Denning 2014). Rather than finding the right answer, the most important and complicated job is to find the right question (Drucker, 1954). Making people to realize things that they do not know implies that the right questions are being asked (Schachter, 2014). Schachter (2014) mentioned Hal Gregersen, a professor of innovation and leadership at the international business school Insead, who stated that "Questions are like keys that unlock doors in our lives and in our work. The challenge is to find the right key to unlock the right door".

2.3.3 *Internal documentation*

When examining internal documentation, the reader has to consider whether or not the documentation is credible and authentic (Yin, 2003). In addition, the validity of the documentation is crucial. It sometimes happened that different documents regarding the same issue were examined. Those documents came from different sources from different departments. Although the data was expected to be the same, it sometimes was different. This caused some problems because the root of the problem needed to be found. In these cases, the reader had to contact the different sources, and examine whether or not the information was credible. Internal documentation - mainly qualitative - was examined and studied in order to map the current situation and gain knowledge of the current practices and systems employed within VTC/VBC.

2.3.4 *Direct observations*

Data observations had their importance when visiting the dealers. Four different dealers were visited depending on their size and depending on whether or not they belong to the Volvo Group (two of them belong to the Volvo Group, while the two others don't). During these visits (two of the four visits), the author had the chance to visit their plants, visit their inventories and see how they operate. This was an incredible experience both personally and academically (for the thesis). Bryman and Bell (2011) defined that direct observations are extremely helpful to understand people´s behavior and they day to day work. In fact, this experience gave the author an overall picture of how returns transport are being handled and the importance that returns have in the dealers´ world. For instance, it was possible to see

where they located the returns, how they handled them, as well as examined the different systems the dealers use to order these returns. Finally, this experience was an incredible insight in order to discover and identify some of the key performance indicators and some of the drives within reverse logistics presented in this thesis.

2.4 Data analysis

Both qualitative and quantitative data were analyzed throughout the thesis.

2.4.1 *Qualitative data*

Qualitative data constitutes an important part of this thesis. Mainly, qualitative data was gathered during internal (both formal and informal) and external interviews, as well as during direct observations. During the interviews, the author took notes that were discussed afterwards with the supervisor within the company. Conclusions were made after each interview and further questions or further interesting topics (based on previous interviews) were assessed in next round of interviews.

Several purposes were the trigger for collecting qualitative data. First of all, at the beginning of the thesis, internal interviews were crucial to gain knowledge about how reverse logistics worked internally, and how workers from different departments saw the current situation. This process was really interesting, since workers from different departments were interested in assessing different flaws of the current situation, and these flaws were completely different between them. This gave an overall picture of how to further investigate RL within the firm. External interviews with dealers were also a niche of great knowledge. Although each dealer wanted to discuss more about what it was of interest for them, a good job was done taking them back to the track in order to discuss all the important point of the interview template presented in Appendix 2. When asked about these different points, dealers seemed to detect the same flaws within the RL flows. Dealers seemed to be experiencing the same issues in a weekly basis, which was a great discovery. The assessment of these issues was the main focus of the analysis of the qualitative data.

2.4.2 *Quantitative data*

Like the collection of qualitative data, the collection of quantitative data played a decisive role in this thesis. This data was mainly collected from the 3PL service company. Several meetings and interviews were held in order to collect the best suitable data for analyzing the returns transports. However, several difficulties were encountered throughout this process. The final operational data gathered regarding returns of VTC/VBC was not of an easy access, and it was finally not possible to get the exact data that was expected from them.

First of all, the timeframe of the data was six months. This made really difficult to study the seasonality of the events. For instance, it was quite impossible to perfectly match the forecast buy-backs (gathered internally) with the current buy-backs of the dealers throughout a whole year, since the data only covered six months.

Additionally, the data did not include pick-up dates the 3PL company. Dealing with returns transports, three dates are crucial to be considered in order to calculate lead times: Order dates

by dealers; pick-up dates by the 3PL service company; and delivery dates by the 3PL service company to VTC/VBC expenses. Therefore, lead time calculations could not be calculated as expected. Instead, it was calculated the lead time from the order date until the delivery date, which at least gave an idea of the lead times within the reverse logistics flows.

Besides, the data regarding buy-backs and wrongly shipped parts (with final destination a CDC located outside of Sweden (all buy-backs are sent to this CDC, but there are also wrongly shipped parts sent to a CDC in Sweden)) were merged. This constituted one of the biggest drawbacks of the analysis. Those two categories could not be perfectly analyzed in extreme detail it since it was not possible to distinguish between them, thus the analysis was necessarily performed considering both of them as a whole. However, the behavior of wrongly ordered parts (that are sent back in Sweden) were taken as a trend to be able to separate the two other merged categories and to be able to study the behavior of buy-backs independently, to some extent.

Regarding the category of the above mentioned buy-backs and wrongly ordered parts that have as final destination another country but Sweden, it is worth mentioning that first, these parts are delivered to a specific hub in Sweden, and then they are transported to the final destination. The scope of the thesis includes the study of the reverse logistics up to the hub in Sweden. The data gathered and therefore the analysis of the performance of the reverse logistics practices was up to that point.

Furthermore, quantitative data was also collected through internal resources. Internal presentations and *The Volvo Group annual and sustainability report 2016 (Volvo Group, 2016b)* served as great sources of quantitative documentation. Moreover, practices of the forwards flows were just analyzed through qualitative data, thus their quantitative analysis was out of the scope.

Finally, quantitative data was analyzed with a data visualization software named "QlikSense Desktop". This software was recommended during an informal interview, and was really useful to perform the analysis.

2.5 Reliability and Validity

Blessing and Chakrabarti (2009) stated that in order to secure both reliability and validity, a research study should be scientific. Reliability is referred to the repeatability of the study, if the same methodology is applied (Bryman and Bell, 2011). Since the reliability of the study is directly related to the methodology of the study, it is stated by Yin (2003) that the research methodology should be presented as clear as possible, so any other researcher could reply this study and obtained the same conclusions. Although Bryman and Bell (2011) discussed that subjective opinions and conclusions give certain richness to the study and are somehow inevitable, transparence in the methodology process is very important to tackle subjectivity. For instance, the qualitative data gathered during the interviews was interpreted by the author. Therefore, since the interviews were conducted following a semi-structure procedure, these interpretations might leave room for subjectivity. Besides, direct observations and informal interviews/conversations were good inputs for this thesis. Since it not an interview template to

follow for other researchers presented in this thesis, subjectivity comes clearly to light in these procedures. However, objectivity was in mind of the author while both these interviews and direct observations were performed. The analysis and the conclusions of this thesis were made with all the objectivity possible.

Validity is referred to the integrity of the study (Bryman and Bell, 2011). When referring to validity of a research study (and case study applies for a research study) construct validity, as well as internal and external validity have to be tested (Yin, 2003). Construct validity refers to having different sources of data (ibid). This was tested for instance when checking all the dealers within the Swedish territory. Several documents were received from different sources and their outcome did not match. Some of the documents were out of date and some of the documents referred to locations that were close to each other when referring to a same dealer. Communication played an important role here, being able to coordinate with all the sources involved to finally get a valid document. Internal validity, which refers to the validation of the results obtained during interviews (ibid), was ensured by having post sessions with the tutor within the company for summarizing the key discoveries after the interviews were conducted. This was the case when interviews with dealers were conducted, where language barriers were present, since some of the dealers were only Swedish spoken. However, this causes big issues since the language barriers implied that the tutor of the company had to translate the key information obtained from the dealers, which meant loss of information through the communication channels. Finally external validity is referred to whether or not the findings are applicable and generalizable to other configurations (ibid). Since the thesis was performed for a single-case study, external validity was put at stake, since the conclusions were suitable and personalized for VTC/VBC. Although conclusions were made for a single-case study, it is believed that they are applicable to other cases as well, since theory and empirical findings were contrasted back and forth.

Finally, it is worth mentioning the confidentiality aspects of this thesis. Throughout this work, the reader will found some undisclosed data. This is due to the confidentiality issues. However, even if some data was not revealed, it is believed that it does not affect the quality of this work, although the reader may feel that precise and in-depth figures are missing.

3. THEORETICAL FRAMEWORK

This chapter describes the pertinent literature used to perform the research study of this thesis. First, relevant theory related with forward and reverse logistics – such as definition, context and drivers – *is presented. Thereafter, literature related to the management of the SC and the Shareholder´s perspectives is presented, followed by important characteristics of RL flows. Finally, performance measurement is presented, as a way to improve the practice of the RL.*

3.1 The Supply Chain concept

3.1.1 *Introduction of Supply Chain*

The concept of Supply Chain emerged due to variations in the manufacturing environment. Practically speaking, these variations include an increase in the manufacturing cost, a shortened product life cycle, the equality in opportunities, a decreasing in resources within manufacturing, and the globalization of industry economies. The traditional supply chain, presented in Figure 3, is a manufacturing process which is integrated, consisting in the acquisition of raw materials, the transformation of these materials into specific final products and finally the delivery of these products to retailers, involving actors such as suppliers, manufacturers, transporters and retailers. (Beamon, 1998)

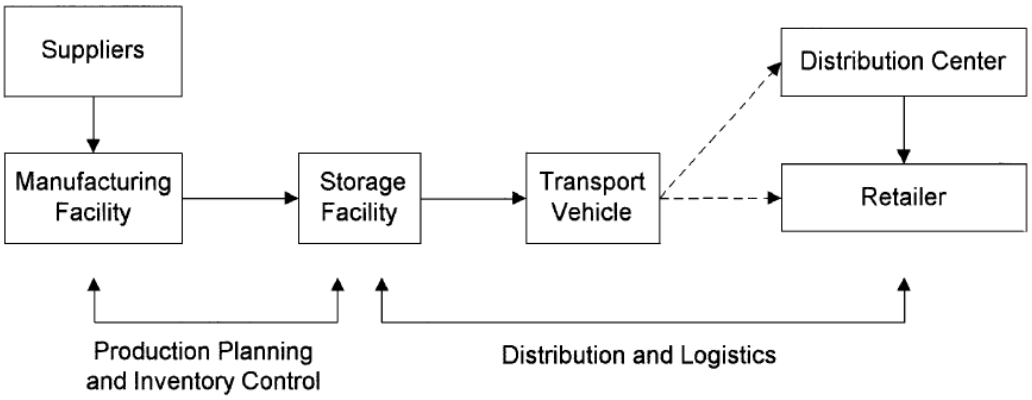

Figure 3: The supply chain process (Beamon 1998).

Mentzer et al. (2001, p.4) defined the concept of supply chain as "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer," with upstream and downstream flows meaning supply and distribution, respectively. They presented three types of different supply chain: the direct supply chain; the extended supply chain; and the ultimate supply chain. The set of entities in the first case are the supplier, the organization and the customer. The extended version includes the supplier of the supplier and the customer of the customer, so the chain is more complex. Lastly, the ultimate supply chain also includes a financial provider as intermediary between the supplier and the organization, a market research between the organization and the ultimate customer and finally and third party logistics supplier between the organization and the customer. These three different versions of supply chain are presented below:

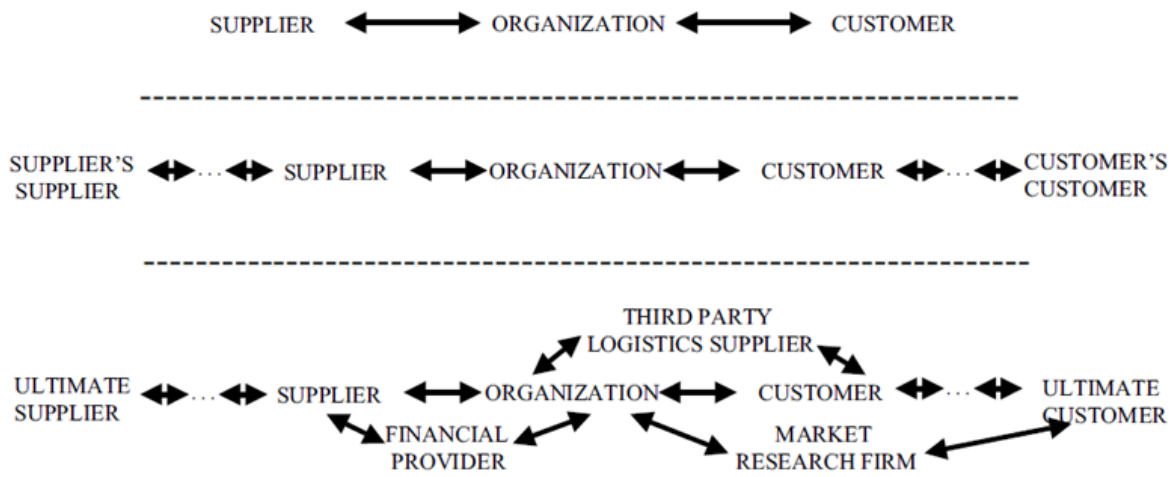

Figure 4: Direct, Extended, and Ultimate (respectively) Supply Chain (Mentzer et al., 2001)

Both "Supply Chain" and "Logistics" terms are commonly used to express the same idea. However, there is a slightly difference between them (WiseGeek[1]). The Council of Logistics Management[2] defines logistics as "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements." SC embraces a bigger picture that logistics itself (WiseGeek). While logistics only focuses in the shipment, freightage and storage of goods/products/materials, supply chain also embraces the supply, as its name indicates, and the acquisition of these goods/products/materials (ibid). Thereby, the former is considered as a subcategory of the latter.

3.1.2 *Lean, Agile, and Leagile Supply Chain*

The concept of Lean Supply Chain lies on the reduction and elimination – if possible – of waste (Christopher, Peck, and Towill, 2006). Christopher (2000) implied that lean supply chains are meant for low uncertainty demands. Put in other way, it is suitable for supply chains where the demand is quite stable and thus predictable (robust forecasts). Lean supply chains are related to the concept of Just In Time. Ideally, this concept implies having zero inventory. This approach is a forecast-driven approach (ibid).

For uncertain demands, the concept used is the Agile Supply Chain (ASC). Agility is strictly related with responsiveness and flexibility. This concept suits then to unpredictable demands. This approach is a demand-driven approach. (Christopher, 2000; Christopher et al., 2006)

[1] *What is the Difference between Supply Chain and Logistics?* Retrieved from: http://www.wisegeek.com/what-is-the-difference-between-supply-chain-and-logistics.htm

[2] Retrieved from the glossary presented at: http://cscmp.org/CSCMP/Educate/SCM_Definitions_and_Glossary_of_Terms/CSCMP/Educate

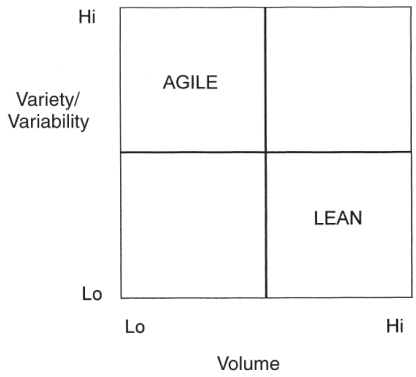

Figure 5: Agile or Lean (Source: Christopher, 2000)

Agile Supply Chains embraces four different characteristics (Christopher, 2000):

i. *Market sensitivity*. The ASC is market sensitive, which means that it is able to respond to actual demand. A great number of firms are forecast-driven instead of demand-driven. This creates the following conjuncture. Forecast-driven firms lack of crucial data (i.e. data from customers) and are forced to forecast demand based on historical data, being forced to convert their forecasts into inventory (ibid).
ii. *Virtual*. It refers to supply chains that share information between both parties (i.e. manufacturer-customer). Virtual Supply Chains are information oriented instead of inventory oriented (ibid).
iii. *Process integration*. It refers to the cooperation between "supply chain partners". Improving communication, trust, reliance and boundaries-free are is crucial (ibid).
iv. *Network based*. Competing as individual firms is no longer profitable in this era of "network competition." Network based refers to linking together all the players of a supply chain, to gain competitive advantage (ibid).

However, both approaches can be merged. This is known as Leagile Supply Chain. In fact, the most suitable supply chain is often a combination of both Lean and Agile Supply Chain (Leagile). (Christopher, 2000)

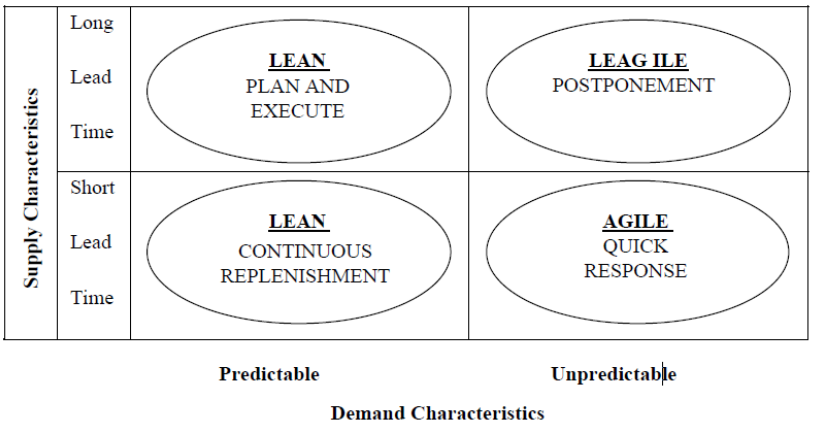

Figure 6: How demand/supply characteristics determine pipeline selection strategy (Source: Christopher et al., 2006)

Christopher (2000) strengthened the importance of the visibility of a particular real demand. He implied that the visibility of real demand is most often "limited" in supply chains, which causes tremendous problems in order to establish a suitable supply chain. Firms tend to be driven by forecast instead of by demand since they work with different inventory levels (i.e. distribution centers, warehouses, etc) (ibid). He established the "de-coupling point" where "the real demand penetrates upstream in a supply chain." Identifying the de-coupling point will designate the point where the demand is visible, thus dictating where the change in the supply chain approach has to be taken. Before the demand is visible, supply chain driven by forecast should be carried out. After the demand, supply chain driven by demand should be carried out. This is illustrated in the following figure. (Christopher, 2000)

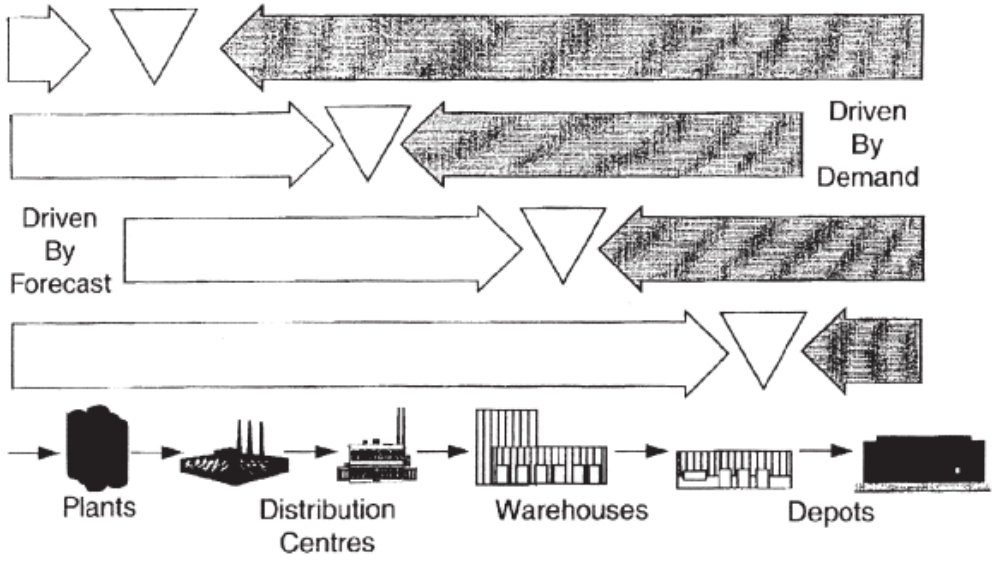

Figure 7: De-coupling points and strategic inventory (Source: Christopher, 2000)

Thereby, in agile strategies, the concept of postponement, which means that inventory should be carried in "standard semi-finished products", by means of modules, where the final assembly is carried out where the demand becomes visible, is crucial. Several benefits will be earned by this postponement approach: fewer stock variants since stock is now carried in a standardized level (thus less stock), more flexibility due to the multifunctional modules, and easier forecasting (forecasting in a generic level (i.e. standardized modules but flexible at the same time)). (Christopher, 2000)

Finally, Christopher (2000) implied that future markets will be more uncertain, and firms need to turn into agile mentality if they want to keep being competitive.

3.1.3 *Open-Loop and Closed-Loop Supply Chain*

Fleischmann (2000, p. 50) defined an open loop network as a one directional structure. Flows enter the loop from one point of the supply chain and they exit the loop at the end of it. Translated to the entities that are part of the supply chain, goods will start flowing in suppliers and they will exit the flow whenever they reach the end customers. Thereby, there is a relationship supplier-customer but there is not a customer-supplier relationship. The structure is not bidirectional. However, Closed-Loop Supply Chain concept does take bidirectional relationships into account. Fleischmann (2000, p. 50) stated that in a closed loop network,

flows do not exit the network at any moment, since they are cycling in the network. Traditional supply chains are then considered as Open-Loop Supply Chain since they deal with *only* forwards logistics services. On the other hand, SCs including not only forwards logistics services but also reverse logistics services are considered CLSC.

Consequently with Fleischmann (2000), Guide Jr et al. (2003) stated that in a forward supply chain, customers are the end of the process, generally speaking. Manufacturers enter CLSC in an attempt of gaining additional value (Guide Jr et al., 2003).

3.2 The Reverse Logistics concept

3.2.1 *Introduction to Reverse Logistics*

When talking about Reverse Logistics, the flow of goods goes backwards, instead of forwards, as the word "reverse" implies. Rogers and Tibben-Lembke (1998) adapted the definition of logistics of The Council of Logistics Management to define reverse logistics as "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal" (p.2).

Beamon (1998) stated three main purposes of extending the traditional SC to include the product recovery: Re-use, Remanufacturing and Recycling. While Rogers and Tibben-Lembke (1998) signaled the economic aspect of the RL, Thierry, Salomon, Nunen and Wassenhove (1995) highlighted both the economic and ecological aspects of what they called "Product Recovery Management" (PRM). The aim of the PRM of retrieving as much economic and ecological value has a clear consequence: waste reduction.

According to Zikmund and Stanton (1971, p.35), "reverse distribution is identical to the traditional channel of distribution. The consumer has a product to sell and, in essence, he assumes the same position as a manufacturer selling a new product. The consumer´s (seller´s) role is to distribute his waste materials to the market that demands his product." Contrary to Zikmund and Stanton (1971), Fleischmann et al. (1997, p. 6) stated that reverse flows are not a mirror of forward flows. In fact, Tibben-Lembke and Rogers (2002) identified the differences between FL and RL, as presented below:

Table 1: Differences in forward and reverse logistics (Adapted from Tibben-Lembke & Rogers, 2002)

	Forward Logistics	Reverse Logistics
Forecasting	Relatively forthright	More complicated
Transportations	One to many	Many to one
Product quality	Uniform	Not uniform
Product packaging	Uniform	Regularly damaged
Destination/routing	Clear	Not clear
Channel	Standardized	Exception driven
Disposition options	Clear	Not clear
Pricing	Relatively uniform	Not uniform
Speed	Priority	Not a priority
Costs	Monitored	Less visible
Inventory management	Consistent	Not consistent
Product lifecycle	Controllable	Complex
Negotiation between parties	Forthright	Complex
Marketing	Well-known approaches	Complex
Track and Trace	Available	Less transparent

3.2.2 *Product recovery processes*

Closed-Loop Supply Chain involves more activities than Open-Loop Supply Chain as it is more complex. Fleischmann, Krikke, Dekker and Flapper (2000) identified the following recurrent activities in the product recovery networks:

i. *Collection*. In the phase, used products are recovered, transported and further inspected. This activity is sometimes mandatory and imposed by the legislation, such the packaging material in Germany.
ii. *Inspection/Separation*. In the phase, products are inspected and then divided depending on if they will be reused or sent to disposal.
iii. *Re-processing*. In the phase, it is decided which of the different activities the reused product will continue with. These activities will be presented later on.
iv. *Disposal*. In the phase, products not suitable to be reprocessed, either because of economic or technical reasons, are disposed. Fleischmann et al. (2000) specified that this activity may include inner activities such as landfilling and incineration steps.
v. *Re-distribution*. In the phase, products are sent into new markets.

An illustration of these activities together with a traditional forward supply chain is presented below.

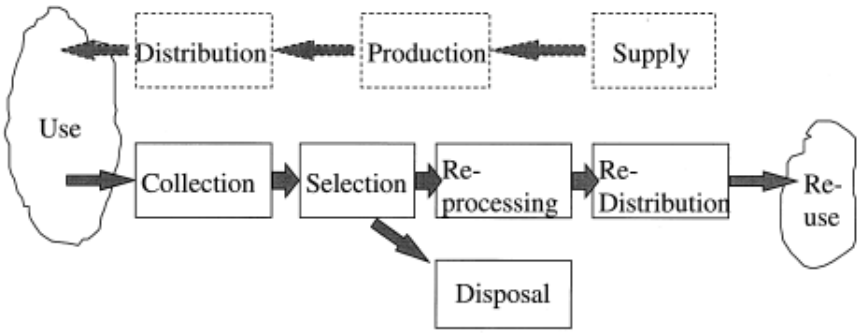

Figure 8: The recovery Chain (Fleischmann et al., 2000)

Three years later, Guide Jr et al. (2003) presented these activities as follows:

i. Procurement of the products from the end-users.
ii. Set-up of the reverse flows to transport products from their point of use to their point of delivery.
iii. Examine the product that has being retrieved and decide which action to take on each product.
iv. Refurbish to exploit the most economical of the following options: Direct reuse; Repair; Remanufacture; Recycle; Disposal.
v. Remarketing and distribute refurbished products so the highest value is recovered.

Product recovery options are broadly studied in the literature. The Original Equipment Manufacturer (OEM) covers all costs and has the responsibility to deal with product recovery (Fleischmann et al., 2000). Collection, reprocessing and redistribution are present in every single process of recovery. The main difference among these various activities is found in the reprocessing activity (Thierry et al., 1995). In fact, Thierry et al. (1995) established five different categories of product recovery: Repair; Refurbishing; Remanufacturing; Cannibalization; and Recycling. They defined the categories as follows:

Repair
It refers to making the product ready to be used again. From a quality point of view, repaired products have less quality than new products, since some of the parts of the product have been fixed or replaced because they were broken. (ibid)

Refurbishing
As repair, refurbishing deals with upgrading products that have been already used in terms of quality and/or technology. In this case, the upgrade is more important than in the repair case, so the service life of the product is increased. Still, the service life is considered to be less important than the service of a new product. The output of disassembling the old/defective products are modules that can be combined and/or improved, after inspection, with other modules so they are reassembled. Reassembled products are then considered refurbished products. (ibid)

Remanufacturing
This activity reaches the highest possible quality. The quality reached from remanufacturing a product is higher than the one obtained from a refurbished product and consequently than the one obtained from repairing a product. In fact, the quality from remanufacturing is expected to be as high as a completely new product. These products can be sold at 30-40% discount of the normal price, while keeping the same quality. (ibid)

Cannibalization
The main difference in cannibalization is the proportion of parts that are being reused. In this case, this proportion is considerably low, compared to repair, refurbishing and remanufacturing. The quality required for the reusable product depends on whether the reused parts go into repair, refurbishing or remanufacturing, the latter having the highest quality level. (ibid)

Recycling
When recycling a product, its identity and functionality is lost. This is the main difference between this activity and the other four, where maintenance of precisely the identity and functionality of the components where precisely what is sought. In this case, the disassembly is not done into different modules, but rather into material level. This means that recycling seeks to reuse material from already used products, not modules. (ibid)

The five categories in the recovery options are summarized in the following table.

Table 2: Comparison between product recovery options (Thierry et al., 1995)

	Level of Disassembly	Quality Requirements	Resulting Product
Repair	To product level	Get the product to work again	Some parts have been fixed/repaired
Refurbishing	To module level	Get the product to a specified quality level	Some modules have been fixed/repaired; with possible upgrade
Remanufacturing	To part level	Get the product to the same quality as *new* product	Combination of new and used products; with possible upgrade
Cannibalization	Selective retrieval of components	It depends on which of the process the part will be reused	Parts are either reused or recycled
Recycling	To material level	It depends on the parts	Reused materials to produced new parts

3.2.3 *Drivers of the returns*

Companies enter the reverse logistics activities mainly because they can obtain a profit from it (referred as "Economics (direct and indirect)"), because legislation has to be fulfilled (referred as "Legislation") or because they feel passionate, socially speaking (referred as "Corporate citizenship") (De Brito and Dekker, 2004). Four years earlier, Fleischmann (2000) identified four drivers instead of three: Economic; Marketing; Legislative; and Asset protection. In addition to economics, legislative and corporate citizenship, Ravi, Shankar, and Tiwari (2005) mentioned environmental issues, as well as unavoidable returns.

Economics (direct and indirect)

From an economic perspective, recover reused products and treat them so they could enter the market again (depending on the recovery options applied to the reuse product) is most of the times cheaper than creating a whole new product (Fleischmann, 2000). There are different reasons why economically speaking reverse logistics is greatly recommended. For instance, in order to avoid competition, a specific company may be involve in returns activities for the simple fact of preventing competitors to enter the market and/or getting their technology (De Brito and Dekker, 2004). Stated by De Brito and Dekker (2004), direct gains are "input materials", "cost reduction", "value added recovery", and indirect gains are "anticipating/impeding legislation", "market protection", "green image" and "improved customer/supplier relations".

Legislation

Legislation may force companies to retrieve their products and manage them to reduce the amount of waste disposal (Fleischmann, 2000). In fact initiatives regarding legislation are mainly found in the European Union and Eastern Asia (Fleischmann, 2000). This is supported by Guide Jr et al., (2003) that stated that companies in the EU have being forced to increase their interests in reverse logistics because of legislation. However, in the United States, economics aspects were the reasons of the increased interests in reverse logistics (Guide Jr et al., 2003), even if legislation exist in Europe and the United States (Kumar and Putman, 2008)

Corporate citizenship

Corporate Social Responsibility is expected by customers (Chan et al., 2012). Corporate citizenships represents this set of values that will push companies to be involved in reverse logistics (De Brito and Dekker, 2004)

These three drivers are illustrated in the below figure.

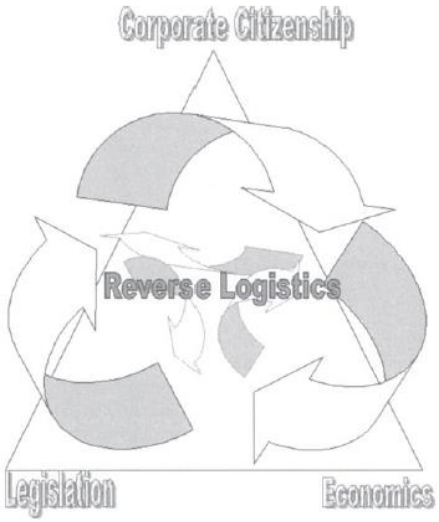

Figure 9: Driving triangle for reverse logistics (Source: De Brito and Dekker, 2004)

Marketing
Marketing refers to the image given by the company. For instance, Fleischmann (2000) claimed that having just an environmental image does not stand alone for entering reverse logistics. However, it brings together several benefits, since environmental issues are increasingly gaining attention. In addition, he supported the idea of entering RL activities, since they can be seen as great customer service, which has tons of benefits.

Asset protection
Asset protection refers to what De Brito and Dekker (2004) covered in the economic driver. Entering RL activities for asset protection will prevent your competitors of retrieving your products (Fleischmann, 2000).

Environmental issues
Environmental issues refer to the management of waste disposal (Chan et al, 2012). Kumar and Putnam (2008) defined it with the concept of "cradle to cradle". Put in other way, the reverse activities there is, the more reused products and recycled will be, the less waste disposal will be and therefore the more the environment will be protected. (Chan et al., 2012).

Unavoidable returns
Unavoidable returns are for instance products that are defective. Warranties are also an example. If a product failed to meet their technical and quality specifications, it will incur in a return (Chan et al., 2012).

RL could be used strategically in the following ways (Rogers and Tibben-Lembke, 1998):

Table 3: Strategic role of returns (Adapted from Rogers and Tibben-Lembke, 1998)

Terms	Percentage	Terms	Percentage
Competitive reasons	65.2%	**Legal disposal issues**	28.9%
Clean inventories	51.8%.	**Assets recovery**	54%

Competitive reasons refer to competitive pressure from customers, which end up in return policy changes and to good corporate citizenship. Clean inventories refer to cleaning customers' inventories, so they can purchase new goods. Thirdly, legal disposal issues refer to legislation and finally, assets recovery refer to the recovered value from recovering assets such as the packaging goods.

Already in 1995, Dawe (1995) identified six symptoms that showed that returns management needed to be revised in case of detecting them:

i. Returns arriving faster than processing or disposal.
ii. Large amount of returns inventory held in the warehouse.
iii. Unidentified or unauthorized returns.
iv. Long processing cycle times
v. Unknown total cost of the returns process
vi. Loss of customers' confidence in the repair activity.

3.2.4 *Type of returns*

While the drivers of the returns expose why companies decide to enter the reverse logistics market, the type of returns presents the types of products that be returned. There is a wide literature review concerning the type of returns. According to Krikke, Blanc, and van de Velde (2004), there are four fundamental type of returns: End-of-Life (EOL) Returns; End-of-Use (EOU) Returns; Commercial Returns; and Re-usable Items. Rogers et al. (2002, p. 3-4) define five different return reasons: Consumer Return; Marketing Returns; Asset Returns; Product Recalls; and Environmental Returns. Also, Fleischmann (2000, p. 22) determined the following five type of returns: End-of-Use Returns; Commercial Returns; Warranty returns; Production Scrap & by-products; and Packaging. In addition, De Brito and Dekker (2004) described three different return reasons: Manufacturing returns; Distribution returns; and Customer Returns. For instance, EOL and EOU returns, as well as commercial and warranty returns (Krikke et al., 2004) are included in what De Brito and Dekker (2004) defined as customer returns.

Manufacturing Returns

This type of returns refers to goods that could not even be final products. They are recovered during the production phase due to an excess in raw materials, quality control that detects that the quality is not under the tolerances, and by-products (De Brito and Dekker, 2004). According to Fleischmann (2000), these type of returns, considered economically driven returns, are defined as production scrap & by-products.

Distribution Returns

Distribution returns occur during the distribution phase. Product recalls, B2B commercial returns, overstock or packaging are examples of what distribution returns embraces (De Brito and Dekker, 2004). According to Rogers et al. (2002, p. 3-4), product recalls are usually due to safety or quality issues, and can be orchestrated by the government. The automotive sector is quite vulnerable for product recalls (Rogers et al., 2002, p. 3-4). B2B Commercial returns

within distribution returns are considered to be wrongly shipped products, damaged deliveries or products that have not been sold (De Brito and Dekker, 2004).

Customer Returns

Products in this group have already reached the customer. Reimbursement guarantees, Warranties, EOL and EOU returns shape this group (De Brito and Dekker, 2004). The former refers to customer remorse when buying a product during a limited period of time (ibid). Warranties refer to returned products because of failure of the product, technically speaking (Fleischmann, 2000). Moreover, to avoid what it is defined by Krikke et al., (2004) as "negative externalities", i.e. environmental contamination, products have to be returned. These returns are termed EOL products, and most often they are due to legislations (ibid). Plus, EOU returns are returns due to termination of the lease period (ibid). Commercial returns within customer returns are tightly related to sales processes (Krikke et al., 2004), where the contact of the two parties (seller-buyer) is direct, and the return undoes the previous sale (B2C processes) (Fleischmann, 2000). Finally, service customer, i.e. repairs, are considered in this group (De Brito and Dekker, 2004).

The following picture represents both forwards and backwards supply chain, clearly stating the different type of returns defined by Fleischmann (2000).

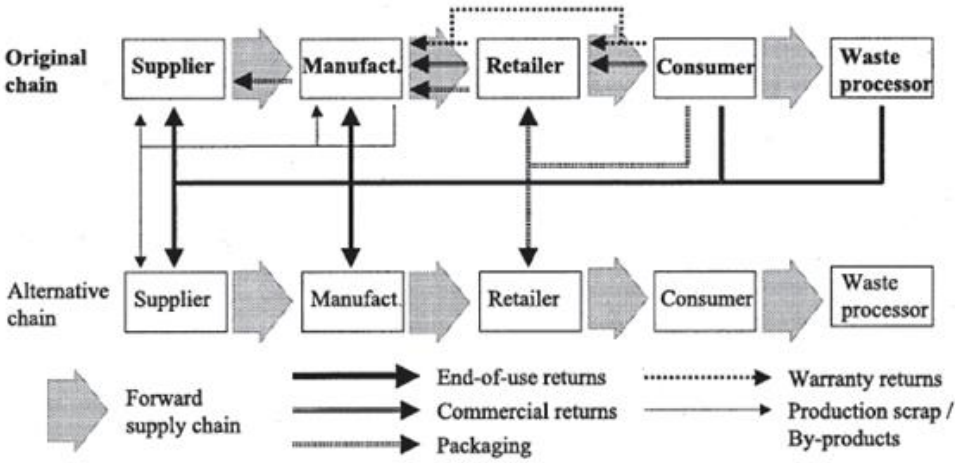

Figure 10: Reverse logistics flows in the supply chain (Fleischmann, 2000)

The following Figure shows a representation of what it has been discussed in this section.

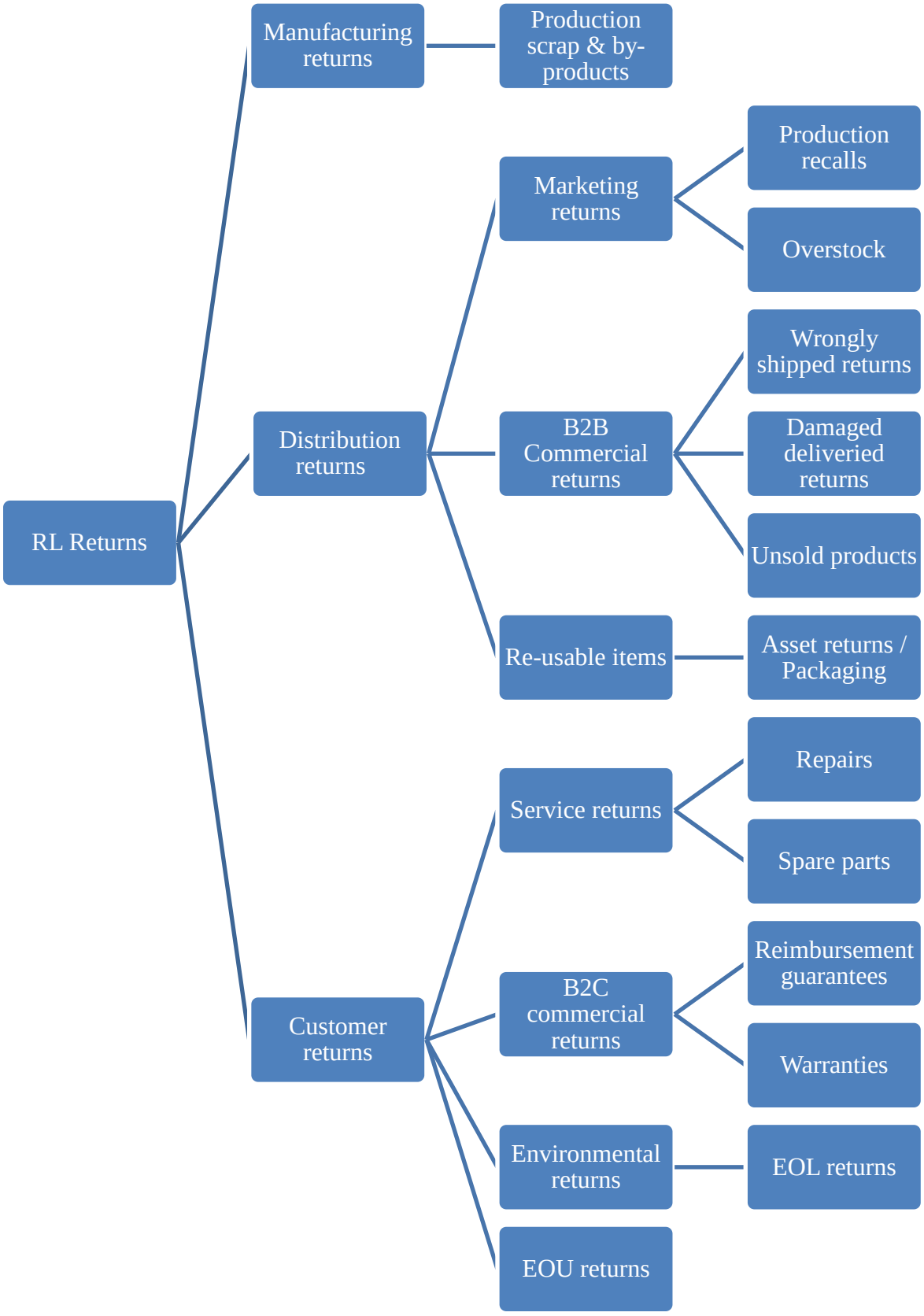

Figure 11: Type of Returns (Adapted from: De Brito and Dekker, 2004; Fleischmann, 2000; Krikke et al., 2004); Rogers et al., 2002)

The cycle time is defined as the amount of time that a specific product remains at the customer. It largely affects reverse logistics planning as well recovery options suitable for that product. A product that has a short cycle time implies that it has been on the market for a short period of time, thereby its value it is expected to be higher than a product that has a larger cycle of time. This means that it will be worth to retrieve a product with a short cycle time with the implications of retrieving it i.e. the way of disposition it. However, the product with a larger cycle time, could be that it is not worth it to spend money on retrieving it, and could be considered scrap. Therefore, cycle time is a characteristic that could greatly influence your decision about the returned product. Cycle time has therefore a great influence in forecasting and in logistics planning. (Fleischmann, 2000).

Another approach for grouping returns is the approach taken by Stock, Speh and Shear (2006). They group the returns in controllable and uncontrollable returns. Controllable returns are those that derives from problems either of the company selling the product or the buyer. These returns can utterly be eliminated, or at least minimized with proper strategic processes. Examples of controllable returns are damaged products or wrongly shipped products. Uncontrollable returns, as its name implies, refer to those returns that cannot be avoided. (Stock et al., 2006).

The Figure presented below (Figure 12) gives an overall picture of what it has already been presented so far. It presents the different returns, the cycle time and the different driver of the returns, as well as the dispositioning options. In addition it provides the possible chains where these returns could be located after treatment, as well as examples of what types of product matches the presented returns.

Description	*Cycle Time*	*Drivers*	*Dispositioning*	*Actors*	*Examples*
1. End–of–use returns					
products disposed of after completing use	long	economic, marketing	remanufacturing, recycling	original chain, alternative chain	electronic equipment remanuf., carpet recycling, tyre retreading
		regulation	recycling	original chain	White & Brown Goods Act (NL)
		asset recovery	remanufacturing recycling disposal	original chain	toner cartridges collection impairment of computer components
2. Commercial returns					
unused products returned for refunding	short, medium	marketing	reuse, remanufacturing, recycling, disposal	original chain	retailer overstocks of pc's, fashion clothes, cosmetics; catalogue retailers
3. Warranty returns					
defective or damaged products	medium	marketing, regulation	repair, disposal	original chain	defective household appliances, rotable spares
4. Production scrap & by–products					
production scrap and by–products	very short	economic, regulation	recycling, remanufacturing	original chain, alternative chain	pharmaceutical industry, steel works
5. Packaging					
packaging material and product carriers	short	economic	reuse	original chain, alternative chain	pallets, crates, bottles
		regulation	recycling	original chain	Green dot system (D)

Figure 12: Characteristics of different categories of Reverse Logistics flows (Source: Fleischmann, 2000).

3.2.5 *Policies of the returns*

According to Padmanabhan and Png (1995), returns policies vary from industry to industry. Return policies can go from wholesale refunds, consisting in refunding the whole price that the customer paid when he/she bought the product, or give credits to customers for future orders; to no refunds at all, where the customer is not refunded at all (ibid). When a full return policy is more convenient than a no returns policy and vice versa was exposed by Padmanabhan and Png, 1995 and it is presented in the following table:

Table 4: A returns policy framework (Padmanabhan and Png, 1995)

Full return policy	No returns policy
Risk-averse retailers	Uncertain primary demand
Weak retailer competition	High production and logistics costs
Retailers don't trust manufacturer	Low salvage value
Competing brands undifferentiated	Manufacturer doesn't trust retailers

In addition to full returns and no returns policies, Padmanabhan and Png (1995) claimed that everything is not one extreme or the other, and that partial returns (where the customer only receives partial refund or partial credit of the returned product) were very important. Darwish and Odah (2010) proposed to establish penalties, regarding customers´ behavior (i.e. if the stock levels are not respected).

Stock is always present when talking about return policies (Emmons and Gilbert, 1998; Kulkarni, Ponnaiyan and Tarakci, 2015; Padmanabhan and Png, 1995). Emmons and Gilbert (1998) stated that the strategy used by manufactures regarding stock, is to provide generous return policies to encourage retailers to stock without fear. According to Kulkarni, Ponnaiyan and Tarakci, (2015), retailer´s risk is split when using return policies regarding, for instance, retailer´ stock volumes. Another important characteristic of return policies is customer satisfaction, which companies should be aware of, since there is an existing tradeoff between customer satisfaction and cost (Kulkarni, Ponnaiyan and Tarakci, 2015; Padmanabhan and Png, 1995). Choosing the right returns policies also give retailers a certain feeling of peacefulness, since manufacturers ensures retailers that new products will not come to light soon enough so their inventories will be antiquated.

Several are the benefits identified regarding returns policies, but also there are several costs implied (Padmanabhan and Png, 1995).

Table 5: Benefits and Costs of returning policies

Benefits	Costs
➢ Mitigate retailers´ risk ➢ Safeguard the brand ➢ Support end-use returns policy ➢ Facilitate distribution of new product information ➢ Structure competition	➢ Production and Logistics ➢ Demand uncertainty ➢ Retailer incentives

As a conclusion, Padmanabhan and Png, 1995 stated that partial returns were the "simplest way to address the retailers´ incentive to overstock and avoid point-of-sale marketing efforts". Therefore, both manufacturer and retailer will share the risk. This conclusion is supported by the model developed by Su (2009), who found the partial returns are optimal return policies.

3.2.6 *Shareholder's perspective*

According to Ginter and Starling (1978), returns can become a core issue of the business. Constant success within a company depends in great manner of the ability of a firm manager´s to create value and satisfaction of the stakeholders (Clarksson, 1995). Stakeholders are a collective that influence or are influenced by the performance of a firm (Freeman, 1984, p.46). Alvarez et al. (2007) presented the different types of stakeholders within a firm, their claims towards the firm and the possible responses of the firm towards these claims. These responses are carried out through RL activities in order to overcome these claims (illustrated below).

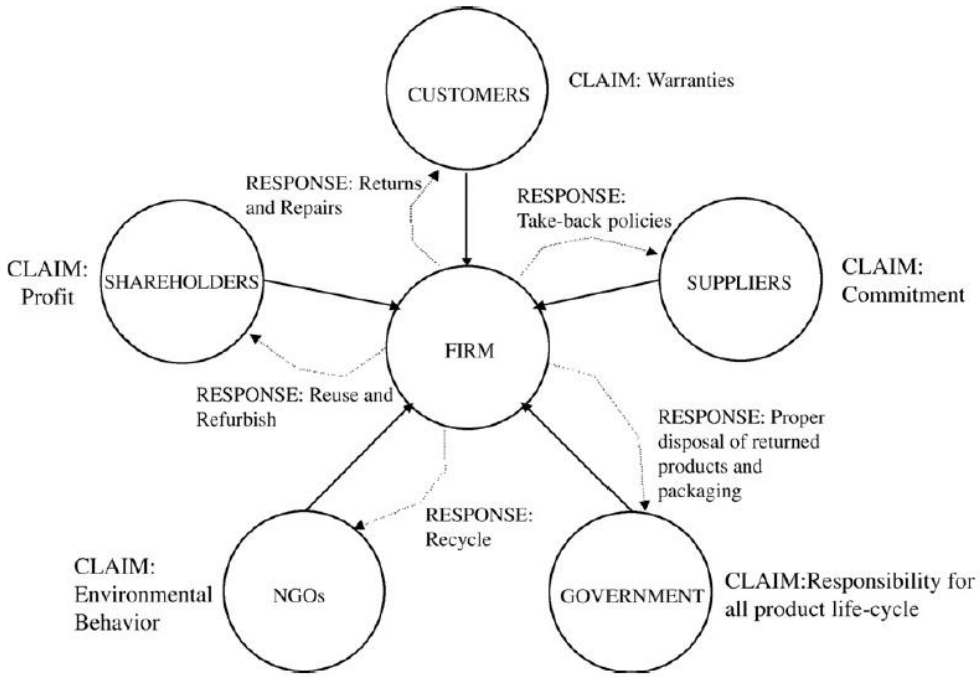

Figure 13: Stakeholder´ claims and firm´s responses (Alvarez et al., 2007)

Shareholders
Maximization of the profits (CLAIM) is what shareholders seek. There is a need of controlling the cost and increasing the profit. To satisfy these two premises, reuse and refurbish of products and material (RESPONSE) are presented as the plausible response.

Customers
To increase customer satisfaction, warranties (CLAIM) seem to be a key opportunity. Increasing the warranty period, customers' returns would increase, and so does repairs. Returns and repairs (RESPONSE) are the response for the plausible customers' claims.

Suppliers
Commitment (CLAIM) is what suppliers will ask from the Firm. According to Alvarez et al. (2007), take-back policies (RESPONSE) will satisfy this demand.

Government
Government will ask the Firm to commit and take the full responsibility of the life cycle of the product (CLAIM). RL processes have therefore to deal with appropriate and convenient procedure to dispose returns (RESPONSE).

NGOs
Ecological aspects are one of main importance aspects of RL. Non-Governmental Organizations will claim the Firm to have an ecologically-oriented behavior (CLAIM). RL activities have to have a proper recycle process (RESPONSE). This is in agreement with what Sheu, Chou and Hu (2005) defined as Green Supply Chain Management in order to decrease the environmental effects of supply chain activities. Srivastava (2007), considering that Supply Chain Management (SCM) has to incorporate eco-friendly within its activities, defined this same concept as "integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life."

3.2.7 *Reverse logistics in the automotive industry*

In the automotive sector, there are two different categories in which production parts can be branched: Original Equipment (OE) and Aftermarket parts (Daugherty, Richey, Hudgens, and Autry, 2003; Kumar, 2011). The first category refers to individual parts used during the production process that end up forming the final product. After the first selling of the product, which is made by the OEM, the product can possibly be sold again, this time in what it is called the Aftermarket, and therefore it would become an aftermarket part. According to Gaiardelli, Saccani & Songini (2007), it has been a shift in the past years, coming from a "traditional productcentric" view and going to a more "innovative customercentric view". The service market can end up being four or five times more powerful than the products market (Bundschuh and Dezvane, 2003). In addition, the service market might constitute between 40% and 50% of a firm´s total revenue (Gaiardelli et al., 2007). In the automotive industry, Makarova et al. (2015) stated that the fact for the end customers of having their trucks idle is considered as lost profit. However, almost 50% of the companies surveyed in a set of different sectors, in which automotive industry was included, get to manage their forward logistics, but

just 20% of them get to manage their reverse logistics (Deloitte, 2014). RL ensures the end-customer satisfaction and the availability of product in the aftermarket (Volvo Group[3]). In 2016, about 95 million vehicles (all types of vehicles) were produced, and among them, the number of sold vehicles (all type of vehicles) in 2016 was about 93.9 million[4]. The automotive industry is one of the largest industries around the globe and reverse logistics has gained tremendous importance not only because of economic factors, but also because of legislation and environmental issues (Chan et al., 2012). So far, models of both forwards and backwards logistics have been presented in a generic way. Put in other way, the models presented so far are valid for any industry and any sector. The following Figure represents the CLSC specifically for the automotive industry.

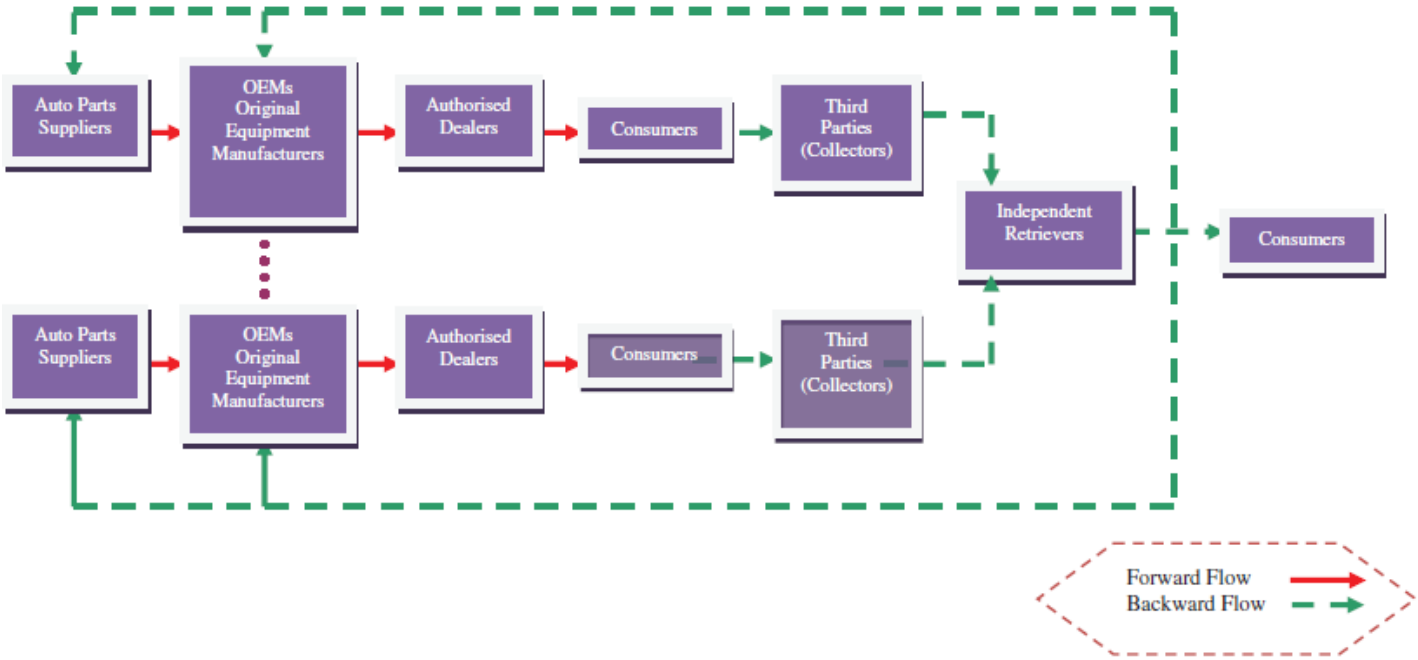

Figure 14: Supply Chain of the automobile industry (Extended view) (Source: Chan et al., 2012)

Within the automotive industry, there are tons of different components that can go through the different processes of recovery that have been discussed previously. The most recurrent recovery options within the literature are Remanufacture, Refurbishing and Recycle. Chan et al. (2012) identified a total of nineteen different components and categorized them into one or more of these three recovery options, as presented below:

[3] Retrieved from: http://www.volvogroup.com/en-en/suppliers/useful-links-and-documents/logistics-solutions.html

[4] Figures have been extracted from the International Organization of Motor Vehicle Manufacturers (http://www.oica.net/).

Table 6: Framework of form of reuse of parts and components (Adapted from Chan et al., 2012)

Components	Remanufacture	Refurbishing	Recycle
Engine; Battery; Transmission	X	X	
Hood; Wire harness; Engine oil; Gear oil; Coolant; Door; Trunk; Vehicle body; Seat; Window			X
Radiator; Bumper; Suspension; Wheel; Tire		X	X
Catalytic converter	X		X

In a study conducted by Counterman Magazine (2009) to 126 aftermarkets workers, it was published that the average return rate was 9.7% in the automotive aftermarket. The follow returns reasons, with their corresponding approximated percentages were identified:

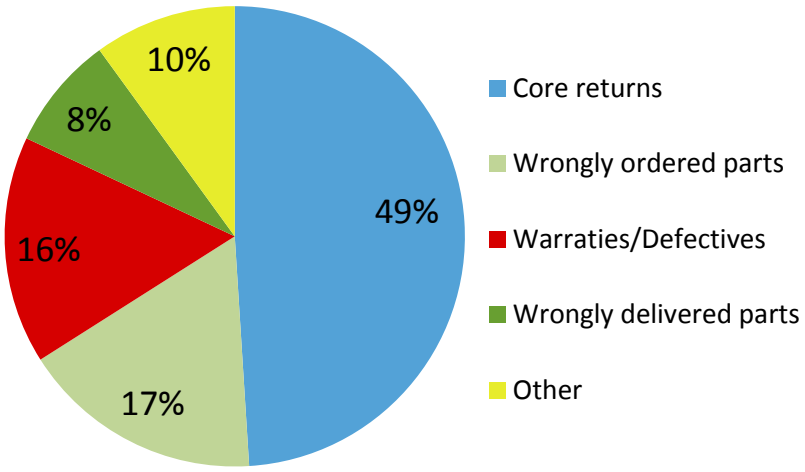

Figure 15: Returns reasons (Counterman Magazine, 2009)

According to Inmar Reverse Logistics (2009), in the automotive aftermarket, returns account for $3.5 billion to $5.7 billion. The cause of these return rates were identified to be a lack of information sharing, several systems without interrelation between them, different references for the same product, wrongly ordered products, wrongly delivered products, warranty issues, surplus ordering, and wrongly diagnosis of the problem (Inmar Reverse Logistics, 2009).

3.3 Supply Chain Management and Returns Management

Rubio et al. (2008) claimed that the notion of RL has gained importance over the years and it continues to increase. Companies that before did not pay attention in understanding and managing reverse logistics have been forced to start looking into it (ibid). In fact, some firms are becoming ISO certified in that matter and there has been an increase in the demand of third parties logistics services (ibid). They clearly state that most of the companies do not know how large reverse logistics costs are, which constitutes a big problem (ibid). This is supported by PricewaterhouseCoopers (2008), who stated that when asked to its clients, RL

was seen as a really complex and immature topic. In fact, one of the responses was: "Reverse Logistics is really perceived as a cost driver but it is strange to observe that we don't have insight in our Reverse Logistics costs. In general, I have no idea how we perform in comparison with our peers" (PricewaterhouseCoopers, 2008). As an example, Delaney (1998) claimed that the logistics cost represents a 10,7 percent of U.S. economy, that is $862 billion in 1997. Rogers and Tibben-Lembke (1998) estimate in their research, that reverse logistics account for four percent of the total logistics costs accounting therefore for $35 billion in 1997. In 2011, the estimated cost of the overall reverse logistics processes, that is, from receiving the goods to when they are resold, for consumer electronics manufacturers and retailers was $16.7 billion in the United States. Among the returns, only five percent were connected to defective product. Moreover, the cost of all activities regarding the reverse logistics flow corresponded to roughly two to three percent of the retailers 'sales and five to six percent of the consumer electronics manufacturers 'revenues. (Accenture, 2011). Chan et al. (2012) stated that reverse logistics costs accounted from 4% to 9.49% of the cost of total logistics.

The following table shows the percentage of the returns depending on the industry back in 1998.

Table 7: Sample Return Percentages (Adapted from Rogers and Tibben-Lembke, 1998)

Industry	Percentage	Industry	Percentage
Magazine Publishing	50%	**CD-ROMs**	18-25%
Book Publishers	20-30%	**Printers**	4-8%
Book Distributors	10-20%	**Mail Order Computer Manufacturers**	2-5%
Greeting Cards	20-30%	**Mass Merchandisers**	4-15%
Catalog Retailers	18-35%	**Auto Industry (Parts)**	4-6%
Electronic Distributors	10-12%	**Consumer Electronics**	4-5%
Computer Manufacturers	10-20%	**Household Chemicals**	2-3%

Reverse Logistics has evolved considerably in the past decades. Rogers, Lambert, Croxton, & Garcia-Dastugue (2002) stated that RL does not encompass the overall picture of managing both the flow of information and materials going backwards. Instead, they defined the term Returns Management (RM). Before defining this term, it is useful to previously understand where this comes from. They used the term Supply Chain Management (SCM), defined by Lambert et al. (1998), who stated that modern business management radically changed its way of working, as it was a supply chain competition, rather than entities competing as individuals. SCM was defined by Lambert et al. (1998) as the "integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders." The key businesses are illustrated in the next Figure.

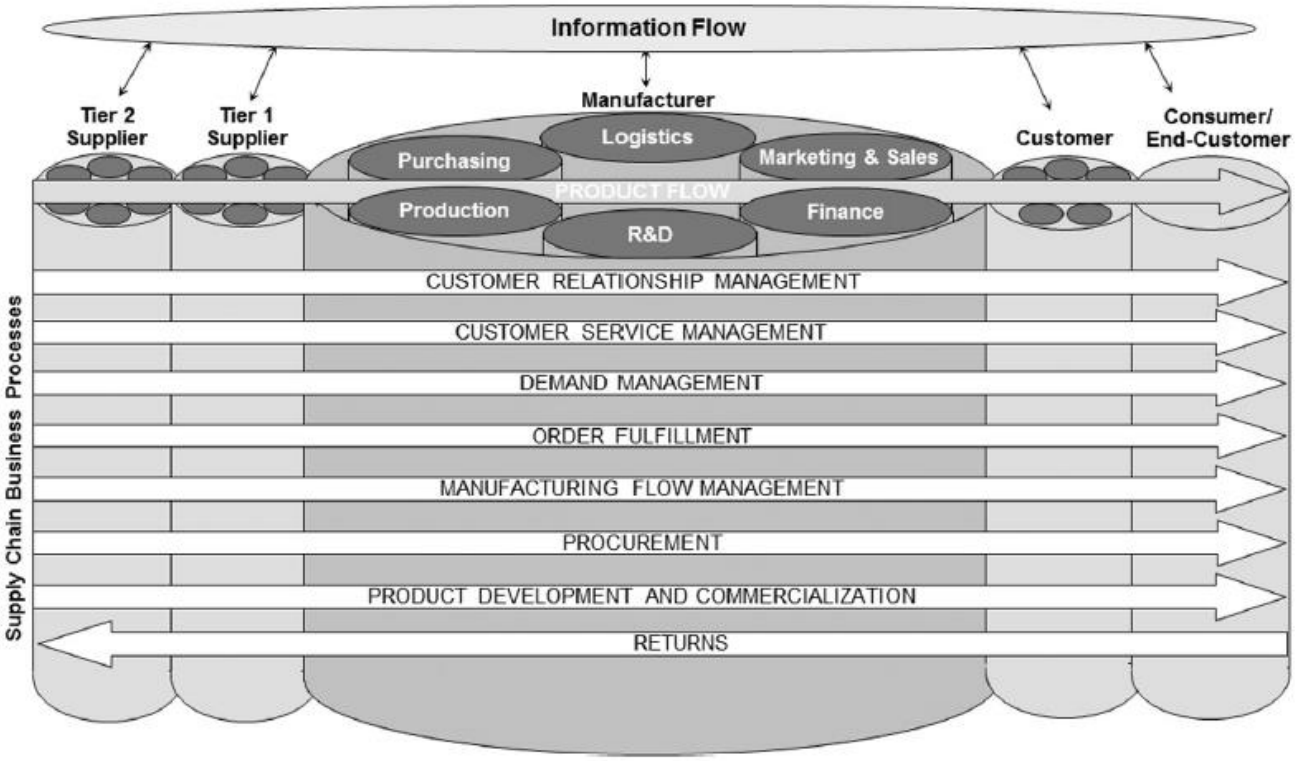

Figure 16: The supply chain management framework in 2000 (Source: Lambert et al., 1998)

Rogers et al. (2002) took this definition a couple of years later to define the RM as a "critical supply chain management process that requires planning and effective execution throughout the supply chain." The extended version of it, replacing supply chain management by its definition would therefore be that "RM is a critical integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders, that requires planning and effective execution throughout the supply chain" (Rogers et al., 2002). The need of defining such a term was the output of going through the definition of different terms, such as RL, and identifying their weaknesses. This is presented in the following table:

Table 8: Definitions assessment (Adapted from Rogers et al., 2002)

Terms	Definitions	Weaknesses
Reverse Logistics	The process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal (Rogers and Tibben-Lembke, 1998).	Lack of including all the activities of the supply chain in the backwards flows. For instance, RL activities only are contemplate when a physical good is returned.
CLSC Mngmt	Supply chains that are designed to consider the acquisition and return flows of products, reuse activities, and the distribution of the recovered products (Guide Jr, 2001).	Does not provide guidance in understanding the activities encompassing the backwards flows.
Returns	Processes associated with returning or receiving returned products for any reason (The Supply Chain Council, 2001).	Not linked to the financial management activities and lack of crucial activities, such as gatekeeping and avoidance.

Returns management is "that part of supply chain management that includes returns, reverse logistics, gatekeeping, and avoidance" (Rogers et al., 2002). Gatekeeping and returns avoidance are part of the Strategic Management (SM) activities when dealing with returns, as well as disposition guidelines. Strategic management activities are increasingly gaining importance within returns management processes (Mollenkopf, Russo, & Frankel, 2007b). In fact, a firm is missing potential value that not only would create value to the firm, but also to their customers, if it sees returns as just a regulatory issue. But Returns Management is not only SM. Rogers et al. (2002) stated that RM embraces both SC and operational activities. In fact, according to Mollenkopf et al. (2007b), combining both strategic and operational activities increased the effectiveness of the RM activities of a firm. In addition, third party service companies may end up being key players within the management teams of the company they are working with (Rogers et al., 2002).

Strategic Activities

According to Rogers et al. (2002), there are six different sub processes:

i. Determine returns management goals and strategy

Managing the returns and the return policies in a strategic way can improve profits, as well as enhance customer loyalty and the public image of the brand (Rogers et al., 2002). In relation with customer loyalty, Mollenkopf, Rabinovich, Laseter, & Boyer (2007a) stated that a well handled return service is an opportunity to service recovery, since customers will assess their experience throughout the process of purchasing, as well as returning. Reducing the risk of the customer is a key feature of customer loyalty. In fact, the chances that a customer buy a specific product if she/he knows that it will be possible to return in a pretty smooth process, are higher than the chances of purchase in case of not having the possibility to return the product at all (Rogers et al., 2002).

To set the appropriate goals and the appropriate strategy regarding returns, there is a need of first clarify the role of the returns within the firm. Put in other way, the importance that returns will have and the effort the firm will put to manage them. Secondly, it is important to set the best procedures that will end up recovering the highest value. Moreover, environmental issues, as well as legal compliances issues have to be taken into considerations. Finally, it is necessary that constraints of the supply chain are also taken into consideration. (Rogers et al., 2002)

ii. Develop avoidance, gatekeeping & disposition guidelines

Developing returns avoidance is minimizing the number of return requests. It is important that a firm clearly identifies the types of returns they will be dealing with. Once this is done, companies might develop a structure to precisely reduce returns. Then, gatekeeping comes to scene. It is defined by Rogers and Tibben-Lembke (1998) as the "screening of defective and unwarranted returned merchandise at the entry point into reverse logistics process." High performance of gatekeeping is a critical factor for manageable and profitable return processes (Rogers and Tibben-Lembke, 1998). Finally, disposition options have to be determined. Disposition options have been exposed earlier. As previously stated, dispositions options determine what to do with a specific return.

iii. Develop returns network and flow options

Backwards logistics flows are in this stage developed. This stage establishes the transportation network and the necessity of outsourcing services to 3PL providers. It is a critical stage, since Rogers and Tibben-Lembke (1998) found that companies most often failed in establishing adequate forwards and backwards flows.

iv. Develop credit rules

Valuation of the returned goods, authorization guidelines and credit policies are established in this stage (Rogers et al., 2002). Among other things, these agreements are collected in the Product and Service Agreements.

v. Determine secondary markets

This activity focuses on what to do with the returned product once it has been repaired/refurbished/cannibalized/recycle etc. The firm seeks potential markets to place these products. The big automobile companies have expressed that the market for remanufactured products can be as profitable as the market for completely new products. (Rogers et al., 2002)

vi. Develop framework of metrics

Data analysis is developed at this stage. For instance, return rates and financial KPIs are established for future analysis.

Operational activities

They consist in the realization of the stages presented in the strategic level. Therefore, according to Rogers et al. (2002), there are six different sub processes. Since these processes are closely related to what it has already presented, they will only be mentioned: Receive return request; Determine routing; Receive returns; Select Disposition; Credit Customer/Supplier; Analyze returns and Measure performance.

3.3.1 *Customer loyalty*

Harrison and van Hoek (2008) stated that customer loyalty was the consequence of good service performance. Andreassen (2000) stated that a good service recovery enhances customer´s loyalty. Customer satisfaction and customer loyalty are two different things (Harrison and van Hoek, 2008). For instance, a good service performance will improve customer satisfaction. It is that customer satisfaction that acts as a "qualifier" for customer loyalty in the long-term (Harrison and van Hoek, 2008). While customer satisfaction wonders about the attitude of the customer and answers the question of how a customer is feeling about the product, customer loyalty wonders about the behaviour of the customer, answering the question if the customer will buy more (Piercy, 2002). There is a huge potential in having loyal customers (Harrison and van Hoek, 2008). Johnston and Clark (2005) enumerated the benefits of loyal customers:

- Ensure revenues stream in the long term.
- There is normally more selling to loyal customers than to new customers.
- Normally, the amount spent by loyal customers tend to increase in the long run.
- Premium services may be required, thus paid from loyal customers.
- Provide cost savings.

Parasuraman and Grewal (2000) linked three different drivers (service quality; product quality and price) that are the basis for perceived value and therefore for customer loyalty (see Figure below). They note that both product quality and price are imitated with easiness for competitors, and that the service quality is critical.

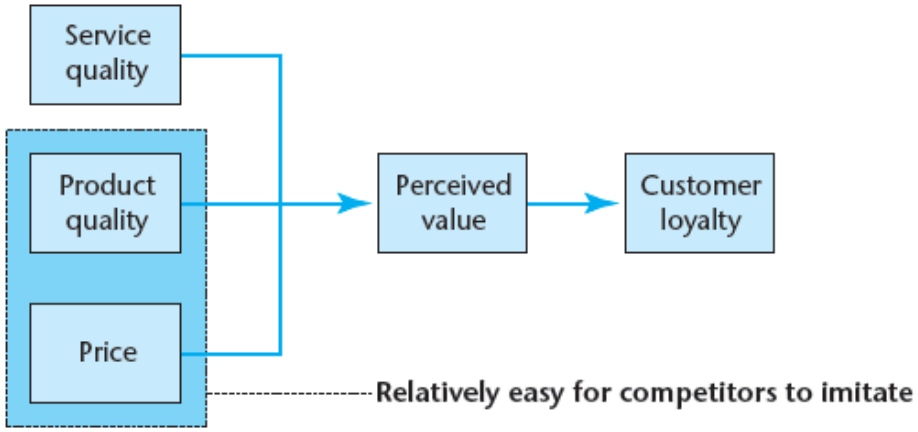

Figure 17: Key drivers of customer loyalty (Source: Harrison and van Hoek, 2008; Parasuraman and Grewal, 2000)

It has been stated that one driver for customer loyalty is the quality of service. These services can either be Business to Business (B2B) or Business to Customer (B2C) (Harrison and van Hoek, 2008). Enhance customer relationships will establish a zone of tolerance between service companies and suppliers (Parasuraman, Berry, and Zeithaml, 1991). The zone of tolerance is defined from where perceptions fall in adequate level of expectations to where perceptions fall in the desired level of expectations. This is illustrated in the Figure below:

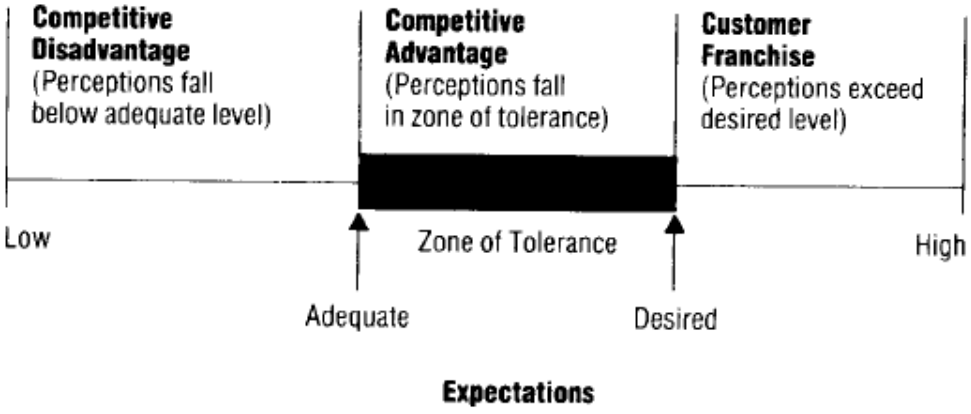

Figure 18: The results of customer perceptions of service performance (Parasuraman et al., 1991)

According to Zeithaml, Berry and Parasuraman (1988) the performance of services differs day to day. Gaps can therefore exist since expectations and perceptions are not always the same. In addition to expectations and perceptions, what the service is supposed to be also counts (Zeithaml et al, 1988; Harrison and van Hoek, 2008). Four different gaps are presented by Harrison and van Hoek (2008) (see Figure below):

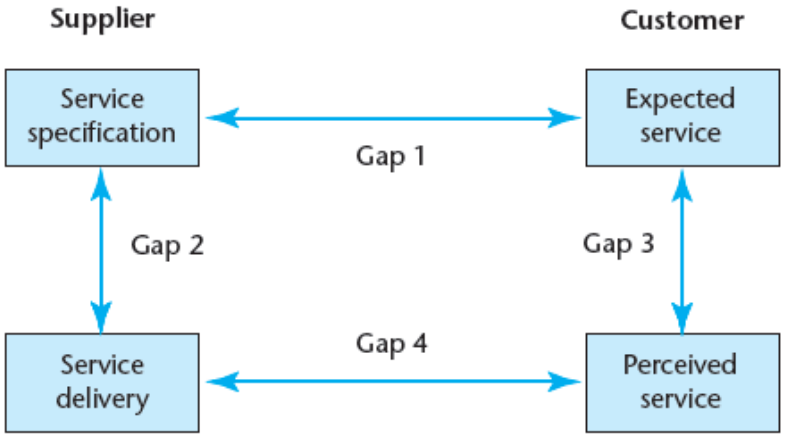

Figure 19: Simplified service quality gap model (Source: Harrison and van Hoek, 2008)

i. *Gap 1*. Alterations between the customer expectations and the actual performance of the supplier.
ii. *Gap 2*. Alterations between how the service was supposed to be and how it was actually delivered.
iii. *Gap 3*. Alterations between customer expectations and customer perceptions of the delivery service.
iv. *Gap 4*. Alterations between perceptions of both supplier and customer of the delivery service.

3.3.2 *Knowledge transfer*

Within an organization, one of the most important strategic resources is considered to be knowledge (Conner and Prahalad, 1996; Martin-Perez and Martin-Cruz, 2015, p. 1167; Nahapiet and Ghoshal, 1998). According to West (2012, p.194), to reach a high rate of effectiveness, there has to be flow of information. In fact, when operating in competitive markets, knowledge transfer is seen as one of the most important resource, and should not be underestimated (Martin-Perez and Martin-Cruz, 2015, p. 1177). Transferring the knowledge within a team allows developing their competences and their skills, and it is seen as a core issue to address (Renzl 2008, p. 207). In fact, knowledge is most often coming from interactions between workers (ibid.). Martin-Perez and Martin-Cruz (2015, p. 1177) claimed that commitment between two different parties (i.e. between to workers; supplier-manufacturer; manufacturer-dealer, dealer-end customer) is one of the reason that people is willing to share their knowledge.

Feedback is considered to be a leading mean with the ability of boosting performance (Parsloe, 1995). In fact, Lally (2013, p.29) stated that being able to provide constructive feedback is also considered to be crucial.

3.4 Performance measurements

Performance measurement and performance assessment are considered to be essential in activity controlling and management planning (Asmild, Paradi, Reese, and Tam, 2007). It is defined by Neely, Adams & Kennerley (2002) as "the process of quantifying the efficiency and effectiveness of past actions". Kaplan & Norton (1992) claimed that "what you measure is what you get."

3.4.1 *The Performance Prism*

The "Performance Prism" (PP) provides a framework to measure performance (Kennerley and Neely, 2002). It focuses in five different areas and how they are interrelated (Kennerley and Neely, 2002; Neely, Adams and Kennerley, 2002):

- *Stakeholder satisfaction*. It aims to identify who the key stakeholders (i.e. Investors, customers, suppliers, and employees) are and what their needs are.
- *Strategies*. It refers to the strategies needed to be put in place to satisfy the stakeholders´ requests.
- *Processes*. It refers to the processes needed to be put in place to satisfy the strategies identified.
- *Capabilities*. It refers to the capabilities, such as technology, people; needed to be put in place to satisfy the processes identified.
- *Stakeholder contribution*. It refers to the needs required from the stakeholders, in order to satisfy the whole prism process.

In its purest form, the Performance Prism is presented in the following figure:

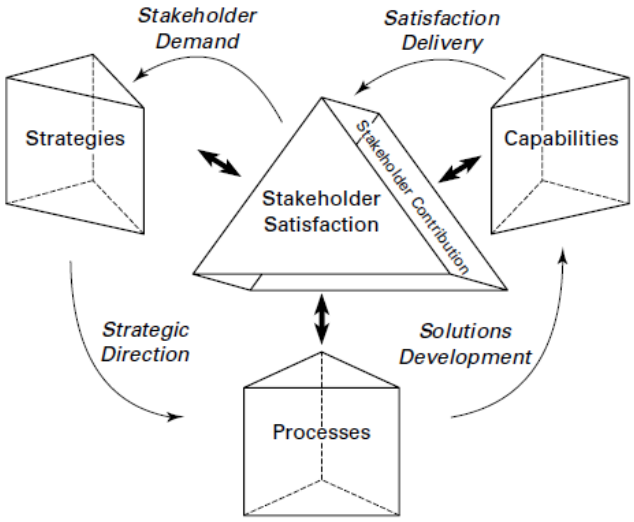

Figure 20: Delivering stakeholder value (Kennerley and Neely, 2002).

First stakeholders' needs are identified ("Stakeholder Demand"). Then, strategies to fulfill the needs of the stakeholders are set-up. Based on these strategies, the processes to put them in place are established ("Strategic direction"). Thereafter, based on these processes, capabilities are identified ("Solutions Development"). Once the capabilities are being set, satisfaction is delivered to stakeholders ("Satisfaction Delivery").

3.4.2 *Balanced scorecard*

According to Krauth et al., (2005), there is a great part of the literature that focus on factor that are numerical focus, such as lead times, utilization rates or costs. However, there is fewer literature review regarding factors that are less tangible than numerical factors. Example of these intangibles factors (numerical factors) are mentioned by Krauth et al., (2005):

- Environmental factors.
- Customer perceptions.
- Employee happiness.

The Balanced Scorecard (BS) rises as an exception and does cover these less palpable indicators (Krauth et al., 2005). Its aim is to provide a framework to achieve a balance between both financials and non-financial results taking into account both short term and long term horizons (Brewer and Speh, 2000; Kaplan and Norton, 1992).

The concept of Supply Chain Management that has already been discussed in 3.3 is strictly related with the balanced scorecard. In fact, competitive advantage is gained through interrelating SCM and the balanced scorecard. (Brewer and Speh, 2000)

The following table exhibits the linkage between SCM and the balanced scorecard (Brewer and Speh, 2000):

Table 9: Linking the supply chain management framework to the balanced scorecard (Source: Brewer and Speh, 2000)

Supply Chain Management	Balanced Scorecard
SCM Goals: • Waste reduction • Time Compression • Flexible response • Unit cost reduction	Business Process Perspective
Customer Benefits: • Improved product/service quality • Improve timeliness • Improved flexibility • Improved value	Customer Perspective
Financial Benefits: • Higher profit margins • Improved cash flows • Revenue growth • Higher return on assets	Financial Perspective
SCM Improvement: • Product/process innovation • Partnership management • Information flows • Threats/substitutes	Innovation and Learning Perspective

Kaplan and Norton (1992) put the following example to define the balance scorecard. The balanced scorecard represents:

> The dials in an airplane cockpit. For the complex task of navigating and flying an airplane, pilots need detailed information about many aspects of the flight. They need information on fuel, air speed, altitude, bearing, destination, and other indicators that summarize the current and predicted environment. Reliance on one instrument can be fatal (p. 72).

Thereby, performance indicators have to be accessible so they give the required information to managers at glance (Kaplan and Norton, 1992).

According to both Kaplan and Norton (1992) and Brewer and Speh (2000), BS focuses on four different interrelated perspectives, in which goals and measures are studied: Financial - How do Shareholders see us? - Customer - How are we seen by Customers? - Internal Business - What must we be master of? – And Innovation and Learning - Are we in a position of still creating value? All four perspectives are presented in the following figure.

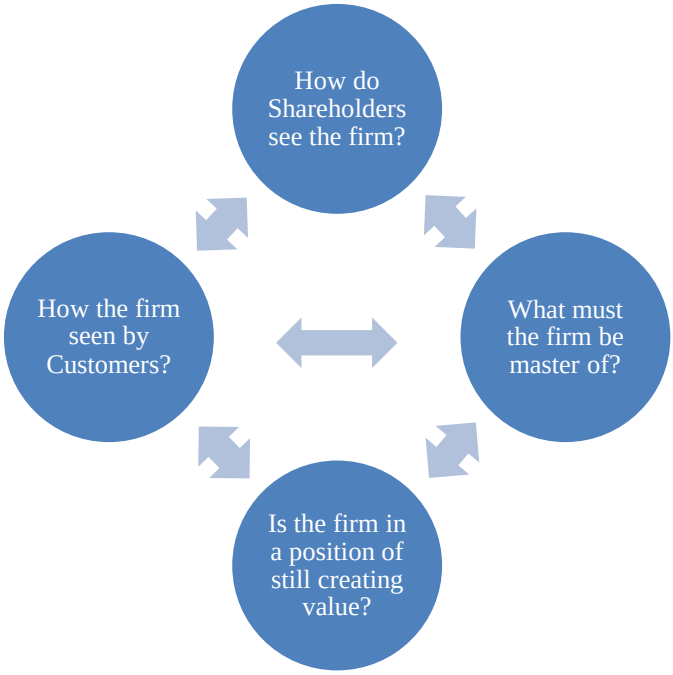

Figure 21: The Balanced Scorecard (Adapted from: Brewer and Speh, 2000; Kaplan and Norton, 1992).

The following table presents their corresponding findings regarding goals and measures of each of the perspectives.

Table 10: Goals and Metrics of the four perspectives in the Balanced Scorecard (Adapted from: Brewer and Speh, 2000; Kaplan and Norton, 1992).

Perspective	Brewer and Speh, 2000		Kaplan and Norton, 1992	
	Goals	Metrics	Goals	Metrics
Internal Business	i. Waste reduction ii. Time compression iii. Flexible response iv. Unit cost reduction	i. Supply chain cost of ownership ii. Supply chain cycle efficiency iii. Number of choices/average response time iv. % of supply chain target costs achieved	i. Technology capability ii. Manufacturing excellence iii. Design productivity iv. New product introduction	i. Manufacturing geometry vs. competition ii. Cycle time / Unit cost / Yield iii. Engineering efficiency iv. Actual introduction schedule vs plan
Customer	i. Customer view of product/service ii. Customer view of timelines iii. Customer view of flexibility iv. Customer value	i. Number of customer contact points ii. Relative customer order response time iii. Customer perception of flexible response iv. Customer value ratio	i. New products ii. Responsive supply iii. Preferred supplier iv. Customer partnership	i. Percent of sales from new products / Percent of sales from proprietary products ii. On-time delivery (defined by customer) iii. Share of key accounts´ purchases / Ranking by key accounts iv. Number of cooperative engineering efforts
Financial	i. Profit margin ii. Cash flow iii. Revenue growth iv. Return on assets	i. Profit margin by supply chain partner ii. Cash-to-cash cycle iii. Customer growth & profitability iv. Return on supply chain assets	i. Survive ii. Succeed iii. Prosper	i. Cash flow ii. Quarterly sales growth and operating income by division iii. Increased market share and ROE
Innovation and Learning	i. Product/process innovation ii. Partnership management iii. Information flows iv. Threats and substitutes	i. Product finalization point ii. Product category commitment ratio iii. Number of shared data sets/total data sets iv. Performance trajectories of competing technologies	i. Technology leadership ii. Manufacturing learning iii. Product focus iv. Time to market	i. Time to develop next generation ii. Process time to maturity iii. Percent of products that equal 80% sales iv. New product introduction vs. competition

3.4.3 *Key Performance Indicators*

Measuring the performance of a process is crucial. To build a measurement system, indicators have to be identified. However, not all the indicators are critical. In fact, the most crucial part of building a measurement system is identifying the indicators that fairly represent the process. These indicators all referred as Key Performance Indicators (KPIs). Therefore, all the indicators are not KPIs, but all the KPIs are indicators. (Franceshini, Galetto, and Maisano, 2007)

KPIs serve to ensure added value to the company (Hall, Huscroft, Hazen, & Hanna, 2013). Indicators have three main functions (Franceschini, et al., 2007):

- *Control*. Indicators must provide to workers and managers the pertinent information to be able to evaluate the performance of what the indicators are referring to.
- *Communication*. Indicators have to be accessible for workers and managers, but also for stakeholders, that should be able to evaluate the performance for external purposes.
- *Improvement*. Expectations and reality are two different things. Indicators must provide relevant information in order to identify gaps precisely between expectations and reality, so improvements can be carried out.

When talking about indicators, effectiveness and efficiency are two different things. The former refers to do the right thing (i.e. cost reduction, use of economic resources), while the latest refers to do things right (i.e. customer service, meet customer requirements) (Chow, Heaver, and Henriksson, 1994; Franceschini, et al., 2007; Gleason and Barnum, 1986; Lai, Ngai, and Cheng, 2004; Mentzer et al., 2001). In addition, Franceschini, et al., 2007 includes not only effectiveness and efficiency, but also customer care, which refers to how much the customers appreciate the provided performance.

According to Hall et al., (2013) firms tend to use the same KPIs for both forward and reverse flows. However, reverse logistics is not the straight mirror image of forward logistics (Daugherty et al., 2003; Guide Jr and Van Wassenhove, 2009). For instance, customer satisfaction may be evaluated in different ways in forward logistics, where lead time is more important, and in reverse logistics, where easiness of return is more important (Hall et al., 2013). Thereby, considering the same KPIs for both systems would end up with wrong strategic decision. In addition, time spectrum is also relevant when choosing KPIs (Krauth, Moonen, Popova, and Schut, 2005). They classed the indicators in long-term and short term indicators. Short-term indicators can be calculated in a monthly basis and its choice depends on "organizational strategy and measurements costs", while long-term are calculated over long periods of time (Krauth et al., 2005).

It has been stated already that not all indicators are KPIs. Moreover, the election of the KPIs is really important. Establishing only one KPI is not sufficient Caplice and Sheffi (1995), but having to many is not advised Charron (2006).

Charron (2006) presented eight different reasons why Key Performance Indicators are important:

i. KPIs set the customer´s expectations regarding performance.
ii. KPIs can provide an incentive for the provider (i.e. tying KPIs to contracts requirements).
iii. KPIs offer a realistic way on how performance should be assessed.
iv. KPIs are greatly related with more robust performance.
v. KPIs provide meaningful data to customer in terms of comparing the performance of the provider and other providers.
vi. KPIs can identify gaps and "on-going services failures".
vii. KPIs can be greatly related with an increased in service performance in the long run with the customer and increase communication.
viii. KPIs can decrease the level of disputes within the firm (i.e. setting performance requirements would decreased disputes regarding and questioned the reached level of performance).

Moreover, Charron (2006) stated that "the important thing to remember is that KPIs can be designed to include both parties´ obligations while setting achievable standards." Charron (2006) provided a list of ten tips for choosing KPIs:

i. Do not forget "TMR". TMR stands for Trigger – Measurable method – Report. What it means is that for KPIs involving time measurement, there is also a trigger that makes the measurement to start. Immediately after, the measurable period starts, until the event comes to its end, and then the report of the indicator can be done.
ii. Do not have too many KPIs. This is supported by Franceschini, et al. (2007), since having too many indicators could have negative impacts, such as losing the overall picture of the impacts of the indicators, or misinterpreting the relations created between the most important indicators
iii. KPIs discussion meetings are highly recommended. Communication and honesty regarding results are crucial.
iv. Benchmark the chosen KPIs and analyze the level of performance.
v. KPIs should be tied up to both parties (i.e. contractual requirement, incentives or penalties for customers).
vi. Flexibility is welcome.
vii. Be clear in the definition of the KPIs, the method of the calculation and the performance required.
viii. Chosen KPIs have to reflect positively and benefit the customers in a tangible way.
ix. KPIs set the minimum performance levels. Thereby, the word target/goal/aim is not to be used when setting KPIs.
x. KPIs reports have to be accurate.

The next table shows four example of possible KPIs (Charron, 2006)

Table 11: Samples of KPIs in a contract (Charron, 2006)

KPI	Description	Minimums
On-Time Delivery	14 days from the point of origin to the port of entry (measured from the time of delivery at port of exit to off-loading)	92%
Order-Picking Accuracy	Measured as the number of orders picked accurately divided by the number of orders received (using the order receipts and packing units)	98%
On-Time Shipping	Within 1 business day: Measured from the time of receipt of order to delivery to motor carrier using the order receipts ad carrier receipts	95%
Loss or Damage	Measured as the number of shipments without loss or damage divided by the number of shipments (using the bill of ladings issued)	99%

According to the research of Birkland (2002), the most important performance indicator for transportation in On-time pickup (see Table 12). This result is supported by the research of Menon, McGinnis, and Ackerman (1998). Moreover, communication and information sharing between both parties of the contract is signaled by Krauth et al., (2005) as having great importance. The following table presents, ranked in order of importance, the most important performance indicators according to Birkland (2002) in the transportation area.

Table 12: Most important performance indicators for transportation (Birkland, 2002)

Most important performance indicators for transportation
On-time pickup and deliver
Total transportation costs
Quality/damage claims
Safety
Asset utilization (fleet, cube, etc)
Perfect documentation
Communication (sharing information, tracking, customer feedback, etc.)
Turnover of transportation personnel
Customer satisfaction

It is stated by Krauth et al., (2005) that there is not a unique balance scorecard that suits for the situations. Managers have then to shape their own balanced scorecard (ibid).

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4. EMPIRICAL FINDINGS

This chapter provides the collected data throughout the thesis on how the focal company is currently working with reverse logistics. It describes the current practices both qualitatively (through personal interviews) and quantitatively (through operational transport transactions). It also provides the perception of the dealers regarding the performance of VTC/VBC on how returns transports are being handled with the current set-up. Drawbacks and flaws of the current set-up are summarized into five different categories, which are further discussed, together with the literature studied, in the Analysis chapter.

4.1 Introduction of the Volvo Group

Volvo brand was founded in 1927, by Assar Gabrielsson and Gustaf Larson, with the objective of creating high quality and safe vehicles. In 1999, Volvo's "crown jewel", Volvo Cars, was sold to the Ford Motor Company for SEK 50 billion[5].Nowadays, the AB Volvo Group (hereinafter referred to as "Volvo", "Company" or "Firm") is a global and multinational company, considered a leading transport solution manufacturer. They manufacture trucks, buses, construction equipment, and marine and industrial engines. The Volvo Group has also two other business areas in which it focuses: Governmental sales and Volvo Financial services. It is present in more than 190 markets, the number of countries in which it has production facilities in 18, and it employs currently approximately 100,000 people. Core values of this company are: *quality, safety*, and *environmental care*. Under the umbrella of these core values, the focal company strives for having a leading position and become the most desired company regarding transport solutions. (Volvo Group, 2016a)

In 2016, Volvo Group Trucks´ deliveries were up to 190,424 trucks (which 102,857 trucks were from the Volvo Brand), where net sales accounted for 200,7 SEK billion (Volvo Group, 2016b).

[5] Retrieved from: http://www.volvogroup.com/en-en/about-us/history-and-r-d-milestones/from-hisingen-to-the-world.html

The following Figure presents the AB Volvo Group brands:

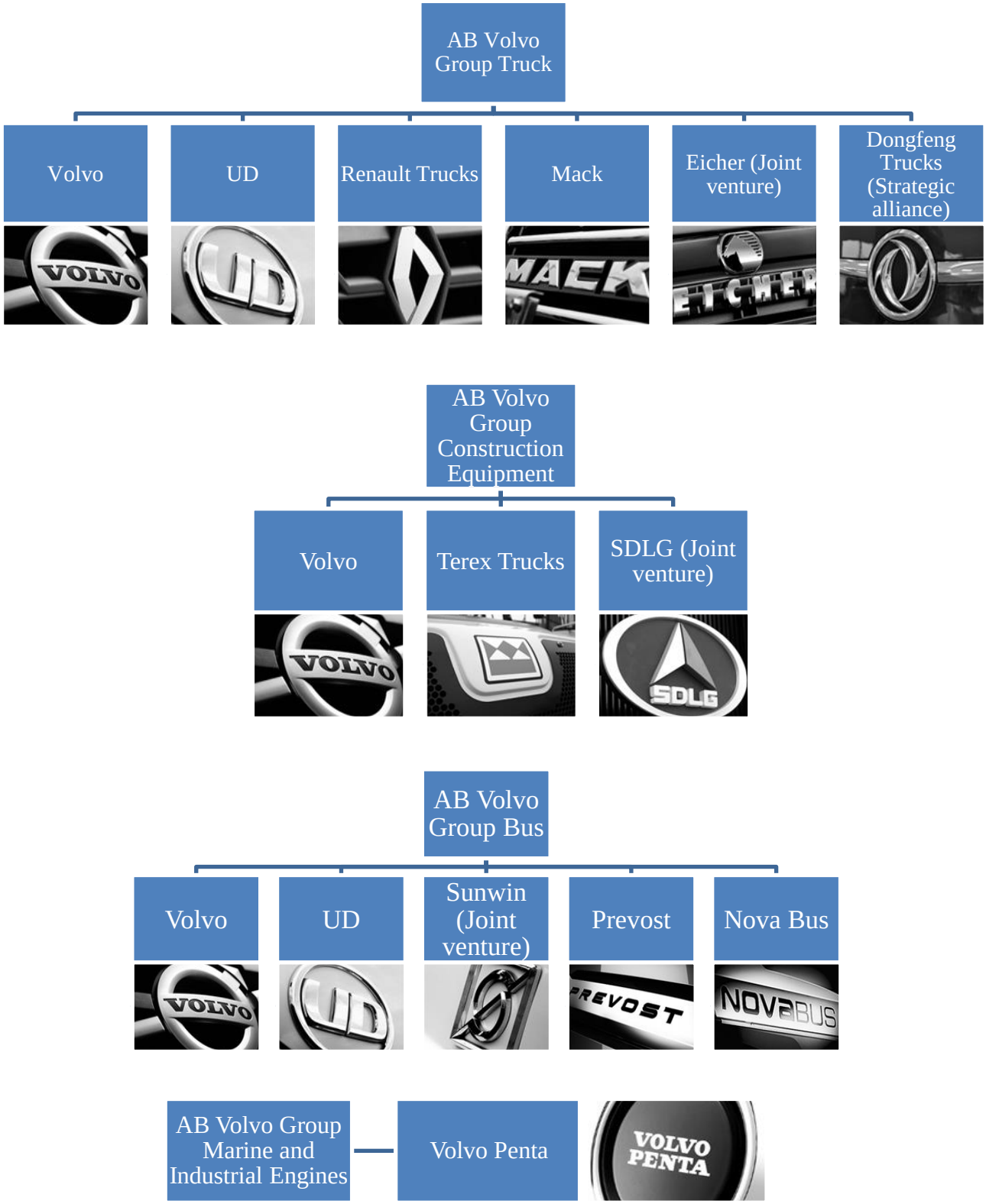

Figure 22: Volvo Group Truck, Construction Equipment, Bus, and Marine and Industrial Engines Brands (Source: Volvo Group, 2016a)

4.2 The VTC/VBC forward flows

The following picture describes both the forward and the reverse flows (in blue are shown the reverse flows).

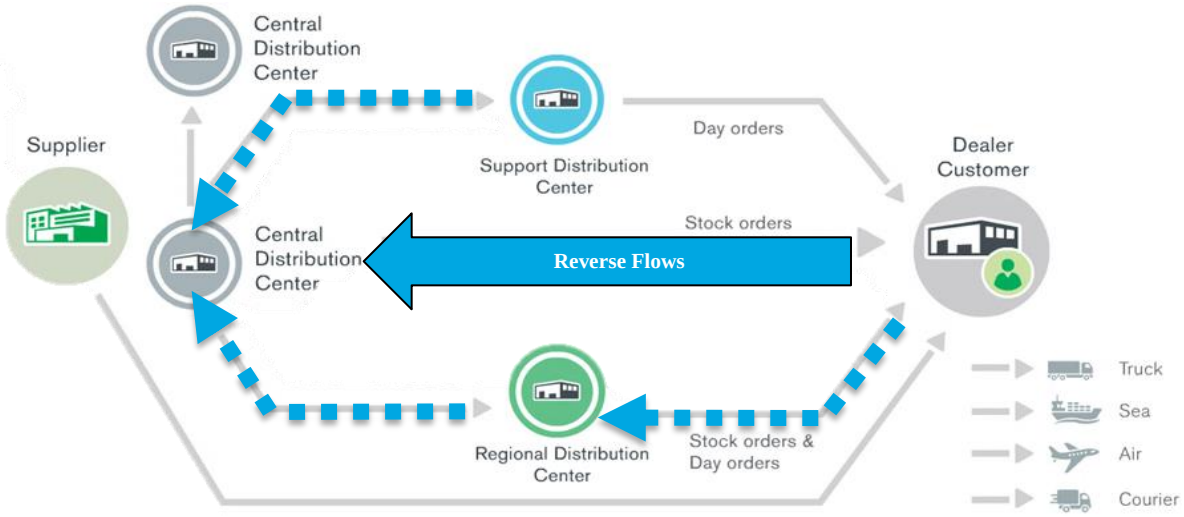

Figure 23: Materials management and distribution structure in the aftermarket supply chain.

4.2.1 *Types of Distribution Centers*

There are three different types of distribution centers. The Central Distribution Center is the biggest one among all three. All the forward flows pass through the Central Distribution Center. To be closer to the dealers and thus to the end-customers, Support Distribution Centers (SDCs) and Regional Distribution Centers (RDCs) are placed strategically (based on lead times requirements) among the Swedish territory to satisfy the required demand of the dealers. Two main differences exist between SDCs and RDCs, (see Figure above). First, SDCs *only* provide Day Orders (DOs), while RDCs provide both Day Orders and Stock Orders (SOs). Secondly, RDCs deal with returns orders, while SDC don´t.

4.2.2 *Stock and Day orders*

On one hand, Stock Orders refer to products automatically refilled that are steered by Volvo. They are replenishment orders of dealers´ stocks. Thereby, SOs are products that are used by the dealers in a regular basis, and therefore need to be in stock to satisfy the demand, so replenishment is constantly required.

On the other hand, Day Orders are orders made by dealers that are not to be stocked. For instance, if an end-customer (i.e. driver of a truck) goes to a dealer due to a certain problem with the truck, and the dealer does not have the necessary component(s) to fix the problem, the dealer will order the required component(s) through a DO. Mainly, DOs are established for the satisfaction of the end-customer to be maximized, so the end customer can have his/her truck fixed, as quickly as possible. Generally speaking, lead times for day orders in forwards flows are from one to two working days.

How Volvo manages the stock is out of the scope of this thesis in the forward flows. However, in order to understand how reverse logistics works, it is important to have a picture

of what the forward logistics looks like. In fact, reverse flows exist because of forward flows, that carry products that in the end are not used/sold by the dealers. Thereby, forward flows were studied in a more generic way.

In fact, during the interviews performed to four different dealers, DOs were a recurring theme of conversation, as problems/issues with DOs are more frequent than with SOs, since in SOs flows the processes involved are much more standardized, thus fewer errors occur.

4.2.3 *Transport operations*

All the transportations operations are outsourced. Therefore, 3PL services enter the scene. This implies that Volvo and dealers are not *directly* connected, since dealers have the responsibility, for day orders, to order the transport of whatever product they want to order or return. Instead of Volvo, 3PL services do the transportation of products. This indirect connection between dealers and Volvo implies that it exists different systems in which dealers have to operate to return a product. This will be assessed in the return policies paragraph (4.3.4. Policies of the returns).

Currently, the 3PL service company gives Volvo an invoice stating the total transportation costs for the reverse logistics. However, Volvo is not able to check what is behind it, and cannot control specifically what it is paying for.

4.3 The VTC/VBC reverse flows

At present, Volvo has a notably high return flows. This return flows are represented by both spare parts (DOs and SOs) and returnable packaging (out of the scope of this thesis). Return flows are flows that start at the dealers and are sent back to the company DCs (i.e. the company´s expenses). However, there are no strict controlled processes established or any type of management of these transports. Thus, the quality and cost of these transports cannot be in any manner improved. Since the actual situation deals with uncontrolled systems, there is no source of data that could provide an overview of the as is situation.

4.3.1 *Product recovery processes*

Depending on the categories of the products, the return goes to a specific destination. What to do with the specific returns once they have reached their corresponding Distribution Center is out of the scope of this thesis. However, in the literature review, recovery options have been presented in order to give an overall picture of the whole process. The phase that has been accomplished when the products reached the DCs of Volvo is the collection phase. Products of different categories go specifically to their corresponding DC. To give an example, products that are supposed to be remanufactured (e.g. usually engines) go directly to the DC where they deal with this type of products. Thus, products are already sorted in that sense.

4.3.2 *Types of returns*

Within the focal company, the products can be returned for several reasons:

- *Buy-backs*. They refer to dealer inventory that is bought back by Volvo and shipped back mainly to a Central Distribution Center. All the buy-backs are sent back to a Central Distribution Center located out of Sweden. They are considered returns of Stock Orders.
- *Core returns*. They refer to replacement parts that are shipped mainly to a firm core hub. They are parts that enter the remanufacturing process.
- *Wrongly shipped parts*. Wrongly shipped parts that are returned to a shipping Distribution Center (DC).
- *Wrongly ordered parts (Code 72)*. Wrongly ordered parts that are returned to a shipping DC. They are considered returns of Day Orders.
- *Warranties*. Parts subjected to warranty claims.
- *Packaging*. (Out of scope)

4.3.3 *Drivers of the returns*

The current categories of return possibilities for dealers are driven for different reason. Volvo Group is well known for its customers´ satisfaction, and the actual set-up of categories are meant to make the dealer experience as satisfactory as possible. In fact, in the current situation, there are no penalties of any kind regarding returns. Volvo embraces all the costs related of every single return (from administration costs, to handling and transportation costs). The reasons behind the actual set-up of these categories are:

Buy-backs

To increase customer satisfaction, Volvo encourages its dealers to overstock. This guarantees the dealers that their inventory will be bought back by Volvo and they will not have any unsold component (in SOs). Offering this option, Volvo increases customer satisfaction, since more components will be at the dealers´ expenses when an end-customer arrives, thus the probability of being able to fix the corresponding problem is higher than having a low level of stock. Additionally, buy-backs ensure customer trust.

Core returns

Economic driven returns. Benefits for remanufactured products are the main reason for these returns.

Wrongly shipped parts

This category refers to either Volvo errors or 3PL services errors. In either case, the dealer is not responsible for receiving a product that it has not ordered. It cannot be measured whether the bad practice was from Volvo or from the 3PL company. Therefore, in the current set-up, Volvo takes care of all the costs. The driver of this return is undoubtedly customer satisfaction.

Wrongly ordered parts (Code 72)

When diagnosing a problem with i.e. a truck, dealers proceed to order a day order. Sometimes, the exact component that is causing the problem cannot be exactly identified. It is very common that dealers order more components than really needed to fix the problem. In fact, Volvo encourages this practice. When a certain component is ordered from a dealer, Volvo personally suggests a related and recommended components list that could help the dealer to fix the problem. Therefore, dealers will end up ordering in day orders, more components than they really need, encouraged by Volvo. The main aim of this practice is once again increased the customer satisfaction. To put an example, let´s imagine that you own a truck and it needs to be repaired. If the dealer does not have the component you are in need of, it will order a day order to Volvo. When this order arrives (lead times will be discussed later), it might end up being that the component your truck needed was not the ordered component or that just this component will not fix the problem, thus it was wrongly diagnosed. In this case, you, the owner of the truck, will have to wait until a new order arrives to the dealer. If instead of proceeding like this, in the first order, the dealer ordered more components than really diagnosed (recommended components by Volvo), your problem would be fixed after the first day order arrives, thus your satisfaction will be greater. Drivers for these returns are then to share dealers´ risk, which will influence the dealer loyalty and the dealer trust, and also increase customer satisfaction.

Warranties

Products that are subjected by warranty claims are also returned. Drivers for these categories are legislations, as well as customer satisfaction.

4.3.4 *Policies of the returns*

Volvo relies on returns policies to share the dealer's risk. Return policies are established mainly to increase the customer satisfaction as much as possible. In the case of the buy-backs (SOs), Volvo guarantees the dealer that unsold stock orders are bought back by Volvo. Thus, Volvo pays the dealers for the stock orders that have not been sold, encouraging the dealer to overstock. If a certain component has been too long in stock or if its value is too low, then this product will be considered a dead stock (i.e. scrap) and it will be sent to Volvo expenses as scrap. These products will not enter any other returns processes.

Concerning discrepancies (wrongly delivered and wrongly ordered parts), the return policy is different. To get refund with the 100% of the price, dealers have to return products within X days (the exact number will remain undisclosed). After the expiration of these days, the dealer will receive 50% of the price. However, if the day order is worth less than X SEK (the exact number will remain undisclosed), the product cannot be returned and will be considered as scrap (the return will be effectuated with the buy-backs returns).

Warranties and core returns follow legislation and environmental policies that were not covered in this thesis.

4.3.5 *Procedures of the returns*

Note: The names of the systems and platforms used will remain anonymous throughout the thesis.

When it comes to order a return, the procedures are different depending on the type of categories. However, all the procedures have something in common: ordering the transportations. No matter how different the processes are depending on the category of the product, that transports are booked the same way. The following Figure illustrates this, as well as gives the names for the systems that are going to be used throughout the thesis.

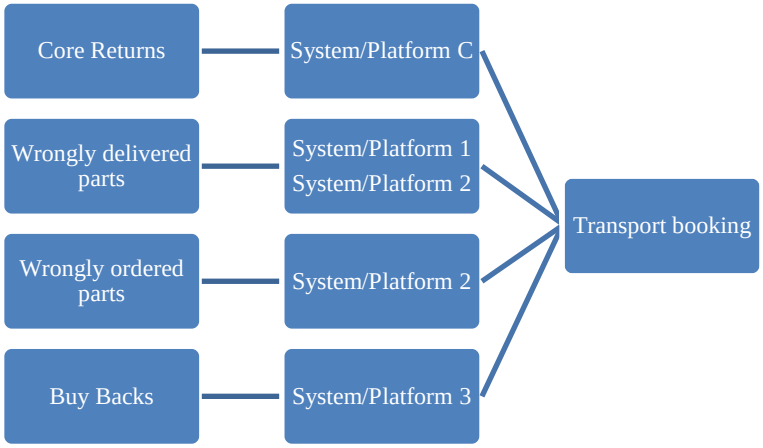

Figure 24: Return procedures depending on categories.

Core returns

For cores returns, the dealers manage their returns through a single platform. From the interviews carried out, all the dealers agreed on the effectiveness of the system.

Wrongly delivered parts

For wrongly delivered parts, things seemed to be different. There was not just one system to be used, but more. The procedures were seen as time consuming and not intuitive. The overall process is divided is two parts (without taking into account the transport booking phase. First, dealers have to enter System 1 where they claim that the product has been wrongly delivered. For doing that, dealers have to actively prove that the order has been wrongly delivered (i.e. taking a picture). Next, they have to wait until their claim is accepted (it was stated for all the dealers interviewed that this normally takes a couple of days). Next, once the claim is accepted, they have to enter platform 2 to ask for what it is called a “return permission”. After approximately two days, the return permission is accepted or not. In case of being accepted, the next step would be to order the transport. Thereby, a normal process takes minimum 4 days to be completed. In case of not being accepted, the return will not occur. This is illustrated in the following Figure.

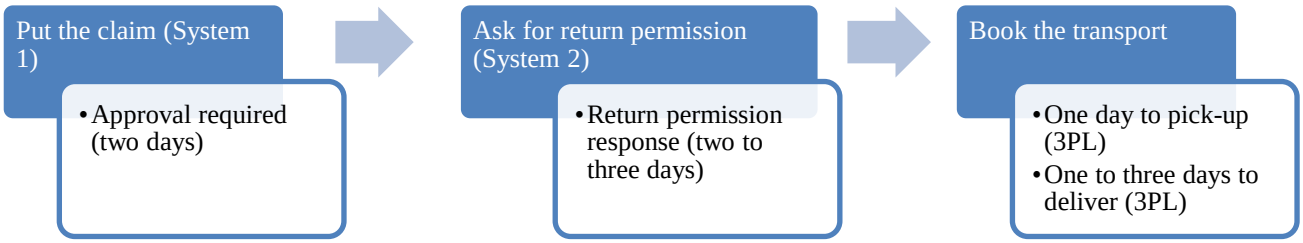

Figure 25: Wrongly delivered procedures.

Wrongly ordered parts

For wrongly ordered parts, the procedures to follow are the same than for wrongly delivered components excepting the use of system 1. Therefore, dealers ask for permission to return the code 72 products, and the system last two to three days until the permission is given.

During those processes, a common behaviour was noticed during the interviews conducted. Both when dealers claim that a product has been wrongly delivered (platform 1) and when they ask for return permission (platform 2), they have to wait a couple of days to receive the pertinent notification. However, dealers have to enter the corresponding systems and check if the notification has been sent. The systems do not alert the dealer of having received anything. This affects customer satisfaction, as they have to be checking whether or not if they have received the notification.

Furthermore, there are no existing and easy connections between the systems used. Since the systems are different, dealers have to enter the component information (required to return it) every time they want to start an application for returning a product. This means that dealers have to enter the product information three times (counting with the booking transport in the 3PL services booking system. In fact, for wrongly shipped parts, they have to access another time the system to order to product that is missing or that it has been wrongly delivered. This accounts then for four times for a dealer, in case of wrongly delivered products (in which either Volvo or the 3PL company is responsible for the error), to enter the different systems.

Buy-Backs

For buy-backs returns, the processes are more complex, since they depend on stock orders. Decision on returning buy backs depends on dealers´ stocks levels. This category differs from the others since in this case, the initiator of the process is Volvo, who sends a list proposing the amount of buy-backs, based on previous forecasts. Then, there is a flow of information that goes back and forth between Volvo and the dealers discussing the amount of buy-backs that are going to be sent back. These mechanisms were not studied in this thesis.

Moreover, a return permission could be denied (in System 2). The main cause of denying return permissions is because of price issues (i.e. the price is too low to be considered for return). This is the only time when dealers have an explanation of why the return permission has been denied, although they still do not receive the notification (they have to personally enter the system and check). Otherwise, dealers will not know why the return permission has been denied. When this happens, they have to call the helpdesk and further ask for explanations. This is also related with customer satisfaction.

4.3.6 *Standard Operating Procedure*

Regarding returns transportations, in the Standard Operating Procedure (SOP) it is specified the destination for the different types of returns (see 4.3.24.3.2). Every product category that has to be returned has a specific DC where it is supposed to be delivered, where further actions regarding this returns are taken, such as remanufacturing, repairing, etc.

Furthermore, the booking procedure system is specified in the SOP. This system corresponds to the above referred as "Transportation booking". Recall that this process is common to all the return processes. However, no further indications are stated in the SOP regarding booking the transportation, which can lead to confusion for dealers. The transportation booking was also object of study. It was identified that when booking the transportation, the dealer has the opportunity to freely introduce comments, which most of the times were not helpful. In fact, when analyzing quantitative data, this field was not helpful in any manner, since there was no standard to identify what was the meaning of the comment.

The study of lead times was an important factor to analyze. The following lead times are specified in the SOP.

- Products are to be picked up (during working days) one day after the booking has been done, with some exception on some specific areas.
- Lead times vary from one to three working days, for all the different categories. That means that from pick-up from dealer to delivery to the corresponding distribution center, the lead time is considered to be less or equal than three days.

The following Figure shows a flowchart of the lead times mentioned above:

Figure 26: Flowchart of returns´ lead time

However, it was identified at some dealers that pick-ups were performed once per week. This was of special interest and could be explained by several factors:

- The volume of the returns is very low
- Dealers do not know that pick-ups are supposed to be done one day after (as stated in the SOP)
- Dealers have learned from previous experiences that it is not worth spend time in a daily basis booking the transport, if the pick-up is done once per week (contrary to what is it stated in the SOP). Thus, they prefer to keep the products to be returned during the week and order the transport just once per week.

Additionally, during one of the interviews conducted with the dealers, a special case was discussed regarding core returns. An engine that weighted more than X Kgs (it was

considered a heavy part) had to be returned. Due to equipment limitations, the engine could not be returned like a normal return, with the 3PL firm. It was stated by the dealer that the documentation was limited regarding the procedures to follow, which made it really difficult and tedious to deal with the engine. It was also stated that this case was a really rare case.

4.3.7 *Pay-back of the returns*

Pay-back of the returns seemed to be a recurring theme of conversation when the interviews were performed. First of all, dealers do not know when the returns have been delivered to Volvo´s expenses, or if they have been delivered at all since there is no a track and trace system that is currently in place. Therefore, dealers do not receive any kind of notification whether returns have been successfully delivered or not. In addition to that, dealers do not receive any notification regarding the payment. They have constantly to check is the payment of theses returns have been done or not. It has come to the attention of the author that the lead times regarding the returns were unstable and sometimes quite large. There is therefore a need of stabilizing the payment lead times, as well as to reduce them.

4.3.8 *Dealer-to-Dealer support*

To explain what Dealer-to-Dealer (D2D) support refers to, the best thing is to put an example. In the normal forward flows, since a component is order as a DO, it takes at least one day to be delivered. There are some cases when a dealer is in need of a specific component and a close dealer has this specific component. Instead of ordering this product as a DO and being forced to wait at least one day until the dealer receives this component from Volvo (which in turn will delay in one day the fixing time of the end-customer´s vehicle), the dealer decides to use its own company car to go and buy by him/herself the component to the close dealer and come back and fix the vehicle. In this case, the journey will be a couple of hours (or less). The following statement was specifically mentioned by one of the interviewed dealers: "We need to support each other much more". Dealers consider a really attractive option to be able to receive the product the same day.

However, dealers supporting each other will make Volvo losing indirectly some control of the system, since the interaction will be Dealer-Dealer instead of Volvo-Dealer (or Dealer-Volvo) and dealers will therefore act independently. It is true that whether it is Dealer-Dealer or Volvo-Dealer interaction, the component would be a Volvo component, and the customer satisfaction will be increased.

In addition, it might be possible that some dealers are not willing to facilitate some components to their competitors (other dealers), and therefore the dealer in need of the component will have to wait at least one day to receive the product.

4.4 As-is situation

This section presents the fact and figures that were obtained from the analysis of the quantitative data collected form the 3PL service company. First, an overall Figure of the current situation of the transportation costs in Sweden is provided. Then, stock orders and day orders are presented independently and the compared. Moreover, a study of the lead times discussed previously is provided, followed by the different statuses that exist within the returns. Finally, current KPIs are studied.

4.4.1 *The Swedish market*

Transportations costs in the reverse flows within Sweden are presented below:

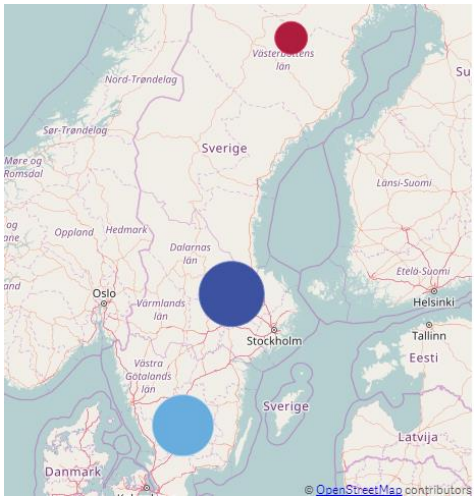

Figure 27: Costs of returns in Sweden

Most of the costs regarding returns occur in the South and the Center of Sweden (the amount of costs/share of costs will remain undisclosed for privacy purpose) (see Figure above). In addition, the following figures will be shown without scales, for the same purpose.

Two important factors regarding costs were taken into account: *Costs of the transport returns* and *Number of orders*. Cores returns - mainly engines – are very weighted products. Costs of returns are based on weights, thus the higher the weight of a product, the higher the costs of the transportation. Therefore, a specific dealer could end up having higher costs (of returns) than another dealer, while having ordered fewer times. Therefore, both costs and number of orders with respect to the different categories are presented below.

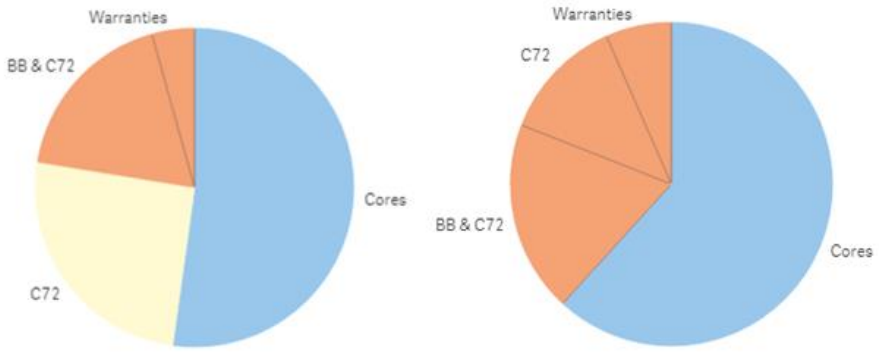

Figure 28: Left: Costs VS. Categories; Right: Avg Costs VS. Categories.

Recall: Buy-Backs and Code 72 are merged. These two products correspond to both buy-backs and code 72 sent to the CDC located out of Sweden (all the buy-backs are sent back there). The column Code 72 corresponds to wrongly ordered parts that are sent back to the CDC in Sweden. In addition, from now on, when referring to Buy-Backs category, in reality it is referred to BB & C72 category, since the data was gathered in this form, and cannot be divided in BB on one hand and C72 on the other hand.

In terms of total transportations costs, core returns represents more than 50% (see left pie chart of the Figure above). This can be either because they are really frequent (high number of orders, or because the cost of each core return is higher than the average cost of other returns. The right pie chart of the Figure presented above shows that the average costs of cores returns are higher than any other average costs regarding the other categories. The following Figure presents the number of orders of each category:

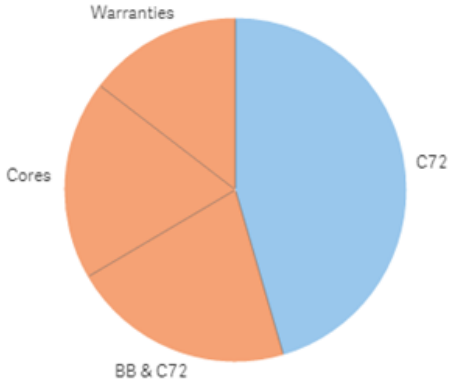

Figure 29: No. of orders VS. Categories

Regarding the number of orders made by all the dealers, cores only represent the third most important category. The most common return is Code 72 returns. Wrongly ordered parts (C72) rises as the most frequent types of return. Surprisingly, the most frequent return is the one that has more room for improvement regarding the procedure to follow when ordering the return. It is interesting to take a look to Buy-Backs and Code 72 categories. Code 72 returns have by far, the most number of returns. It is a good estimation to say that Code 72 sent back within Sweden (C72 category) and out of Sweden (Code 72 parts of the BB & C72 category), will more or less have the same behavior. In this case, Code 72 returns order will further increase (even more), while buy-backs will decrease. This will imply that Code 72 returns account for approximately 50% of all the returns, which is impressive.

The previous three Figures are summarized in the following picture, in which Costs; Average Overall Costs (referring to the Average Costs of a return within all the dealers); Average Costs (referring to the Average Costs of returns per Dealer); and No. of Orders (referring to the numbers of return per dealer) are represented in a dealer level.

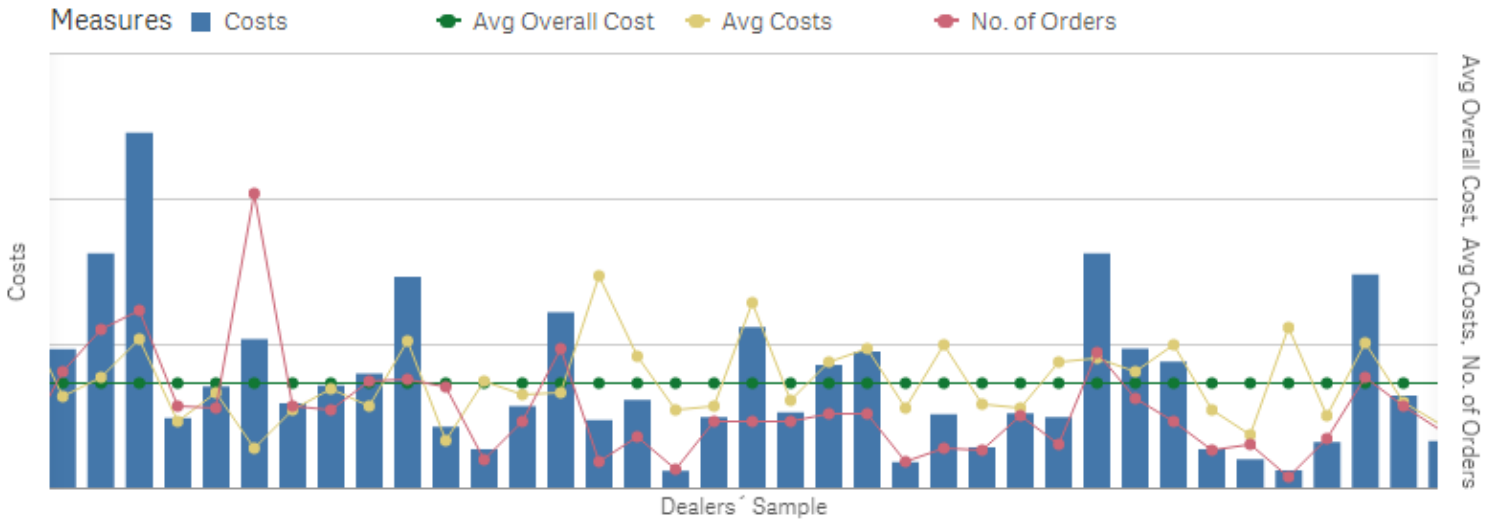

Figure 30: Costs, Avg Overall Costs, Avg Costs and No. of Orders of a sample of dealers

The scale of costs differs from the scale of average overall costs, average costs and no. of orders, so the four parameters can be shown in the same figure. Different patterns can be identified. In some cases, the number of orders is high compare to the average costs per dealer (lower than the avg overall costs), which can be explained generally by a low quantity of cores returns (most expensive returns). Other dealers have a quite high average costs compared to the numbers of orders, which can generally be explained by high amounts of cores (opposite of the first pattern). Evaluating these two different patterns, different behaviors were identified. The following Figure shows the three different cases that are further discussed.

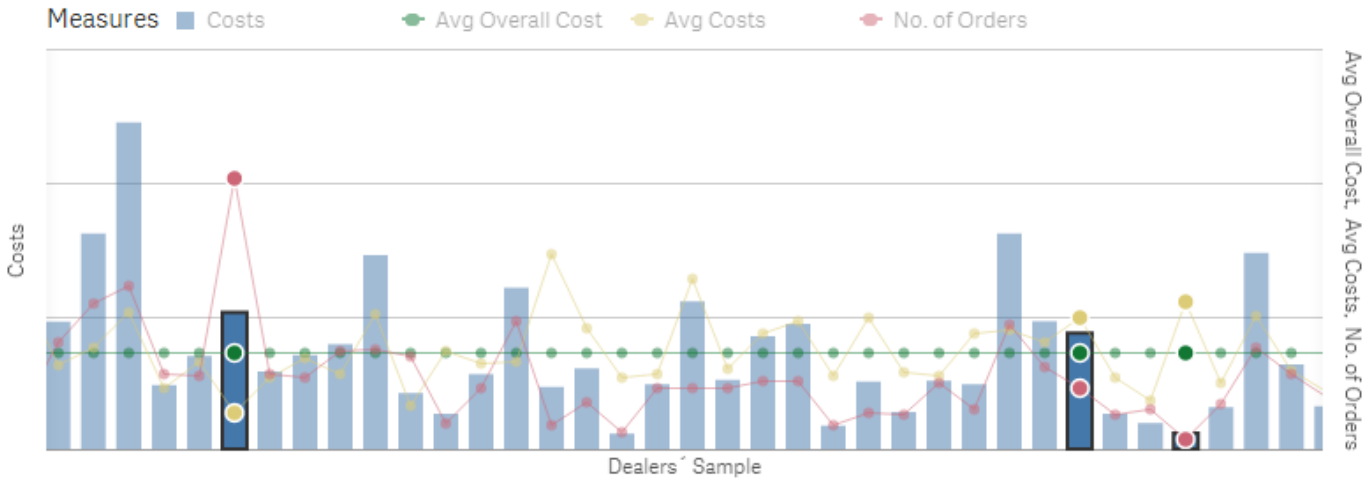

Figure 31: Three chosen scenarios

Cases are referred as Case I; Case II; and Case III respectively from left to right.

4.4.1.1 *Case I: High No. of Orders & Low Avg Costs.*

Specific figures for this dealer are:

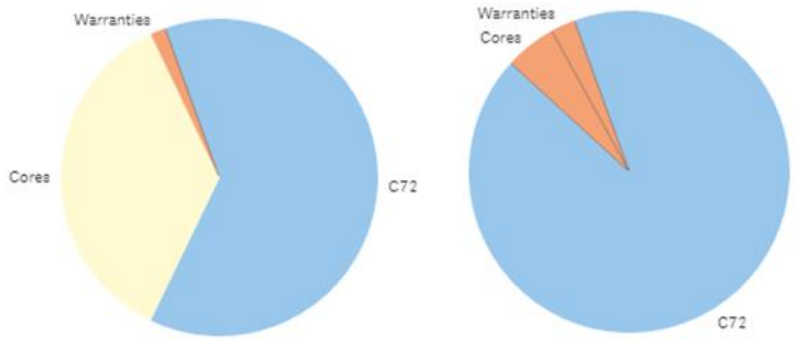

Figure 32: Case I: Left: Costs VS. Categories; Right: No. of Orders VS. Categories.

The first thing that comes to attention is the completely lack of buy backs. In fact, for this specific dealer, the numbers of buy-backs per year that were forecast were more than 2 per year. Since the data covers six months of returns transactions, the reason of not having buy-backs is that the real amount of Buy-Backs was not what it was forecast.

Other than the lack of buy-backs, the results were as expected: High number of orders regarding wrongly ordered parts (Code 72), accounting for the most of its transportation costs.

4.4.1.2 *Case II: Normal No. of Orders; Normal Avg Costs*

Specific figures for this dealer are:

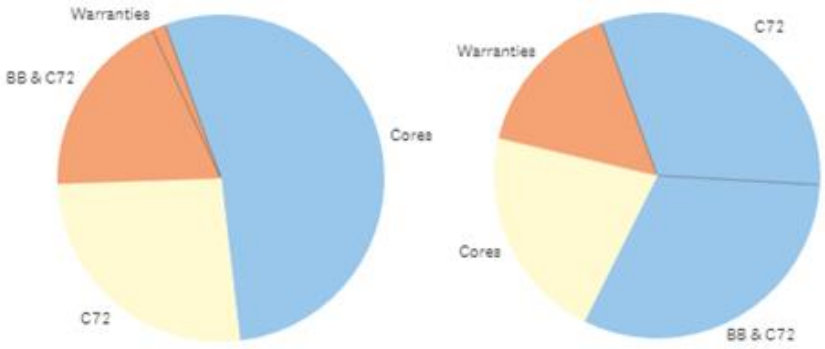

Figure 33: Case II: Left: Costs VS. Categories; Right: No. of Orders VS. Categories.

This particular dealer represents approximately the average behaviour of a dealer (see Figure 28 and Figure 29). Additionally, buy-backs are forecast to be four times a year, which constitutes approximately the average number of times that buy-backs are returned. Cores are the dominant category in costs, while Code 72 and Buy-backs are the dominant categories in number of orders.

4.4.1.3 *Case III: Low No. of Orders; High Avg Costs & Low Total Costs*

Specific figures for this dealer are:

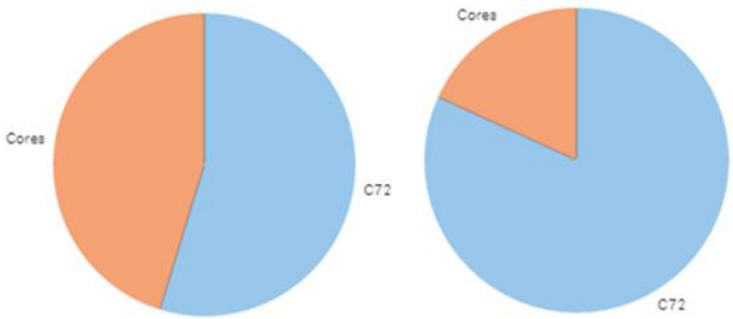

Figure 34: Case III: Left: Costs VS. Categories; Right: No. of Orders VS. Categories.

Again, the lack of buy-backs comes to attention. In this case, the number of BB forecast were twice a year. Since the data collected covered six months (and from the forecast BB, BB should be present in the data), the lack of BB was not expected. The first forecast buy-backs recovery was supposed to be in January, and the data collected largely covers this month, so Buy-backs were expected to be seen. Thereby, the reason behind the lack of BB is that the real amount of Buy-Backs was not what it was forecast.

Additionally, no warranties are presented. This fact is not as surprisingly as the lack of BB, since normally warranties represent a little percentage of total costs and total numbers of orders. It can be that for the six months, there were no warranty claims.

With high average costs, it was expected that cores represented the most percentage share of the costs. However, this is not the case. With the absence of buy-backs and warranties, it can be seen that there were more 75% of Code 72 orders and less than 25% cores orders. But regarding costs, the percentage is almost 50%-50%. Low numbers of core orders and high costs (recall that cores are the most expensive products to return, due to their high weight) will increase the average costs a lot. Having an overall low number of orders, the average costs will also increase.

4.4.2 *Stock orders*

Buy-backs – returns on stock orders - are returned a number of times per year that can go, depending on the dealer, from 2 to 8 times a year. The number of orders regarding buy-backs differs from dealers to dealers (see Figure below).

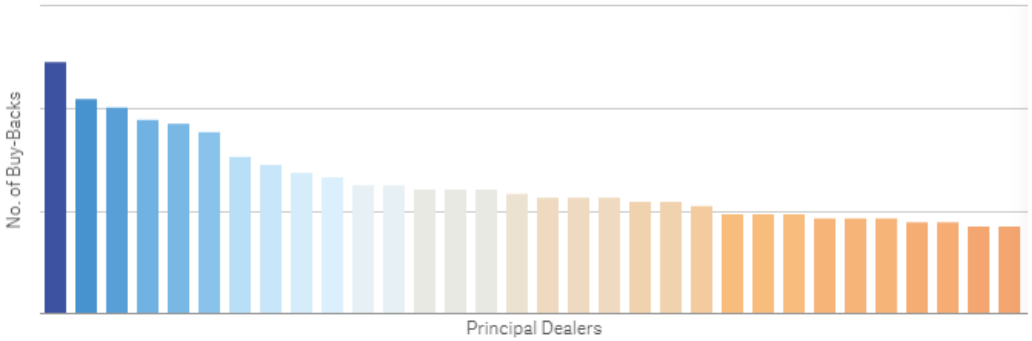

Figure 35: Number of buy-backs for the principal dealers (in terms of amount of BB).

The number of buy-backs varies with the size of the dealers. It is forecast how many times per year buy-backs are going to be returned. To be able to control the flow of buy-backs, the quantity of buy-backs is forecast, which constitutes a really arduous task. Buy-backs correspond to stock orders that are not sold during a certain amount of time. Put in other way, inventory that will no longer be needed.

Currently, regarding forward flows, Volvo encourages its dealer to over stock so the customer satisfaction is maximized. To have more stock means to have more components available when a truck/bus needs to be fixed, but also increases the tied-up capital. It also implies that the number of products that the dealers will not be able to sell increases, and therefore buy-backs increases.

4.4.3 *Day orders*

The following pictures shows the as is situation for the past six months regarding code 72 return within Sweden.

Figure 36: Number of buy-backs for the principal dealers (in terms of amount of C72)

It can be seen that it seems to be a dealer that has an extremely high number of Code 72 returns compared with the other dealers, which seem to have a more similar behavior for wrongly ordered parts. The former dealer is clearly ordering too much day orders.

In addition, even though Volvo encourages to over order components, the system that is required to be used for returning the products seems, for interviewed dealers to be time consuming and very tedious (explained in 4.3.5. Procedures of the returns).

4.4.4 *Lead times*

It has already been stated that general lead times for returns logistics are one day (since the transport has been booked by the dealer) for picking the component(s) up and one to three days until the component(s) are delivered to a Volvo´s expense. This constitutes an average of four days of lead time since the transport has been booked until the product is delivered. The following Figure provides the lead times (Average lead time, Maximum lead time, and permitted lead time (4 days)) for all the dealers and for the categories.

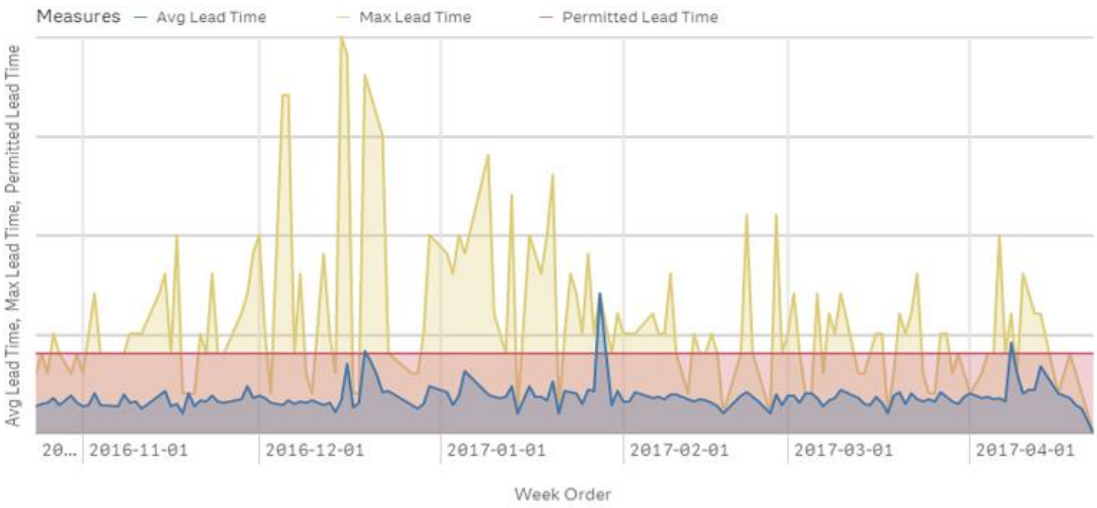

Figure 37: Lead Times including all categories and all dealers.

It can be seen that in average, lead times are within margins. However, something that comes to attention is the high values that max lead time (meaning the maximum lead time occurring in a specific date) reaches. To gain more knowledge regarding the lead times, the following pie chart, showing the average lead time depending on the category, is presented:

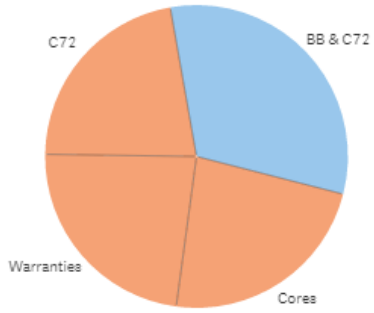

Figure 38: Average Lead Times including all categories and all dealers (II).

BB & C72 category are the category with the highest average lead times. To further study this phenomenon and gain knowledge regarding BB & C72 returns (from stock orders), the following figure is shown.

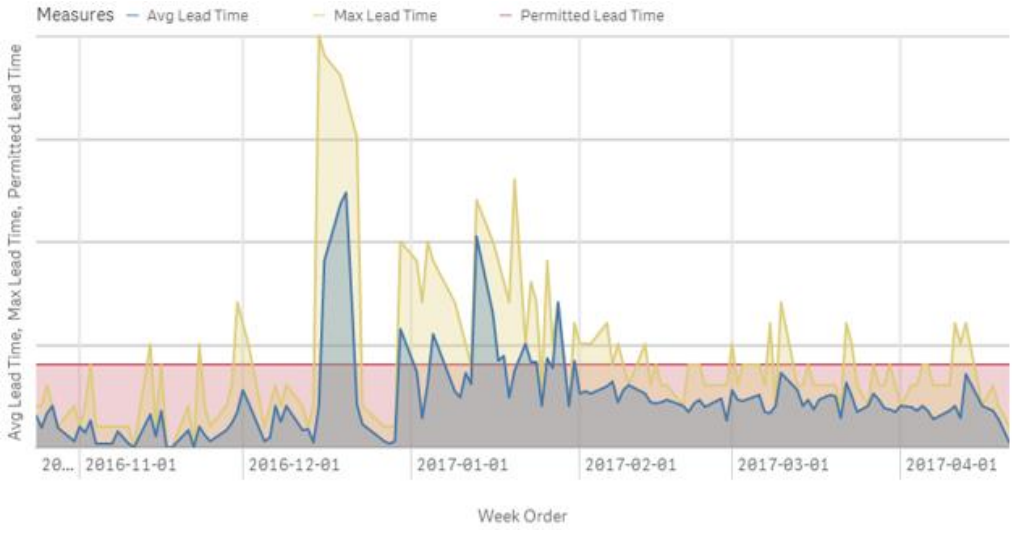

Figure 39: BB & C72 Lead Times including all dealers.

Buy-Backs (BB & C72 category) are the category where the lead times are less respected. Effectively, it can be seen that from mid-December to the end January, the average lead time is not respected as it was expected. Since seasonality cannot be studied with the data gathered (it only covers six months), a reason for this could be the weather conditions, and therefore, the road conditions, in this season of the year. For that to be studied it will be required data from at least 2 years back. Based on if there is a seasonality pattern or not, measures should be taken. However, this just occurs for BB and not for the others categories in the same period, which takes the hypothesis of the weather conditions (seasonality) down. Another reason behind it could be that since buy-backs are returns from stock orders, and that these returns are taken to a specific hub in Sweden to be further transported outside of Sweden, the stability of the process is put at stake, and therefore lead times increase. The Figure above presented reinforces the idea of not stable BB flows in reverse logistics. If the same thing happens in the forward flows (instability of stock orders) dealers will further order DOs for products that were supposed to be SOs, which will further generate returns.

In addition, the above Figure refers just to the lead times from the dealer to the hub in Sweden. After, products are transported to a CDC located outside of Sweden, which implies that the real lead time is even higher. For forward logistics, it happens the other way around. The thing is that lead times from the CDC to the hub in Sweden have also to be taken into account. Since this lead time will also be experienced by the dealer when receiving stock orders. Therefore, total lead times for SOs are even higher.

4.4.5 *Status of the deliveries*

There are three different possible statuses:

- *Cancelled.* They refer to orders booked but immediately cancelled. Therefore, they do not incur in any costs.
- *Delivered*. These are returns that have been delivered.
- *Probably delivered but missing delivery scan*. They refer to returns that have been *probably* delivered, but the scan to confirm that the return had arrived to the corresponding DC was missing.

The following Figure shows the percentage of each status among all the returns.

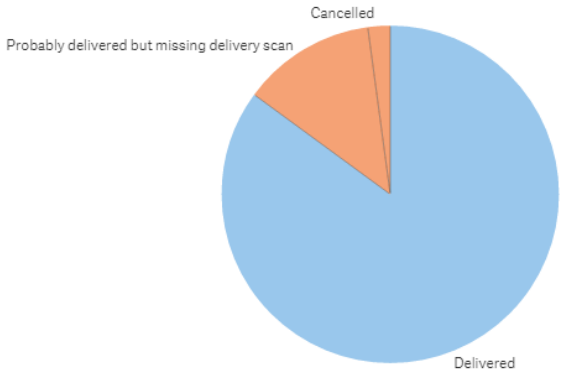

Figure 40: Status of the returns for all categories.

It can be seen that the return that is *probably delivered but missing delivery scan* account for a quite high percentage, having in mind that in a perfect situation, this percentage should be zero. This Figure indicates that some procedures are not being performed as they should be, such as scanning all the delivered products. The findings so far pointed to some instabilities regarding BB & C72 categories. Therefore, the following Figure represents the status of the returns for BB & C72:

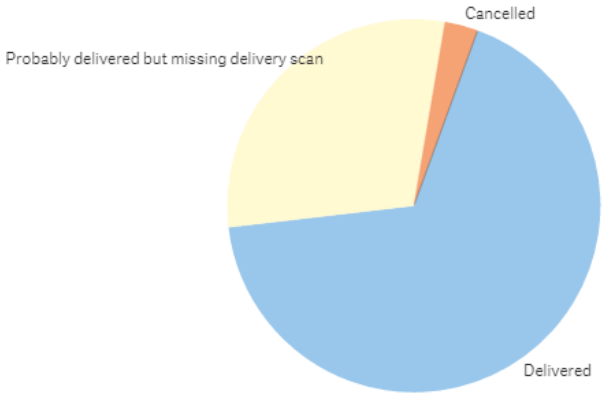

Figure 41: Status of the returns for BB & C72.

In fact, the number of *probably delivered but missing delivery scan* is higher of BB & C72 than for the average. To control the returns, there is a need of controlling the returns arriving to the DCs, and this is a proof that not all the returns are controlled.

In addition, it was identified that in the DCs, returns are sometimes stored until there is a high amount of returns in order to process all of them at the same time. This is a really negative aspect for Volvo. During this time, these products are like *dead* products for Volvo, since they do not know that they are in their possession. An example of this could be the following. Dealer A has returned a product (wrongly ordered product) that has already been delivered to the corresponding DC, but it has not been processed yet. This product is now ordered by Dealer B as a day order. Volvo still does not know that it is in possession of this product, since the product has been stored in the DC until there is a great amount of returns to be processed. Therefore, Volvo would send the product as a day order to Dealer B, as usual. If Volvo has known that this product was in the DC, it could have sent this product directly from this DC instead of sending another one from another DC and having the need of relocating the returned one. Therefore, scanning the returned products at the correct pace is really important for managing the returned products, and particularly, wrongly ordered products.

4.5 Key Performance Indicators within Volvo in reverse logistics

This thesis was a first contact with the assessment of the current reverse logistics systems employed. All the knowledge acquired during the thesis was new. KPIs regarding returns transport were therefore not established within the firm, since the current situation is not controlled. In the *Analysis* (Chapter 5), KPIs regarding returns transport will be covered and suggested.

4.6 Summary of empirical findings

The lack of control is jeopardizing any improvement in adjusting total logistics cost, transport cost, inventory control and capital tied-up. There are certainly being lost business opportunities. Besides, there exist different categories of products.

Through this chapter, important factors influencing the practices that are being currently carried-out regarding revers logistics have been exposed. Since the causes of the factors are different, the author has summarized them in five different categories, to be able to further analyze them and provide recommendations.

The following factors were established:

Table 13: Identified factors influencing the practices concerning reverse logistics

Identified categories
Communication
Dealer´s experiences
Returns planning and policies
Lead times
Performance measurements

These identified categories are seen as crucial to stabilize a system that is currently under no control. The following figures shows that the categories serve to move towards a common objective (i.e. a stable reverse logistics set-up). Although these categories could be interrelated, they are not dependent from one another. They expose different points of action to act on in order to achieve the common goal.

The following Figure shows the identified factors influencing the practices concerning reverse logistics and how the combinations of them drives towards a stable RL set-up.

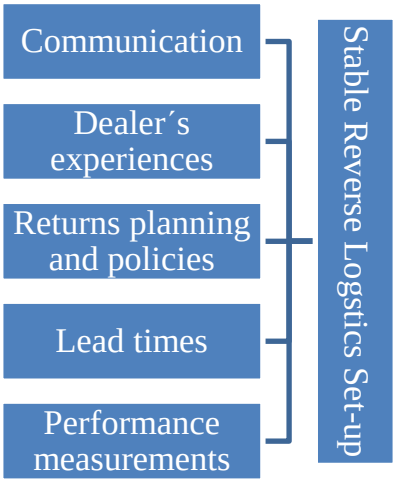

Figure 42: Identified factors influencing the practices concerning reverse logistics

These five different categories will form the basis of the analysis part, where they will be further studied.

5. ANALYSIS

This chapter serves to match the theory presented in the Theoretical Framework chapter with the Empirical Findings chapter. It aims to answer the research questions presented in the Introduction Chapter. Flaws and drawbacks of the current practices are identified, as well as Key Performance Indicators. Thereafter, recommendations are suggested. These recommendations are then related to the KPIs to study their impact and together with their difficulty of implementation, they are ranked.

The analysis of this thesis has been carried out matching the literature review and the empirical findings. Both the Performance Prism defined by Kennerley and Neely (2002) and the balanced scorecard model defined by Kaplan and Norton (1992), and Brewer and Speh (2000). On the first hand, the performance prism first identify the stakeholders and their needs, to secondly set the strategies required to satisfy these needs. Thereafter, processes to satisfy the previous strategies are established, followed by the capabilities required. The ultimate aim is to deliver satisfaction to the stakeholders. In this case, stakeholders are the dealers, the end-customers and Volvo itself (Kennerley and Neely, 2002; Neely, Adams and Kennerley, 2002). On the second hand, the balanced scorecard relies on four different perspectives: Business process; Customer; Financial; and Innovation and Learning (Brewer and Speh, 2000). Four main questions are required to be assessed in the Balance Scorecard, related to these perspectives: What must be the firm master of? How the firm is seen by the customers? How do stakeholders see the firm? And is the firm in a position of still creating value? (Kaplan and Norton, 1992; Brewer and Speh, 2000). These two processed were kept in my mind throughout this chapter.

5.1 Communication

The automotive market is a competitive market. In such markets, knowledge transfer is seen as the main resource to operate (Martin-Perez and Martin-Cruz, 2015, p. 1177). Communication is vital in all its senses. However, during the realization of this thesis, it was identified that communication and knowledge transfer was not a priority regarding reverse flows procedures. According to West (2012, p.194), the flow of information is necessary if high rates of effectiveness want to be achieved (West, 2012, p.194). Three different channel of communication seemed to be lacking of good flows of information between the two parties involved:

i. Knowledge transfer between Volvo and the 3PL service company.
ii. Feedback between Volvo and the dealers.
iii. Awareness of reverse logistics.

Actors within the supply chain in sensitive markets need to share information between them. This is in accordance with Christopher (2000), who stated that virtual supply chains, where information sharing between parties, is crucial. Sensitive SC should be information oriented instead of inventory oriented. Additionally, Christopher (2000) stated that there is a need of process integration, consisting in improving communication, reliance and trust between the different actors of a SC, and a need of competing all together as a network to be competitive

in the market, instead of competing as individual entities. Therefore, communication is a crucial feature within a SC to be competitive in such a sensitive market. The lack of information is seen as one of the causes of the returns (Inmar Reverse Logistics, 2009). In fact, customer relationship and customer service as seen as two of the key business of a SC (Lambert et al., 1998).

These three channels of information are further explained below.

5.1.1 *Lack of knowledge transfer (3PL Data Collection)*

The difficulty of getting the operational data of reverse logistics transactions is something that needs to be mentioned. VTC/VBC is currently handling all the costs when it comes to return any types of products. They should be able to have an easy access to the operational data of the flow of the products. However, the process of having access to this data took more than expected. Additionally, the data gathered was to some extent, incomplete. For instance, when it comes to study lead times, pick up dates (i.e. when the product has been retrieved by the 3PL service company from a dealer) were missing. This jeopardized a proper analysis.

Knowledge is one of the main important strategic resources of an entity (Conner and Prahalad, 1996; Martin-Perez and Martin-Cruz, 2015, p. 1167; Nahapiet and Ghoshal, 1998). In this particular case, it is clear that knowledge transfer was far from being optimal. Volvo should therefore establish on the first hand, that they want to receive the data, and on the second hand how they want to receive this data. An agreement should be established between the two parties stating that Volvo is willing to control the performance of the services provided by the 3PL service company. To be able to control it, suitable data should be gathered. When analyzing the data gathered for this master thesis, it was found that a lot of work treating this data was needed in order to be able to work with it. An example could be for instance internal references from the 3PL firm that were of course not needed. Additionally, there was a section of *free comments*, where dealers can state whatever they considered relevant when returning a product. From one order to another, the comments were completely different. Managing thousands of orders made this section useless, since it did not give any additional value to the analysis.

Additionally, it has been stated that the BB and C72 returns with destination the CDC located outside of Sweden were merged into the same category. Volvo needs to be able to study separately both categories, as the logistics behind them in forwards logistics is completely different.

Crucial information that Volvo needs to gather from each operation is:

- *Product reference*. Reference of the product within Volvo
- *Dealer*. Who is the product picked-up from?
- *Category of the product returned*. With BB and C72 category divided.
- *Destination*. Where is the product delivered?
- *Weight*. What is the weight of the product/package to be returned?
- *Status*. The status of the delivery.
- *Dates*:

- *Order date*. When is the transport booked?
- *Pick-up date*. When has the 3PL company picked-up the product?
- *Delivery date*. When has the 3PL company delivered the product?

Recommendation: *Data collection (3PL).* Agreement with 3PL firm on data collection.

5.1.2 *Lack of feedback (from Dealers)*

Feedback is a necessary tool. According to Lally (2013, p.29) providing feedback is crucial. When the interviews with the different dealers were performed, they were *surprised* that the aim of the interview was reverse logistics. Indeed, they were willing to help. Commitment between parties (interviewees-author in this case) is one the reason to share knowledge. The commitment in this case were out of any doubts. These interviews were seen as very fruitful that led to important improvements. According to Parsloe (1995), feedback boots performance. It is therefore important to work hand to hand with people/workers that personally handle the products to be returned and that work with the systems involved in a daily basis. Perform workshops with dealers will allow to give feedback and to perform brainstorming to improve the returns flows and to better handle them. During these workshops, expectations and perceptions regarding customer services should be discussed. Four different gaps could exist between supplier and customers and their respective expectations and perceptions. (See Figure 19 in page 46). During these workshops, expectations and perceptions of the actual service provided by Volvo should be discussed. They refer to the *Stakeholder contribution* of the Performance Prism defined by Kennerley and Neely, (2002). Dealers should share with Volvo their needs, so Volvo could satisfy the whole prism processes (strategies, processes and capabilities based on stakeholders needs) to deliver stakeholders satisfaction.

Moreover, to be able to study the end-customer satisfaction, Volvo should study the average time that vehicle spends at the dealers. This would be a very good input for Volvo in order to measure their performance. This implies collecting internal data from each dealer, needing to rely on previous customer trust.

Recommendations:

- *Workshops with dealers*.
- *Data collection (Dealers)*. Collect data to evaluate the average time of fixing a vehicle.

5.1.3 *Lack of awareness of RL (Bad practices of Dealers & DCs)*

When referring to lack of awareness in the handling of products that have to be returned, it is important to divide between the Distribution Centers and the dealers. The interactions between workers is the main source for sharing the knowledge, which in turn enhance their skills and competences (Renzl 2008, p. 207). The first step to set the appropriate goals and the appropriate strategy regarding returns, is to clarify the importance that returns will have and the effort the firm will put to manage them (Rogers et al., 2002).

5.1.3.1 *Common practices at Distribution Centers*

Since returns transports are not that numerous (volume wise) with respect of products in the forward logistics flows, returned products are being stocked in the distribution centers until the volume is considered to be sufficient to be processed. Processing the product refers to make this product available in the system again. This could be, depending of the size of the distribution center, each week. That means that in the worst case, a specific product that is received the first working day of the week, will not be processed until the next week. According to Dawe (1995), having a large amount of returns inventory held in the warehouse was a clear symptom that return management should be revised. This consists in a loss of opportunity for Volvo. In the system, Volvo does not know that this product is available to be sent to another dealer until one week later. What if during this *lost* week, a dealer needed this specific component. In the current practice, a new product would be sent from the closest CDC/RDC/SDC. But what if the return product is even closer? The lead time will therefore decrease, which in turn will enhance customer satisfaction. This will be possible if the lead times for handling the returns in the DCs were decreased. Therefore, awareness of the importance of handling the returns is required at this level.

Recommendation: *Workshops with workers handling the returns in the DCs*.

5.1.3.2 *Common practices at Dealers*

Concerning the practices of dealers when referring to returning a product it was identified, also depending of the size of the dealer, that they store the products that they want to return in a specific corner, and they proceed to return the products once a week (some dealers). Once again, this causes a week of delay for products to be available in the aftermarket. This can be either because the dealers, based on previous experiences, only gets the products picked-up by the 3PL company once a week (in this case, the 3PL company will not be respected the agreed lead times), because of the way returns procedures are built up (time consuming), or because dealers do not add any value and do not lose money (Volvo is taking all the costs) for doing it at a quicker pace. Volvo should further encourage dealers to return products at a quicker pace, to gain availability in the aftermarket. Therefore, awareness of the importance of handling the returns is required at this level.

Recommendation: *Workshops with dealers*.

5.2 Dealers´ experiences

This section covers the different factors affecting the dealer satisfaction when it comes to the systems that they have to use in order to return a product. It covers three different aspects:

i. The amount of systems.
ii. The lack of notifications regarding these systems.
iii. The instability when it comes to pay-back the returned products.

A good service recovery enhances customer´s loyalty (Andreassen, 2000), and having loyal customers create huge potential (Harrison and van Hoek, 2008), such as ensure revenues in the long term (Johnston and Clark, 2005). The service quality is considered as one the main

three drivers to enhance customer loyalty together with product quality and price (Harrison and van Hoek, 2008; Parasuraman and Grewal, 2000). While product quality and price is easily imitated by the competitors, service quality rises as the key driver to ensure a great perceived value and therefore a high level of customer loyalty (ibid). Additionally, this customer loyalty will set a zone of tolerance between the Volvo and the dealers, which is defined from where perceptions fall in adequate level of expectations to where perceptions fall in the desired level of expectations (Parasuraman, Berry, and Zeithaml, 1991). There is therefore a tradeoff between customer loyalty and quality of performance.

5.2.1 *Amount of systems*

Having different systems without correlation between them is seen as one the causes of the returns (Inmar Reverse Logistics, 2009). The number of different systems that dealers have to use to return a product varies depending on the category of each product. For some categories, such as cores or BB, the systems that are currently being employed do not cause annoyance to the dealers that were interviewed. However, for the case of the wrongly ordered parts (C72), which constitutes the highest amount of returns, the systems employed were seen hard to manage and time consuming. Additionally, in each system, the dealer has to enter the specifications of the product, since they are not connected between them. This can end up being the cause of what it has been discussed in section 5.1.3.2 Common practices at Dealers, which reflects on the availability of the products in the aftermarket.

Recommendation*: See end of this section*.

5.2.2 *Lack of notifications*

Regarding the systems used for wrongly ordered parts, dealers are not been notified at any moment of the process. Therefore, they have to enter to see if they have received the approval of their claim, the permission for returning the product and the see if Volvo has paid back the product. When discussing this particular issue during the interviews with the dealers, they seemed to be dealing with it because this was what it was. But receiving this type of notifications was seen as a positive improvement.

Furthermore, another thing that was considered *normal* (the system is what it is) in a daily basis were the lead times from step to another. This amount of days was identified as too high. Having these lead times regarding just the procedure of being able to return a product impacts directly in the availability in the aftermarket of the products, and can also be the cause of what it has been discussed in section 5.1.3.2 Common practices at Dealers.

Moreover, dealers do not receive any notification when the returned product is delivered in the corresponding DC, or when the payment is done by Volvo. They rely on the current set-up. However, is there is any problem with the pay-back of a specific return, they do not even know if the product has reached the corresponding DC. They have therefore to call the Help Desk to sort things out.

Recommendation*: See end of this section*.

5.2.3 *Instability in the pay-back of the returns*

Develop stable credit rules is one the six strategic activities in the RM (Rogers et al., 2002). Pay-back of the returns seemed to be a recurring theme of conversation when the interviews were performed. First of all, dealers do not know when the returns have been delivered to Volvo´s expenses, or if they have been delivered at all since there is no a track and trace system that is currently put in place. Therefore, dealers do not receive any kind of notification whether returns have been successfully delivered or not. In addition to that, dealers do not receive any notification regarding the payment. They have constantly to check if the payment of theses returns have been done or not. It has come to the attention of the author that the lead times regarding the returns were unstable and sometimes quite large (up to several months). There is therefore a need of stabilizing the payment lead times, as well as to reduce them.

Furthermore, Volvo is not currently aware of the exact transactions happening in the reverse flows. Since the dealers book the transport, and Volvo does not have easy access to operational data, the cost of the reverse logistics is not reachable at first sight. Volvo receives an invoice from the 3PL service company and proceed to pay, with no further details. Thus, there is a need of controlling the payments.

Finally, it has already been stated that up to the point of booking the transportation, the procedures may vary. However, the booking transportation is the same procedure independently of the category of the product. Therefore, another way to proceed (different from the current practice) could be that Volvo books the transportation. The required information for booking the transportation will be gathered when the dealer ask for the return permission. Thereafter, Volvo could directly contact the 3PL and book the transportation. This will help Volvo to gain direct control of the firm is paying for, as well as total control of the operations concerning reverse logistics, without the need of depending that much on the data gathered form the 3PL firm. Additionally, dealer satisfaction will be greatly enhanced, as they are no longer required to book the transportation by themselves.

Recommendations:

- *Build a new system.* This new system should:
  - Stabilize lead time:
    - *Reduce procedures' lead time*
  - Control the payment
    - *Stabilize payment lead time*
    - *Gain knowledge about what it is paid*
  - Be easy to manage
- *Send pop-up notifications.*
- *Self-booking transport.*

These gains reflect directly in enhancing dealer satisfaction, as well as in reducing tied-up capital.

5.3 Returns planning and policies

This section covers three different aspects of the current returns planning and policies:

i. Excessive amount of BB & C72 returns
ii. Poor forecasts
iii. Self-interests behaviors

As stated by De Brito and Dekker (2004), companies enter the reverse logistics activities mainly because economics, legislation and corporate citizenship. Entering the reverse logistics activities has certainly economic benefits, but the amount of returns can sometimes be excessive. Controlling the amount of returns and be in a position of knowing what a reasonable amount of returns is will utterly help the firm in gaining competitive advantage. According to Rogers et al., 2002, managing the return policies in a strategic way can improve profits, as well as enhance customer loyalty and the public image of the brand.

5.3.1 *Excessive amount of BB & C72 returns*

Wrongly ordered parts (C72 category) are the most common types of returns. These returns are returns from day orders in the forwards flows. These returns are the consequence of ordering more products than really needed. Volvo encourages the dealers to order more products when they diagnose the vehicle, to be sure that he demand is covered properly, thus end-customer satisfaction is guaranteed. This makes the C72 returns by far the most dominant category.

Put in other way, day orders are orders that need to be delivered as soon as possible, so the dealer can fix the vehicle as soon as possible, and therefore the waiting time of the end-customer is minimized, maximizing therefore the end-customer satisfaction. Volvo currently suggests ordering more components than really needed for precisely increasing the probability of being sure to have ordered all the components than the vehicle will need. Sometimes, dealers diagnose vehicles and know where the problem is located, but do not know the exact root of the problem. Volvo encourages dealers to not hesitate in ordering too much, since they will be able to return the not used components, with Volvo paying these returns (recall: with the X day rule). This will imply that dealers will have the possibility of ordering more than really needed, in case their first diagnose was not as accurate as thought in the first place. This will definitely enhanced end-customer satisfaction. Surplus ordering and wrongly diagnosis of the problem are seen as a direct cause of having returns (Inmar Reverse Logistics, 2009).

Regarding returns policies, dealers do not have any limit for ordering too much components or doing too many orders. In addition, since there is no possibility of tracking and trace the ordered components, and lead times are no less than 1 day since the component(s) have being ordered, dealers may order even more than what it is suggested by Volvo. This causes that over ordering products are unlimited.

Regarding C72 category, it is Volvo who sends a notification stating which component is about to expire (in terms of returns). This is made to enhance dealer satisfaction and to minimize dealer's risk of not being refund, which in turn increases the returns, or at least, it

does not help in reducing them. In other words, dealers can return a day order, and the next day order it again, receiving it the day after. They avoid then the risk of exceeding the X days expiration rule. This is allowed by the system since there is no control and no possibility of measuring the returns of each dealer, and no penalties exist for ordering too much.

Recommendation*: See end of this section*.

5.3.2 *Poor forecasts*

Forecasting is a complex and arduous task. One of the responses of a client from PricewaterhouseCoopers when asked about Reverse Logistics was: "Forecasting & planning of returns is very hard or, in fact, impossible so we don't do it" (PricewaterhouseCoopers, 2008). A perfect forecast will imply that no returns regarding the BB category exist. However, the second most dominant category is the BB & C72 category. This category refers to returns of stock orders. It is important to differentiate between BB and C72 among this category:

- *Buy-backs*. They refer to returned products that were sent to the dealers (in the forward flows) as *stock* orders.
- *Code 72 (wrongly ordered parts)*. They are returned products that were sent to the dealers (in the forward flows) as *day* orders.

The aftermarket is a sensitive market. According to Christopher (2000). In sensitive markets, supply chains should be agile SC, instead of Lean SC. Lean Supply Chains are forecast-driven. This is the case within the focal company, where stock returns are the second most relevant category.

As the data gathered does not allow the author to study separately BB and C72, an in-depth analysis could not be performed. However, both scenarios (High BB/Low C72 VS Low BB/High C72) were considered.

5.3.2.1 High BB/Low C72

In this scenario, forecasts are the main reason of the high returns. Two different cases (See 4.4.1.1 and 4.4.1.3) were shown where BB returns were expected according to the forecast made by Volvo and it turned out that no BB returns were made. Therefore, forecast do not match the reality. Thus, the opposite could also happen: no BB were expected and it reality there were BB returns.

5.3.2.2 Low BB/High C72

This scenario could reveal two different things:

- Stock orders are poorly forecast, and dealers have to order more orders (that were supposed to be already in their stocks) in day orders.
- Stability of stock orders it not reliable. It was shown in the findings that the lead times for BB were the most unstable lead times considering all the categories in the reverse flows. This could also be the case forward flows. Therefore, to satisfy the demand and the end-customer satisfaction, dealers order day orders (of stock components). This is also related to tack and trace, as the dealers do not know when their components will

be delivered (in both forward and reveres flows). Therefore, they prefer ensure, by the mean of day orders, availability of products for repairing the vehicle.

Forecast-driven firms lack of relevant data from customers, and are forced to forecast the demand based on historical data (Christopher, 2000).As it has been stated above, this is the case of the focal company. However, the focal company lack of data from customers not because it cannot be collected, but because there is a lack of awareness of the potential benefits of good performance in reveres logistics

Recommendation*: See end of this section*.

5.3.3 *Self-interest behaviors*

There are several reasons that led the author to think that dealers are taking advantage of the current situation of the reverse logistics set-up within VTC/VBC. Still, the policies of the current system allow them to do it.

Having no limitation on the amount of returns and the firm taking the responsibility for all payments, give the dealers the freedom to order massively. Additionally, it was identified, that because of the X days rule, dealer waited until the rule was about to expire to either try to sale the product or sent it back. The keep the products more than needed because they know that they will still have full refund. This added to the fact that they take (depending on the dealer) their time to return the products, decreases the availability of products in the aftermarket.

Furthermore, the instability in the stock orders in the forward flows make dealers to order stock components through day orders, which increases to returns both of BB & C72.

These two factors certainly enhance the dealer satisfaction, although they jeopardize the availability of products in the aftermarket. For the dealers, it is a win situation. However, for Volvo it could be a lose-win situation (lose for Volvo and win for dealers) since dealers could abuse of the current policies established, and the higher the returns, the higher the cost.

Thereby, there is a need of controlling this type of behaviors, keeping in mind that it is crucial to ensure end-customer satisfaction, as well as dealer satisfaction.

Policies regarding returns varies from industry to industry, and go from full return policy to no returns policy at all (Padmanabhan and Png, 1995). Create value and satisfaction of the stakeholders of the firm is needed to ensure success (Clarksson, 1995). Ginter and Starling (1978) stated that returns could end up being a core issue of the business. In this case, dealers are the firm´s customers, and therefore they are also stakeholders. Thereby, customer satisfaction should be taken into considerations, and returns are on the firm´s response to guarantee customer satisfaction (Alvarez et al., 2007).

In the case of the focal company, the policies (excepting the X day policy) are full returns policy. Volvo encourages dealer to over stock and over order products to maximize customer satisfaction. To build trust and share the risk with the dealers, Volvo is taking all the cost related to these returns. This is accordance with Fleischmann et al. (2000), who stated that the OEM covers all costs and has the responsibility to deal with product recovery. However, this

could end in large accosts for the company. In fact, there exists a tradeoff between customer satisfaction and costs (Kulkarni, Ponnaiyan and Tarakci, 2015; Padmanabhan and Png, 1995). Padmanabhan and Png (1995) stated that it exists a large scale of options between one extreme and the other. Partial returns (where the customer only receives partial refund or partial credit of the returned product) were very important (ibid). In fact, this is what happens with the X da policy for day orders, but it has been identified that dealers abuse of that rules, keeping the products more time than really needed, jeopardizing the availability in the aftermarket of products. The actual policy of Volvo regarding inventories and stock is a loyal image of what Emmons and Gilbert (1998) stated: the strategy used by manufactures regarding stock, is to provide generous return policies to encourage retailers to stock without fear. Su (2009) found partial returns optimal for return policies, if well respected. A system of incentives/penalties is necessary to ensure that returns policies are respected by the customer. This is supported by Darwish and Odah (2010), who proposed to establish penalties, regarding customers´ behavior (i.e. if the stock levels are not respected).

Recommendations:

- *Measure the performance of each dealer*. This could be done by measuring the amount of orders in the FL flows and compare them to the amount of returns in the RL flows).
- *Establish incentives/penalties.* These incentives/penalties should be based on dealer performance.
- *Enhance forecasts.* Put more effort in forecasting stock orders so stock orders could be more exact.

This will s*tabilize stock orders lead times both in FL and RL*. In FL, it is required to reduce day orders due to stock components, whereas in RL, it ensures availability of products in the aftermarket.

5.4 Lead times

In this section, three different aspects regarding lead times are covered:

i. Lack of measurements
ii. Dealer-to-Dealer support
iii. Uncertain deliveries

Having a flexible response and time compression are related to the business process perspective of the balanced scorecard (Brewer and Speh, 2000). The importance of short lead times in the aftermarket is crucial, since every time a vehicle is idle, it exist a loss of profit associated (Makarova et al., 2015).

5.4.1 *Lack of measurements*

Volvo is not currently able to gather suitable data to analyze the operations carried out in the reverse flows. Moreover, when it comes to lead times, pickup dates were missing, although great efforts were put into getting this type of data. Thus, dealers must rely on lead times and sometimes, the lead times specified in the SOP are not met, as seen in the previous chapter.

Volvo needs to ensure lead times measurements to ensure that lead times are being respected. In the worst scenario, from the time of when the transport is booked until the products are picked-up, it can be up to five days (a whole working week), as reported at some dealers during the interviews. Then, the transport itself is supposed to be from 1 to 3 working days. Finally, when the products arrive to the corresponding DCs, it was identified than they are not processed immediately. Instead, returned products are accumulated until there are enough products to be processed (the responsible person working at DCs chose when to process them). This process can go from 1 day to 5 days (a whole working week, since it was considered that at least, return products are processed once a week. Therefore, in the worst case, the lead times are as following:

Figure 43: Worst lead times scenario

The following table present the theoretical lead times compare with the current performance lead times:

Table 14: Comparison between theoretical and current performance lead times

Lead times	Theoretical	Current performance
Transport booking	1 day	1-5 days
The return is picked-up and delivered	1-3 days	1-3 days
The return is process	As soon as possible	1-5 days

Note: It has been considered that the current performance of the 3PL company is within the average (which it is actually the case). It was considered that taking the worst scenario is this particular case was not representative of the results (outlier).

If we take the worst scenario, the theoretical lead time is 4 days, whereas the current performance lead time is 13 days. It is a really big difference between the two. In addition, this difference will further increase if pay-back lead times are included (there were not gathered exact data regarding this, but it was stated from the interviewees that pay-back lead times went from a couple of weeks to several months) .

Moreover, if lead times of the returns procedures for wrongly ordered parts are included:

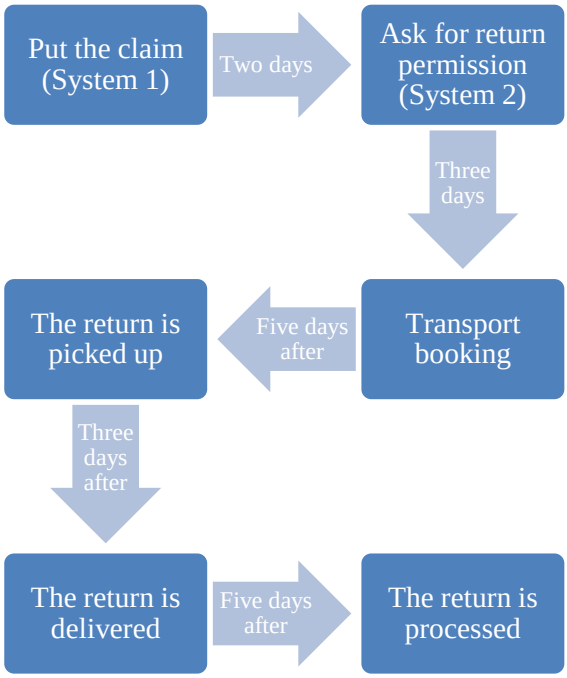

Figure 44: Worst lead times scenario including return procedures.

The above Figure shows that in the worst case, from the time when the dealers want to return a product (C72 category), until the return is processed in the DCs, 18 days are spent. This is just for C72 returns for day orders in Sweden. In the case of C72 that go to the CDC located outside of Sweden, the lead time of the 3PL taking the goods from Sweden to the final destination has to be added. More than half a month for retrieving goods until they are available in the aftermarket again seem to be too much.

Another aspect that need to be assessed is how time deviations are handle in the return flows. The findings have showed that there are some deviations regarding lead times pre-established in the SOP. This affects the availability of products in the aftermarket. It was seemed important to measure the 3PL performance and establish incentives/penalties based on that. This is supported by Darwish and Odah (2010), who proposed to establish penalties regarding the performance. In fact, 3PL service companies may end up being key players (Rogers et al., 2002) in the overall RL flows.

Recommendations*:*

- *Ensure proper data collection (3PL).*
- *Perform lead times measurements*.
- *Establish incentives/penalties*. These incentives/penalties should be based on 3PL performance.

This will contribute to s*tabilize lead times in RL*.

5.4.2 *Dealer-to-Dealer support*

From the interviews that were performed, it was identified that with the current lead times (at least one day to receive a day order), dealers need to support each other (D2D support). Particularly, this statement by one the interviewed dealers speaks by itself: ”We need to support each other much more”. Dealers feel the necessity of having access to day orders in the same day of the order. Nowadays, when a dealer order a day order (FL), it takes at least one day until they receive the product. This jeopardizes the end customer satisfaction, and dealers have started to count on each other to satisfy the demand.

There is an existing tradeoff between stock and day orders. If you do not allow dealers to overstock (that will imply reduce stock orders, therefore reducing BB), they will be forced to order more products in day orders, thus having higher returns in day orders. But, establishing same day deliveries will imply that dealers will not be encouraged by Volvo to over order components in day orders to satisfy the demand. Instead, they will order what they think they need (a bit more to play on the safe side) in day orders, and could eventually order a specific component in same day orders. This is obviously suitable in regions when there is a demand of products in the aftermarket. Besides, this will increase the operational cost, since deliveries in the same day are expected to be more expensive. There is a need of studying the tradeoff between these two factors (same day orders – transportation cost).

According to Christopher (2000), future markets will be more uncertain. For firms to keep being competitive, they need to turn into agile mentality. This implies that there is a need to quicken the responsiveness of the supply chain, where firms should be demand-driven instead of forecast-driven (Christopher, 2000).

Recommendations*:*

- *Reduce stock orders.*
- *Establish same day deliveries*.

5.4.3 *Uncertain deliveries*

In FL flows, dealers just know when the 3PL service company has picked-up the products. However, even in lead times are specify in the SOP, dealers do not know when their products are expected to be delivered. This causes an uncertainty about the arrival of the products that causes the dealers to order component that were supposedly stock products as day orders (note that the high amount of C72 returns could also be due to empty stocks because of bad forecasts, as it has already been stated).

In RL flows, dealers do not know when the return products are deliver to the corresponding DC. According to Tibben-Lembke and Rogers (2002), track and trace in RL is more complicated and less transparent than in FL. A big difference regarding the transportations for FL and RL, is that in RL, transportation are from many places (number of dealers) to one (or a couple, depending on the number of DCs), while in FL the transportations are the other way around (Tibben-Lembke and Rogers, 2002). Then, dealers rely on the 3PL company and they do not know if the product has been correctly delivered. If there is any problem once the

product has been picked-up, the dealer does no longer know nothing about the related product.

Recommendations:

- *Track and trace.* There is a need of stabilizing lead times regarding returns operations both in FL and in RL.

5.5 Summary of recommendations

So far, the recommendations that have been proposed are:

Table 15: Summary of the recommendations

Related field	Recommendations
Communication	*Data Collection (3PL)*
	Workshops with dealers
	Data collection (Dealers)
	Workshops with workers handling the returns in the DCs
Dealers´ experiences	*Build a new system*
	Reduce procedures' lead time
	Stabilize payment lead time
	Gain knowledge about what it is paid
	Send pop-up notifications
	Self-booking transport
Returns planning and policies	*Measure the performance of each dealer*
	Establish incentives/penalties (Dealers)
	Enhance forecasts
Lead times	*Ensure proper data collection (3PL)*
	Perform lead times measurements
	Establish incentives/penalties (3PL)
	Reduce stock orders
	Establish same day deliveries
	Track and trace

This recommendations correspond to the phase of setting the proper strategies and processes in the performance prism defined by Kennerley and Neely (2002) to satisfy stakeholders' requests (e.g. control the returns flows).

5.6 Performance measurements

According to Asmild et al. (2007), performance measurement and performance assessment are both considered to be crucial in activity controlling and management planning. According to Franceshini et al., (2007) not all the indicators are critical. Critical indicators are those that fairly represent the process, and are called KPIs (ibid). In this section, performance indicators regarding the recommendations provided in the above section are exposed:

i. Track & trace.
ii. Status of the deliveries.
iii. More KPIs.

Key Performance Indicators serve to ensure added value to the company (Hall, Huscroft, Hazen, & Hanna, 2013). In this sections, the KPIs that are exposed have been chosen based on the three main functions of KPIs defined by Franceschini, et al. (2007): *Control* (easy interpretable); *Communication* (easy access); and *Improvement* (easy observability of the real situation).

5.6.1 *Lack of track & trace*

Tack and trace has already been mentioned in the above section. It affects the stability in the pay-back of the returns, the high amount of returns (especially C72 returns), and most importantly it affects the stability of both FL and RL flows, and both dealers and Volvo´s interests.

Currently, track and traceability is not possible for Volvo, nor for the dealers in both the forward and reverse flows. Regarding forward flows, dealers are just told when the products they have ordered (both stock and day orders) are picked-up in the corresponding DCs. Since the lead time for delivery those products are not fixed (it goes from X to X days), dealers are not able to exactly know when those products are going to arrive. This makes the forward flows unstable. To put an example, a vehicle needs to be fixed and goes to a dealer. The dealer is waiting for some products to arrive but those products are having a delay of a couple of day (It has been stated that stock orders for instance have unstable lead times). Therefore, the dealer decides to order the products needed for repairing the vehicle as day order (even if among those products they were also stock components), to ensure, that at least these products will be received the day after. The fact that he could not checked where the original products are, ends up being the reason or ordering a new set of products, which most probably will be returned as code 72 returns.

Track and trace will therefore help to reduce the amount of returns (dealers will know when their products will be delivered), reducing the cost of returns and stabilizing both FL and RL flows. In terms of availability of products in the aftermarket, having track and trace will enable Volvo to better coordinate the flows of goods. For instance, if a dealer returns a product (Dealer A) and another dealer (Dealer B) have ordered this product, Volvo could study the possibility of sending the returned product to Dealer B, instead of sending a product ordered from a DC.

5.6.2 *Lack of scanned deliveries*

The status of the deliveries has been exposed to be: *Delivered* and *Probably delivered but missing scan*. This is related to the importance of the reverse logistics flows, and to the transfer of knowledge from the 3PL service company. From the current data collection, Volvo is not a hundred percent sure that a specific return product has been delivered. The awareness of the RL plays an important role here. Having unidentified products in the DCs is a clear symptom that the return management of the returns should be revised (Dawe, 1995).

In the case of the workers handling the returns in the DCs, it was also identified that the scanning of the returned products are not a priority (since they process them when they have a considerable amount).

5.6.3 *Lack of KPIs*

KPIs are crucial to be able to picture the performance of the reverse logistics flows at a glance. Therefore, it is necessary to be set the indicators that are most representatives of the performance of the practices. Charron (2006) stated that KPIs must be clearly defined. The author proposes, based on the literature review and the empirical findings, the following KPIs:

Table 16: Proposed KPIs

KPI	Description
Communication	An agreement with the 3PL service company have to be established to ensure proper data collection. Regarding the dealer, workshops have to be performed (twice a year)
Awareness of RL	Proper communication to the workers in the DCs and the dealers handling the returns have to be performed, to increase to awareness and the importance the of RL
End-customer satisfaction	Expectations VS Perceptions of dealers' services
Customer satisfaction	Expectations VS Perceptions of Volvo's services
On time pick-ups	Measured from the point of transport booking by the dealers to the point of picking the products up by the 3PL service company
On time deliveries	Measured from the point of picking the products up by the 3PL service company to the point of delivering the products by the 3PL service company in the DCs
On time scanning of the deliveries	Measured from the point of delivering the products by the 3PL service company in the DCs to the point of processing the products by the workers handling the returns
Average end-customer time	Measured from the time of an end-customer entrance at the dealers' expenses to the time of exit
Quick returns procedures	Measured from the point of when the dealer wants to return a product until the transport booking is done
Stable Pay-backs	Measured from the point of delivering the products by the 3PL service company in the DCs to the point of when the dealer receives the payment
% of Sales Vs Returns	Ratio between what it is sent (forward flows) to a specific dealer and what it is sent back (backward flows)
Tied-up capital	Value of the product in possession of the dealer

The main reasons for choosing these KPIs rely on the importance of choosing the right KPIs identified by Charron (2006). The reasons that were considered the most important and applicable to this analysis were the following:

- KPIs set the customer´s expectations regarding performance.
- KPIs can provide an incentive for the provider (i.e. tying KPIs to contracts requirements).
- KPIs offer a realistic way on how performance should be assessed.
- KPIs are greatly related with more robust performance.
- KPIs can identify gaps and "on-going services failures".
- KPIs can be greatly related with an increased in service performance in the long run with the customer and increase communication.

5.7 Evaluation of the recommendations

Based on the recommendations provided above, an analysis of the level of influence and the level of difficulty of implementing those recommendations was performed. The recommendations were compared with the KPIs that were proposed. Symbols with different weight were assigned to each recommendation based on the relationship with each KPI. The more related to the KPIs, the more impact will have in the current practices. Additionally, to each recommendation it is applied a coefficient consisting in the difficulty of implementation. The more complicated the implementation is, either in terms of costs or in terms of incompatibility with the current systems, the less the coefficient is (0,5). The less complicated recommendations have a coefficient equal to 1 (this means that this suggestion is not jeopardized), and a coefficient of 0,75 is applied to the recommendations that have an intermediate level of implementation. The given weights to the symbols are the following:

$$\Delta = 5 \quad ; \quad \Diamond = 3 \quad ; \quad \circ = 1 \quad ; \quad None = not\ related$$

The following table presents the results:

Table 17: Ranking of the recommendations

			KPIs														
			Communication	Awareness of RL	End-customer satisfaction	Customer satisfaction	On time picks-ups	On time deliveries	On time scanning	Average end-customer time	Quick return procedures	Stable Pay-backs	% Sales Vs Returns	Tied-up capital	KPIs Total	Implementation	Total
Actions	Communication	Data collection (3PL)	Δ	◊		○	◊	◊	○				Δ	○	22	1	22
		Workshops with dealers	Δ	◊	Δ	Δ								◊	21	1	21
		Data collection (Dealers)	Δ	◊	Δ					Δ				◊	21	1	21
		Workshops with workers handling the returns in the DCs	Δ	Δ	Δ										15	1	15
	Dealer´s experiences	Build a new system	Δ		Δ	Δ					Δ	Δ	Δ	Δ	35	0,5	17,5
		Reduce procedures' lead time			Δ	Δ				○	Δ				16	0,75	12
		Stabilize payment lead time			◊	Δ					◊	Δ		○	17	0,75	12,75
		Gain knowledge about what it is paid			◊							Δ	Δ		13	1	13
		Send pop-up notifications				Δ					Δ	Δ			15	0,75	11,25
		Self-booking transport			◊	Δ				◊	◊		○	Δ	20	0,5	10
	Returns planning and policies	Measure the performance of each dealer	○	◊	Δ	Δ				Δ			Δ	Δ	29	0,75	21,75
		Establish incentives/penalties (Dealers)		◊	Δ	◊				○	Δ		◊	Δ	24	0,75	18
		Enhance forecasts			Δ	Δ							◊	Δ	18	0,75	13,5
	Lead Times	Ensure proper data collection (3PL)	Δ	◊		◊	○	○	○				Δ		19	1	19
		Perform lead times measurements	◊		○	◊	Δ	Δ	Δ		Δ	Δ			32	0,75	24
		Establish incentives/penalties (3PL)			○	◊	Δ	Δ	◊				◊	Δ	24	0,75	18
		Reduce stock orders			◊	○	◊	◊	○	◊	Δ			Δ	24	0,75	18
		Establish same day deliveries			Δ	Δ	◊	◊	◊	Δ				Δ	29	0,75	21,75
		Track and trace			◊	Δ	Δ	Δ	Δ			◊	Δ		31	0,75	23,25
		Total	34	23	62	62	22	22	18	20	36	28	40	48		Avg:	16,95

From the above and without considering the difficulty of implementation, build a new system is the most relevant action to take to improve the control of the RL flows. However, to build a new system is something for the long term, and it is a costly solution, as well as hard to implement.

It is important to note that the suggestions provided are not independent. For example, after considering the difficulty of implementation, the most relevant recommendation is to perform lead times measurements. This is seen crucial as lead times measurements will provide vital information on how both forward and backward flows are being handled, how the performance of the 3PL is, how fast dealers returns their products, etc. However, in the case of measuring lead times of the 3PL service company, the suggestion of collecting data form the 3PL also applies. Therefore, suggestions are interrelated.

Together with performing lead time measurements, being able to track and trace the products is fundamental, which is shown in the table (second most important results). Recommendations provided under the communication field are seen to be *easy* to implement and appears to be really relevant. This is just a confirmation of what it has been discussed previously (importance of communication).

Regarding the recommendations under the dealer's experiences category, it is believed that this analysis do not represent its importance. This table relates suggestions with the KPIs suggested. The KPIs suggested are more operational indicators, which explains why the results of the recommendations under the dealers' experiences might not be as high as expected.

The following list exposes the five most relevant recommendations, based on the analysis done:

1. Perform lead times measurements. It refers to get the proper data to be able to measure lead times regarding the transportation of goods both in the forward and backwards flows, as well as measure lead times concerning dealers returns (systems wise dealer's experiences)
2. Track and trace. It refers to the availability of both dealers and Volvo to track and trace the products, both in forward and reverse flows).
3. Data collection (3PL). It refers to collecting data from the 3PL service company. Nowadays Volvo is not performing any analysis in the reverse logistics flows. To be able to analyze reverse flows, data has to be collected.
4. Establish same day deliveries. It refers to be able to deliver a product the same day as ordered.
5. Measure the performance of each dealer. Measuring the performance of the dealers (% Sales VS Returns) is a crucial indicator to study. Base on this ratio, measures need to be taken, such as putting incentives/penalties based on the dealer's behavior (revealed as important suggestions).

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6. CONCLUSIONS

This chapter describes the main findings of the thesis. It first reminds the purpose of this work and then it provides a summary of the answers provided for the three research questions throughout the thesis.

The purpose of this master thesis was to *assess the reverse logistics systems that are currently being employed in the focal company and suggest improvements.* According to Rogers and Tibben-Lembke (1998), most of the companies do not know how large reverse logistics costs are. The purpose of study was fulfilled by the mean of three research questions. First, the current situation regarding reverse flows was studied. Secondly, key factors influencing this situation within the focal company were exposed, and thirdly, recommendations to improve the control and the performance of the reverse logistics practices were provided.

RQ 1: What are the actual practices regarding returns within the focal company?

When the thesis started, the author started to realize that the knowledge about reverse logistics within the focal company was limited. Semi-structured interviews were first conducted to gain knowledge about the current practices within the company. Additionally, data collection was harder than expected, since no previous contact with the 3PL service company regarding operational data has been done before. The scope of the thesis was reduced to the Swedish Market, since it was a good representative of the overall market behavior and since the data was more accessible, since the thesis was perform in Gothenburg, Sweden. From the interviews and the data collection, facts and figures were obtained. The forward flows were also studied to understand a bigger picture of the logistics network. The two different types of orders (stock and day orders) were analyzed and compared. Regarding the returns (reverse logistics), several aspects were studied. The different types of returns, the policies behind them, their drivers, their procedures were assessed. Concerning the operational data (obtained from the 3PL service company), volumes and percentage of stock and day orders depending on the category of the return, as well as lead times were studied.

RQ 2: What are the key factors influencing the flow of returns at the focal company?

To be able to recommend actions to take to improve the control and the performance of the current situation within the focal company regarding reverse flows, three was a need of identification the key factors that influence the current set-up. Based on the current practice identified in RQ1, the author identified five different factors to focus on: Communication (between Volvo and both 3PL company and dealers), Dealer's experiences (regarding the systems used to return a product); Returns planning and policies; Lead times; and Performance measurements. This five factors served as a baseline to identify recommendations for improving the current systems

RQ 3: How can the focal company improve the control and the performance of its return logistics set-up?

Once the key drivers of the return transports were identified, it was crucial to further investigate how the focal company could improve in its practices to better handle return flows. Nineteen different recommendations were provided based on the five key factors previously identified. Additionally, KPIs based on the literature review and the empirical

findings were studied. Thereafter, these nineteen recommendations were evaluated with respect to each KPI. After this grading, which provided which recommendation had the most impact if applied, there were given a difficulty of implementation coefficient. The more complicated the recommendation was the less multiplier value was assigned. Thus, these recommendations were ranked based of the impact they have if applied and based on the easiness of implementation. Finally, the best five ranked recommendations were: *Perform lead times measurements; Track and trace; Data collection (3PL); Establish same day deliveries;* and *Measure the performance of each dealer*.

7. FUTURE RESEARCH

This chapter describes the possible future studies recommended by the author.

There are several possible actions to take to further study the current practices of the reverse logistics practices within VTC/VBC.

First of all, data collection only cover a period of time of six months. Seasonality is an important factor to study when performing this type of analysis, and having only six months of data made it impossible. To be able to study seasonality, at least two years of data has to be collected. Thus, it is recommended for future researches to make a study of the RL flows considering two years of data.

Although this thesis focused in reverse transports flows, forwards flows have been mentioned and analyzed. However, no data has been collected regarding forwards flows. From the data extracted, some results, such as poor forecast (in the FL) or high amount of Buy-backs, have come to light. Further research need to take this into account, and make an analysis of the forwards flows, to further validate the results of this master thesis. For instance, lead times of stock and day orders should be studied, as well as the amount of sales compared to the amount of returns for each dealer.

Another study that is recommended to be made is the fact of Volvo doing itself the transportation booking. In the current practice, dealers do it themselves. If Volvo does the transportation booking, data collection will be more accessible since Volvo would already know what products have to be returned. Study that pros and cons of proceeding this way is recommended for future improvements.

Finally, Volvo does not participate in establishing the best route for picking up goods with the 3PL. The 3PL routes are not assessed by Volvo, and the 3PL has the freedom to operate as desired, while satisfying the lead times established in the SOP. If Volvo forces the 3PL to follow a specific logistics network, it would change the route that the 3PL has planned for their own business. The price would certainly increase, but also the dealer satisfaction, as lead times would be more stable than with the current practices. There is a trade-off that needs to be identify between transportation costs and dealer satisfaction.

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APPENDIX 1 –INTERVIEWEES' POSITION WITHIN VOLVO AND THE 3PL COMPANY

Position
Project Manager
Logistics Developer
Contracting Manager
Transport Manager
Process Manager Reverse Logistics
Process Manager Transport Parts
Process Manager Manage Cores
Operations Specialist
Key Account Manager

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APPENDIX 2- TEMPLATE OT THE DEALERS´ INTERVIEW

Administrative Aspects

- Please list the different steps that you take when you want to return a product until you get the money back (e.g. order the return in the system, wait for the return permission, etc).
- Who is responsible for the booking?
- Is it always the same person that places the orders? (Yes/No)
- Could you please check the different inputs that you introduce in the system when asking for a return?
    - Type of return / Weight/ Volume/ Free comments/ Other.
- Which of them are mandatory to be filled in?
    - Type of return / Weight / Volume /Free comments / Other.
- When you fill these fields, are you required to follow any standards (e.g. you choose from a dropdown list already stipulated) or you can freely introduce the information?
    - Follow standards / Freely introduced the information.
- Is it the same procedure for all types of products? (Yes/No)
- If no, what are the differences between the types of products?
- Are you able to track and trace the product that you are returning, so you are aware of when the product arrives to a Volvo hub and therefore when you are going get your money back? (Yes/No)
- Would you like to be able to track and trace your product? (Yes/No)
- How do you think is the administration process?

Administration process	Strongly Disagree	Disagree	Agree	Strongly Agree
It is very easy and intuitive				
It is time consuming				
It is efficient				

- Are you satisfied with this service?

Very poor	Poor	Good	Excellent

- What Volvo can do better in order to facilitate the process? (Please check the improvements you would like to point out).
    - Less complexity in the system for ordering the return.
    - More information about when the pick-up will be done.
    - Be able to track and trace the product.
    - Being informed when the product is delivered.
    - Being informed when the money will be sent.
    - Other:
- Can you think of any limitations in the actual return process?

Planning Aspects

- How often do you place return orders?
    - More than once a week / Once a week / Once every two weeks / Once a month / Other.
- Do you wait until you have a considerable amount of products in order to place any order? (Yes/No)
- Regarding the following categories of products, estimate the percentage that they represent in your return flows.
    - Buy-backs / Core returns / Wrongly ordered / Wrongly shipped / Warranties

Financial aspects

- What is the average time of getting your money back for the overall Volvo return processes?
    - One week / Two weeks / One month / More than a month / Other.
- Are you happy with this amount of time for this service? (Yes/No)
- Do you consider that it could be improved? If yes, please list one (or more) way(s) that you can think of:
- What is the percentage of the revenues created by Volvo returns process with respect of your total revenues?

KPIs measurement

- How would you grade the importance and the benefits of a good reverse logistics process? How would you grade the level of implementation of reverse logistics with Volvo?

Reverse logistics	Very poor	Poor	Good	Excellent
Level of importance				
Level of implementation				

- Could you check which the most appreciated characteristics of our services regarding returns are?
    - Easiness
    - Overall Quickness
    - Reliability
    - Payment methodology
    - Payment quickness
    - Other:

Additional comments

Please, feel free to add additional comments you want to share.