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A 360 degree approach?

Possibility to increase circularity of postconsumer footwear in Swedish footwear industry

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Thesis for the fulfilment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, September 2015

THE INTERNATIONAL INSTITUTE FOR
INDUSTRIAL ENVIRONMENTAL ECONOMICS

Published in 2015 by IIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
Tel: +46 – 46 222 02 00, Fax: +46 – 46 222 02 10, e-mail: iiiee@iiiee.lu.se.

ISSN 1401-9191

Acknowledgements

I would like to express my warmest gratitude to my supervisor, Beatrice Kogg, for her great support and understanding during a tough time, for her honest and profound guidance, and not least, her encouragement for making me continue.

Bona moja, you know *all* who you are. Thank you for always being there to enjoy good times with, for taking the time to listen. You always have something kind to say and your advice has steered me in the right direction. Without your support and love I wouldn't have completed this thesis. I will always be grateful for this.

A special thanks to the Tute: Ronja, for pouring large glasses of wine and for always making me feel like the crazy stories of my day are important. You are absolutely amazing! Tatiana, for being brutally Latino honest with me when I am being ridiculous. Cillian, what would I do without your Irish jokes and English corrections. To Batch 20 and Mespom 9, what would the Tute be without you!

Finally, a thanks to the library in IIIEE. For sharing your wisdom and time, my dear inspirational source!

Abstract

As the consumption of footwear increases, so does the footwear waste. At the same time there is an increased interest to find solutions to close loop channels and adopt circularity of material flow. However, in order to create such circularity it means to overcome the typical barriers to such implementation, which usually are addressed by networking between actors, efficient reprocessing techniques and overall division of responsibilities among all involved actors. There is also a large interest to reach a toxic free cycle of material which complicates the current footwear production as many chemicals and other hazardous substances are still highly used during production of footwear. This research aims to provide an understanding of the possibilities to enhance circular material flow of postconsumer footwear in Sweden. It includes perspectives from various actors in the Swedish footwear market and provides a broad illustration of the different perspectives to enhance a circular approach in the footwear sector in Sweden.

Keywords: Footwear, circular approach, reverse logistic, repair, postconsumer product

Executive Summary

According to the Swedish Trade Federation (Svensk Handel), the Swedish consumption of shoes has steadily increased over the last decade. The footwear consumption in stores has increased with 17.6 % in July 2015, comparing to the same month the previous (Svensk Handel, 2015). On average, each Swede consumes 2.6 kilo shoes every year and the overall consumption is around 9 billion SEK kronor each year (WWF, 2015). Only a few footwear companies have been recognized to produce footwear in a sustainable manner (WWF, 2015). Instead, many footwear producers are using hazardous and toxic chemicals which much is released in air, water and as solid waste emissions. Also, larger extend of the used chemicals during production follows the footwear to the final customer (Naturskyddsföreningen, 2009).

This together illustrates the magnitude of environmental issues which are related to the use of raw material and reprocessing (Jacques & Guimarães, 2012). Traditional economic linear model encourages businesses to extract resources from our planet into products that will most likely be disposed after its first use (Circular Economy, 2016b.). With today's economic model of "take, make, dispose" the physical limits will, sooner or later, be reached (Ellen Macarthur Foundation, 2016). This illustrates also the challenges related to end-of-life disposal of products (Jacques & Guimarães, 2012). The challenge is to overcome the barriers towards a closed loop system that are usually addressed by material reprocessing techniques, collaboration among stakeholders, responsibilities and interest within a company's supply channel (Jacques and Guimarães, 2012; Fleischmann).

What seems to be missing is the recognition of potential responsibilities and collaboration among actors in the footwear industry in terms of reaching a circular approach of footwear material flow and footwear postconsumer reuse and recycling. To succeed with such reverse logistic activities in a company and among its suppliers it is necessary with a strong commitment from all involved actors within the supply chain (Staikos and Rahimifard, 2007). Likewise, it is necessary with external influence to enhance the actors' responsibility to enhance their activities and participation in terms of reaching a circular approach within the specific industry (Carter and Ellram, 1998).

Aim

The main objective for this thesis is to provide a better understanding to enhance circular flow of material in the Swedish footwear industry. The aim is to identify key functions behind such circularity as well as relate drivers and barriers in terms of recognizing potential enablers for the overall system.

Methodology

The methodological part for this research was mainly performed by three main steps. The first step identified the functional actors and the influential actors in a potential circular approach in the Swedish footwear industry, based on the developed analytical framework for this research. In total, six main actors were identified: (1) producers and retailers; (2) third party organizations; (3) shoe-repairers; (4) customers; (5) government and (6) reprocess technique. The second step was to collect the data for this research, which was performed through literature review, interviews and survey. The third step was to develop an approach for the research data analyze.

Conclusion

The traditional reversed logistic literature presented five major functions in terms of increasing reversed logistic activities for postconsumer products. This thesis indicated that more functions should be included to provide a comprehensive understanding of the Swedish footwear industry potentials to increase circularity and postconsumer reuse and recycling. Overall, it resulted in

seven main functions: (1) Use-phase, (2) Repair, (3) Collection, (4) Resale as second hand and charity, (6) Reprocessing and (7) Distribution.

The optimal circular approach for the Swedish footwear industry did not reflect the actual situation. Accordingly to the recognized seven key functions for the Swedish footwear industry there were missing important elements in terms of increasing reverse logistic activities and enhance a circular approach were not recognized. Both participation and networking between all identified functional actors appeared to be weak. Although, the strongest collaboration and networking occurred between retailers and third party providers. Accordingly to the findings, the only worldwide recognized footwear reprocessing technique was Nike's grinding system, which system only could receive athletic footwear. Other reprocessing and recycling actors for postconsumer footwear were also recognized, but they were neither as widely recognized nor had a technical system completely developed to achieve certain efficiencies with the process.

Based on the identified drivers in the analytical framework different actors were differently affected by the drivers. It resulted that actors, the producers and retailers, who introduced the reverse logistic models in-house without professional service from other providers were not much affected by external drivers. However, actors who had outsourced their system and introduced customized reverse logistic models were more affected by its external drivers. The third party organizations that provides the customized reverse logistic system for the retailers and produces verified to be extra sensitive to external drivers due to the high dependency on quality and amount of collected postconsumer products in the reverse logistical models. All actors, producers, retailers and third party organizations, were similarly affected by the internal drivers in terms of introducing reverse logistic models.

The regulatory influence and support was recognized from all actors to be vague in terms of increasing reverse logistic activities and enhance a circular approach for the Swedish footwear industry. A stronger influence from regulation may enhance more actors' participation and collaboration and result into a complete circular flow of footwear material and further reuse possibilities. Their influence may contribute strongest to footwear's longer utilization, repair and reprocess possibilities. Consequently this may benefit both shoemakers' business and the development of reprocessing technique. As footwear with these functional designs will give an easier repair service as well as possible efficiency and purification when the footwear material is separated and reprocessed. Also, a regulatory support to customers may increase customers' participation to provide a better footwear-care in terms of prolonging its life-cycle, and also a participation of collection of postconsumer footwear.

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1 Introduction

It begins to introduce the reader to the thesis background and describing the problem definition. This together automatically leads into the thesis' objective and research questions. Based on the research goals, particular audience groups will be presented as well as its scope and limitations.

1.1 Background

A shoe is a complex product assembled from many different materials, requiring various chemicals in the making. Finally, when the shoe reaches the consumer, it contains a cocktail of chemicals. During the whole lifecycle, from the tanning of the leather until the shoe is finally discarded as waste, a shoe can be hazardous to health and the environment.

(Naturskyddsföreningen, 2009. Page 5.)

According to the Swedish Trade Federation (Svensk Handel), the Swedish consumption of footwear has steadily increased over the last decade. The footwear consumption in stores has increased by 17.6 % in July 2015, comparing to the same month previous year (Svensk Handel, 2015). In average, each Swede consumes 2.6 kilo shoes every year and the overall consumption is around 9 billion SEK kronor each year (WWF, 2015). Only a few footwear companies have been recognized to produce in a sustainable manner[1] (WWF, 2015). Instead, many footwear producers use hazardous and toxic chemicals which much is released into the air, water and as solid waste emissions. Many of the chemicals used during the production follow the footwear to the final customer (Naturskyddsföreningen, 2009).

Footwear as a product differs in many ways within its own product category. A footwear model can include all from slippers to athletic models, boots, sneakers or dressing shoes. Each type of footwear differs from one and another by its choice of material, construction and even its purpose for use. The differences between each type can be significant as a pair of shoes can contain up to 40 different components depending on the type of shoe model. The most common materials are leather, synthetic, rubber and textile. Even more complex is that each material has its own specific characteristics (Staikos, Heath, Hawort and Rahimifard, 2006).

Leather for example, has the highest negative impact on the environment compared to many other materials used in footwear (WWF, 2015). Observing the overall leather production, from raw hides and skin into fine leather to use, the process that contributes the highest impact is the tanning process. (See Appendix 1 about the tanning process and the environmental concerns). Almost 80% of all leather is tanned with chrome, ammonia, sulphides, arsenic, zinc and cadmium. The tanning process is also highly water consumptive as each kilo produced leather requires approximately 35 liter of water (WWF, 2015). The high use of metal and chemicals contributes not only damage to the environment if released, but also a huge risk for workers at all stages because dust from the production is highly carcinogen (Staikos et al., 2006; Rena kläder, 2008). According to the Swedish Environmental Protection Agency the risk classification of the tanning activity is categorized in the same risk zone as oil refineries, paint industry and pesticides production (Rena kläder, 2008).

[1] A sustainable footwear production requires vegetable tanning (using substances from bark and fruit instead of heavy metals), less water use, colors without heavy metal, reuse of color, purify used water before discharging and water-based glue (WWF, 2015).

All this together illustrates the magnitude of environmental issues related to raw material and its processing (Jacques and Guimarães, 2012). Traditional economic linear models encourage businesses to extract resources from our planet into products that will most likely be disposed after its first use (Circular Economy, 2016b). With today's traditional economic model of "take, make, dispose" the physical limits will, sooner or later, be reached (Ellen Macarthur Foundation, 2016). These concerns clarifies not only an unsustainable consumption pattern, but also the challenges related to end-of-life disposal of all products including footwear (Jacques and Guimarães, 2012; Staikos et al., 2006; Rena kläder, 2008).

1.2 Problem definition

Working towards more sustainable products – with less harmful ingredients to environment and humans, higher product utility, design out of waste and reuse possibilities – will not stop the predicted prognoses for our planet but can only delay the inevitable. What seems to be necessary is to alter the entire operating system (Ellen Macarthur Foundation, 2016; Circular Economy, 2016b). It becomes crucial to understand relationships between different parts in an operating system, how these influence and are necessary for one and another (Ellen Macarthur Foundation, 2013). These systems cannot be steered by traditional economic models, it should rather mimic natural ecosystems and adapt a circular economic approach. Circular economy enhance practitioners to think in systems to organize businesses and society and to close resource loops (Ellen Macarthur Foundation, 2016; Circular Economy, 2016b).

On the other hand, the challenge towards closing resource loops is usually reflected with material reprocessing techniques, collaboration among supplier, responsibilities and different interest from all actors in a supply channel (Jacques and Guimarães, 2012; Fleischmann, 1997). Observing the Swedish footwear industry there are different actors involved regarding footwear's overall life-cycle process: the producers and retailers, that produce the footwear and perform point of purchase; different reuse channels for footwear such as donations and second hand markets (Hvass, 2014); shoe-repairers who repair defective footwear material (Sveriges Skomakarmästarförbund, 2015). Though, there is a vague recognition of their potential collaboration in terms of a circular approach for footwear material.

However, the missing part is not a specific identification of an actor's responsibility for footwear's end-of-life treatment (Jacques and Guimarães, 2012; Fleischmann, 1997). Different terms have been used to define and analyze the problematic part of a company's distribution channel and its economic business approach. Several authors have identified necessary activities which companies need to maintain and different decision-making models of postconsumer products "reverse logistic" system or also known as "product take-back" (Fleischmann, 1997; Carter and Ellram, 1998; Klausner and Handrickson, 2000). Reverse logistic reflects the theoretical definition of all operations related to reuse of products and materials from the point of purchase to the point of recapturing material value (Fleischmann, 1997; Carter and Ellram, 1998). While product take-back reflects the markets definition related to producer responsibility, which either are legislative or voluntary choice (Klausner and Handrickson, 2000). Product take-back is also recognized as a collection station at retailers and third party organizations for reusable items or end-of-life products (D. Johansson personal communication, June 26, 2015; I:CO, 2015).

Few have recognized and discussed footwear industry's potential to include such reverse logistic activities or to reach a circular approach. Rahimifard et al. (2009) have during several years researched the development process of a footwear recycling technique and together with others developed a decision support tool for product recovery, decision-making model for waste management in the footwear industry. Also the author have researched and identified drivers

and barriers for a sustainable product recovery and recycling for postconsumer footwear (Lee and Rahimifard, 2012; Rahimifard, Coates, Staikos, Edwards and Abu-Bakar, 2009; Staikos and Rahimifard, 2007; Rahimifard, Staikos and Coates, 2007). All of these researches have mostly been business or industrial specific with goal to find technical and social academic solution in terms of minimizing environmental impacts with a most economic feasibility.

What seems to be missing is the recognition of potential responsibilities and collaboration among actors in the footwear industry in terms of reaching a circular approach of footwear material flow and footwear postconsumer reuse and recycling. To succeed with such reverse logistic activities in a company and among its suppliers it is necessary with a strong commitment from all involved actors within the supply chain (Staikos and Rahimifard, 2007). Likewise, it is necessary with external influence to enhance the actors' responsibility to enhance their activities and participation in terms of reaching a circular approach within the specific industry (Carter and Ellram, 1998).

1.3 Objective and Research Question

The main objective for this thesis is to provide a better understanding of potentials to enhance circular flow of material in the Swedish footwear industry. The aim is to identify key functions behind such circularity as well as relate drivers and barriers in terms of recognizing potential enablers for the overall system. In order to achieve this objective the following questions will be answered:

1. What are the key functions that must be in place in order to stimulate a significant increase of circularity and postconsumer reuse and recycling in the footwear sector?
2. What functions are in place today and which actors are engaged in these functions?
3. Within a Swedish context, what are the drivers and barriers for relevant actors to engage to increase the circular flow of material in the footwear sector and what actions may be required to enhance a circularity of material?

1.4 Scope and limitations

This research is scoped to study only the Swedish perspective and potentials to enhance a circular flow of footwear material. It is further scoped down to only focus on the footwear industry. The main purpose is to understand potential flow between functions and relation of potential actors that acting within reversed logistic systems and actors that have potential influence to enhance the circular footwear material approach. Therefore, it is not of interest to evaluate or analyze any technical parts or aspects to create a circular flow of material. Nor to analyze any specific logistical perspectives, as product flow in a supply chain.

1.5 Audience

The first group of audience that should find this thesis of interest are policymakers and authorities engaged with circular economy and postconsumer products reuse and/or recycling. Practitioners engaged within these questions should find it interesting to take part of the thesis results as it gives an understanding on how to increase a circularity of material flow within a specific product category. It also provides perspective of what kind of drivers are necessary in terms of enhancing a circular approach of material flow.

Other identified audience that would find the results interesting are practitioners acting within the footwear industry. These practitioners are one of the main actors and with highest influence to increase circularity of footwear material flow. Taking part of these results may influence their

actions by collaboration and engagement with other stakeholders with potentials to increase circularity of postconsumer footwear.

Researchers and students may find this thesis of interest as it provides an example of one specific product group possibilities to create circular flow among actors playing in the footwear market. Other actors that may be of interested are researchers and students with an interest in circular economy and postconsumer products reuse and/or recycling.

1.6 Disposition

So far, the reader have been introduced to the background of the thesis. The rest of this thesis is organized as follows:

Chapter 2 presents the literature review and the analytical framework.

Chapter 3 describes the methodology behind this research.

Chapter 4 presents the findings.

Chapter 5 discuss and analysis the findings accordingly to the analytical framework.

Chapter 6 – the closing chapter – concludes the results and reflects the research approach.

2 Literature review and the analytical framework

This chapter intends to provide a literature overview of different definitions and frameworks regarding sustainable responsibilities and treatment of end-of-life products. First, the waste hierarchy and extended producer responsibility are described. Afterwards, a literature overview of reversed logistic models and circular economy is conducted. Lastly the research analytical framework is developed.

2.1 Waste hierarchy and extended producer responsibility

2.1.1 Waste hierarchy

In Sweden and remaining Member States of the European Union, all waste should be treated accordingly to EU's waste hierarchy directive (2008/98/EC). The directive is in line with extended producer responsibility (for further information see the following section "Extended producer responsibility") and the polluter pays principle. The Member States of EU should apply the waste priority order as the figure 2-1 illustrates.

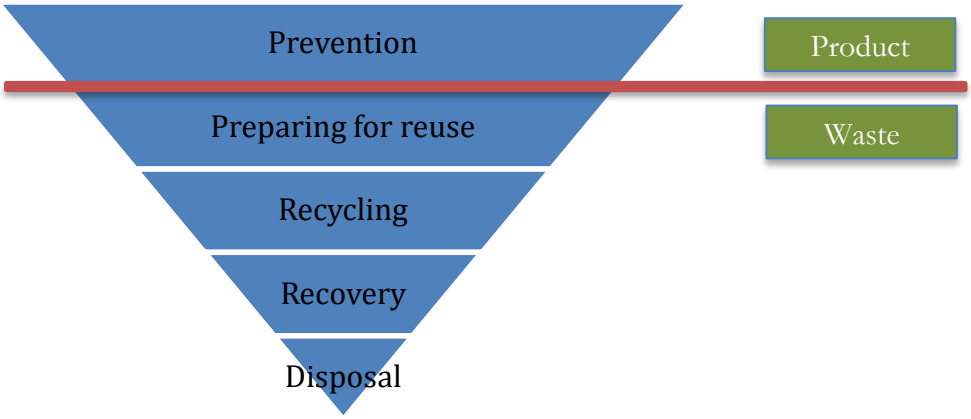

Figure 2-1. EU waste hierarchy

Source: Adapted from 2008/98/EC

The waste hierarchy provides a selective order of action to reduce and manage a country's waste. It aims to give product's maximum benefit and use in terms of minimizing the amount of waste (2008/98/EC). The prevention of waste is a high priority in Sweden and each municipality is searching for better solutions to prevent waste (Avfall Sverige, 2015).

2.1.2 Extended producer responsibility

Extended producer responsibility, EPR, has been widely studied under different contexts but with same purpose. Lindhqvist (2000), one of the first to define, defines EPR as *a policy principle that promotes total life cycle environmental improvements of product systems by extending the responsibilities of the manufacturer of the product to various parts of the product's life cycle, and especially to the take-back, recovery and final disposal of the product"* (Lindhqvist, 2000).

Lifset (1993) describes EPR more as a performance standard. If EPR would have been legally set on a product category the producer would not be legally forced to take responsibility accordingly to a command and control style. Instead, the producer would be free to choose inexpensive solutions and innovate to meet the legal requirements. In such perspective, EPR can be seen as an incentive-based regulation. When producers must comply to an EPR, legally

or physically, then an internalization automatically occurs. As producers becomes responsible for product throughout its entire life cycle, it forces producers to consider environmental consequences caused by its products, which costs cannot be transferred to another third party besides on them (Lifset, 1993). Accordingly to Lifset (1993) there are four underlying motivations for EPR: Firstly to accomplish a higher level of reuse, recycling and remanufacturing; Secondly to influence producers behavior by changing decisions regarding material use and design; thirdly to give incentives to producers and their capabilities as designers and distributers; And lastly, by financial support to create more environmental solutions, especially towards waste management (Lifset, 1993).

King, Burgess, Ijomah and McMahon (2006) argue by legalizing EPR producers will be liable for their products and therefore find solutions at the products end of life. Though, a main barrier for such legalization is to maintain customer's behavior in terms of accomplishing an EPR. The huge culture of fast fashion contributes to massive waste and without smart solution, for either stopping such consumption or collecting the waste, it will become harder for producers to collect and reprocess into new products (King et al., 2006; Hvass, 2014; Birtwistle and Moore, 2007). On the other hand, accordingly to King et al. (2006) the main practical solution and key to true sustainability is to close loop channels by converting waste into new raw material. They refer to four necessary waste avoidance strategies to close loop channels. The first strategy is to repair product's faults and extend its lifecycle. If repair is not possible reconditioning should be adopted by adding necessary components for product's lifecycle extension.[2] When neither repair nor reconditioning is not possible next strategy is to remanufacture products into new product/s with same market value, by its original producer. And the last strategy is to collect material, sort and proceed it in production to produce new products, but not necessary by its original producer (King et al. 2006).

2.2 Definition and review of reverse logistic

Reverse logistic have been widely studied in different contexts but with same underlying purpose. Reverse logistic basically means to use current supply channel and network to take products back from the market (Flapper, 1996; Barker and Zabinsky, 2011; Bernon, Rossi, and Cullen, 2011; Carter and Ellram, 1998; Fleischmann, Bloemhof-Ruwaards, Dkker, van der Laan, van Nune and van Wassenhove, 1997; Krumweide and Sheu, 2002). It is an activity to optimize the aftermarket of a product, thus to save money and environmental resources. From a retail perspective, this activity has always been a fundamental part of the industry. Customers who are unsatisfied with the purchased product return it to original retailer for a commercial decision (Bernon et. al. 2011).

Most of the research regarding reverse logistics have been product or industry specific and mainly focusing on monotone products as electronics, recycled paper, auto parts, carpet, and copiers. In these research reverse logistic have been recognized as a "take-back system", meaning taking back postconsumer products from costumers for further treatment as reuse or recycling of material (Klausner, 2000). This system was primarily created due to efficiencies gained from such products during its recycling or remanufacturing processes (Realff, Ammons and Newton, 2000). Many current recycling systems for glass bottles and metallic parts are based on reverse logistic systems and have been around for a long time due to economic value of material reuse and recycle of the product. Though, these systems are usually based on networks involving more than one actor in terms of saving resources. The original producer can take help from a third party provider that either collects or/and handling the whole process of

[2] For instance, white goods usually goes through this process and are sold after their reconditioning as a "grey goods" on a second market (King et al., 2006).

reprocessing the consumed material (Fleischmann et al., 1997). Meaning, the third party provider controls and maintain reverse logistic activities for the original producer.

From a business point of view there are numerous different decision models for reverse logistic activities. Barker and Zabinsky (2011) developed a decision-making framework based on a multi-criteria decision making model. It is based on two alternative criteria for companies to choose regarding the decisions as having recycling and remanufacturing process in-house (meaning the producer is controlling and maintaining the technical process) or to be outsourced. The two criteria are based on cost savings and business relations with proprietary knowledge. Meaning, if the company has a few strong customer relations and do not have a proprietary product knowledge, then cost savings should be in favor. But, if the company has higher customer relations and proprietary product knowledge investments that need to be protected, than business relation should be in favor (Barker and Zabinsky, 2011). Krumwiede and Sheu (2002) proposed a decision-making model for third party providers. They identified a three-stage flow: retrieval (collection), transportation (including storage), and disposition (two types: on-site and off-site). The authors developed a marketing oriented model for decision making that included researching existing issues and identifying current customers, building marketing channels and identifying a specific niche.

Other previous studies have developed frameworks and decision models to understand and manage the reversed logistic distribution channel's different functions (Flapper, 1996; Barker and Zabinsky, 2011; Carter and Ellram, 1998; Fleischmann et al., 1997 and Krumweide and Sheu, 2002). Flapper (1996) for instance, categorized all activities in the supply channel as "reused" and identified three main steps; collection, processing and distribution. Under each step, a number of trade-offs where presented which included whether collection should come directly from customers and whether to differ collection of different items, whether the items should be reused or recycled, and so on.

2.2.1 Framework of reversed distribution channel

Fleischmann et al. (1997) provide an instructively review of quantitative models within three main fields of reverse logistic; distribution planning, inventory control and production planning. The aim of their framework is to give a perspective of what kind of implications reverse logistic may cause and what is necessary to be considered when implementing such activities. Accordingly to Fleischmann et al. (1997) there are two different underlying motivations why considering implementing reverse logistic activities, which are either ecological or economic motivations. The ecological motivations aim to minimize waste and takes into account obligations as legislation. The economic motivations are more beneficial for the company as it considers remanufacturing to have an economic value compared to extracting raw material. In the sphere of these motivations, Fleischmann et al. (1997) developed criteria for companies before implementing reversed logistic activities. These criteria are explained below.

The first criteria provides the company of identification strategy of their potential actors to plan a distribution channel. The actors can be involved in the forward channel, such as retailers, current manufacturers, and third party provider. In order to create a reverse distribution network necessary functions needs to be recognized. Functions in reversed channel usually are collection, testing and sorting, transportation and reprocessing. A reversed distribution network will be designed after identifying the whole channel as its functions and actors possibilities. For instance, to proceed an early testing and sorting in-house may save transportation cost but will contribute to trade-offs as expensive equipment' and expertise. While outsourcing may contribute lost control over the system's function. Customers' willingness to participate in the process might also restraint the system (Fleischmann et al., 1997; Barker and Zabinsky, 2011).

The relationship between forward and reverse distribution channels should be decided whether to be provide through an open or closed loop system. An open loop system usually covers a recycling process of the product which is usually outsourced to a third party. A closed loop system generally reflects the original producer maintaining and controlling reuse and remanufacture processes. Though, even with same actors acting in reverse channel as in forward may complicate within distribution, collection and transportation as it is handled differently (Fleischmann et al. 1997). Figure 2-3 visualize the relation between forward and reverse channel.

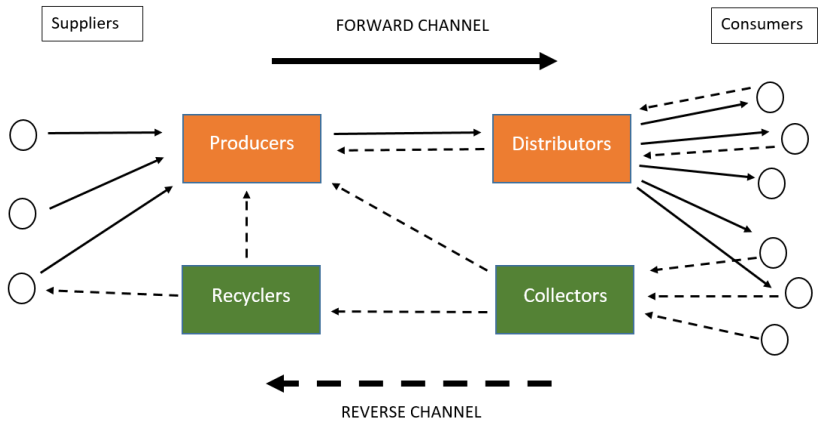

Figure 2-2. Forward distribution channel versus reverse distribution channel

Source: Adapted from Fleischmann et al. (1997)

The second step is inventory control. The producer has two alternatives to fulfil their customer's demand. Either through extracting raw materials and producing the product or through refurbishing and reusing old products into new condition. The goal of inventory management is to control external components and internal recovery process to provide a new product to minimize costs. Though, the main issue is that producers typically have low influence on return control in terms of quantity, quality and timing. It may save costs by refurbishing and repairing old products than producing new products, but it may increase the uncertainty of stock hold of collected product and provide difficult planning (Fleischmann et al., 1997; Flapper, 1996; Barker and Zabinsky, 2011). In this context, repair means that a failed product is repaired with spares. Repairing a product as much as possible replaces a production of a new product, which provide a constant number of products. Though the question is how many spares and repairs can guarantee the available degree of the whole repair system. Trade-offs between inventory carrying costs versus material saving require either one way or the other control order, recovery and disposal (Fleischmann et al., 1997).

The third criteria is to plan production of reused materials. If the product can be directly reused through minor cleaning and repair, no recycling process will be needed. However, those products that are no longer in function should go through a recycling process. The difficulty is to accomplish a management system behind the process, which from a technical aspect requires to be preceded in high quality and efficiency. On the other hand, if the process requires disassembly it will obstruct the recycling process. Remanufacturing is the most complex process as it requires high level of coordination between different parts and subassemblies. The technical aspects may also become a constraint in terms of selecting between different recovery possibilities. The selection depends on products complexity and must consider technical as economic aspects (Fleischmann et al., 1997). The figure 2-4 illustrates production planning's flow from that postconsumer product is received to it becoming a new product.

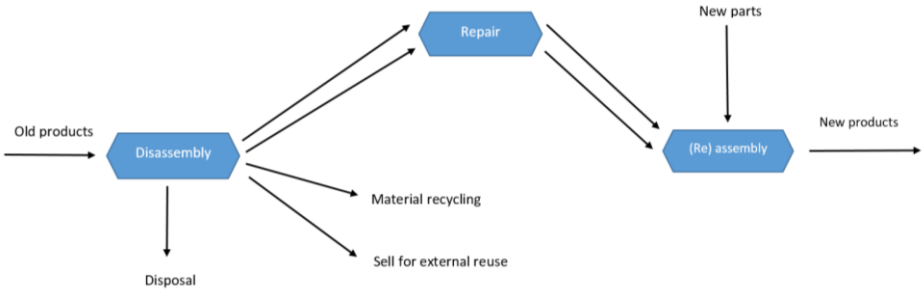

Figure 2-3. Production planning

Source: Adapted from Fleischmann et al. (1997)

2.2.2 Framework of drivers and constraints of reverse logistics

Carter and Ellram (1998) developed a framework for companies in terms of understanding their external environment based on their reversed logistic activity in order to develop a suitable business strategy. The model is constructed on external and internal drivers which could act as constraints if not present. Carter and Ellram's (1998) framework of identified drivers are presented in the figure 2-5 below as external and internal drivers for implementing reverse logistic activities. (Green boxes are external drivers while orange boxes are internal drivers). The external and internal drivers are explained separately below.

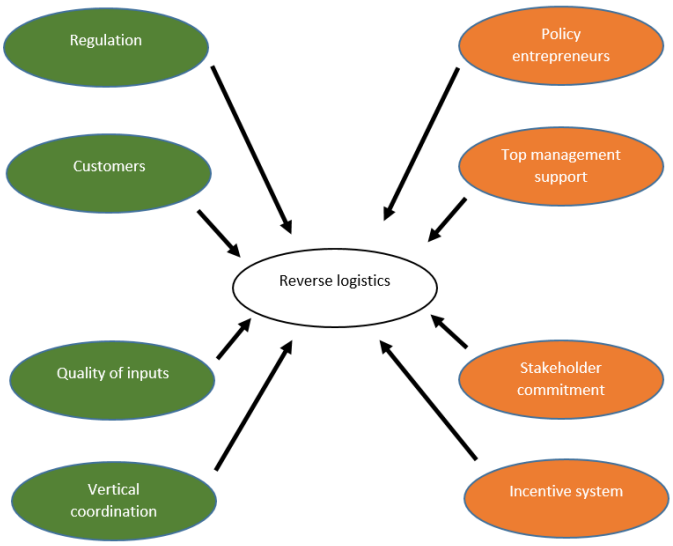

Figure 2-4. External and internal drivers to reversed logistic activities

Source: Adapted from Carter and Ellram (1998)

External drivers. There are three potential external drivers: the first driver has the greatest external influence on company which is either pressure from regulation or customers. If regulation is perceived, the company must proactively lobby and cooperate with other companies from the same industries to adjust regulatory agreement. If customers are perceived to have greater influence then companies should develop green marketing and work closely with retailers. The second driver is the pressure on companies to invest in recycled material to reach an end market and a potential purchaser. The higher environmentally friendly inputs of the recycled material there is, the greater will be the chances to find a purchaser. The company need to work with their suppliers throughout the supply chain to reach a consistency and high level of

environmental friendly inputs. Third driver discusses the importance of vertical coordination in the reversed distribution channel. If a high uncertainty occurs on the market the company should increase their cooperation with their suppliers. If vertical coordination is better between supplier and buyer it will imply a higher level of reversed logistic activity.

Internal drivers. There are three potential internal drivers: First driver implies to create a common commitment with all stakeholders that are involved in reverse logistic activities. It is possible to establish reversed activities without stakeholder's commitment, but for continued success such will become necessary. Second driver implies for effective policy entrepreneurs for a successful reverse logistic system. Top management support is important but not sufficient to ensure success. Last driver imply to establish an incentive system for employees and managers for their involvement in reverse logistic activities. It is not a necessary strategy but it might act as a constraint if not present.

2.3 Circular economy

Circular economy is a recently defined concept and sharing the same purpose as waste hierarchy and EPR. Circular economy compared to traditional linear economic models of "take-make-dispose" provide a systematic thinking where waste becomes new source for fabrication use (European Commission, 2015b; Circular Economy, 2015; Ellen MacArthur Foundation, 2015 and Gregson, 2015). It should be viewed as an approach through the whole product's life cycle, which all stages are linked and requires action, "*from the extraction of raw material, through material and product design, production, distribution and consumption of goods, repair, remanufacturing and re-use schemes, to waste management and recycling*" (European Commission, 2015b). A transformation to circular economy requires adjustment and new strategies to all economic actors across the product's value chain. It can promote innovation, competitiveness, a higher level of environmental protection as human protection, change in consumer behavior towards resource saving and waste handling as well as bringing economic benefits such as job creation and growth.

Though, there are some potential barriers with circular economy. As circular economy requires much collaboration between more than one actors in the value chain there is a risk of a lack of information and split incentives between involved actors. Cooperation with investors that lacking of succeeding internalization of externalities can cause complication for the original actor's business. Other barriers could be potentially from customers and government as lack of involving customers in the system may provide weak price signals and lack of involvement and push from governance may provide ineffective policy tools (European Commission, 2015b).

2.3.1 Stahel's framework of circular approach

Circular economy is also about economic and profit maximization through reuse and service-life extension of goods which provides a resource efficient business model. Though such a business model is dependent on material use and construction of products. Stahel (2013) explains this path with three potential opportunities to enhance maximization reuse of products. This is illustrated in the figure 2-2 below.

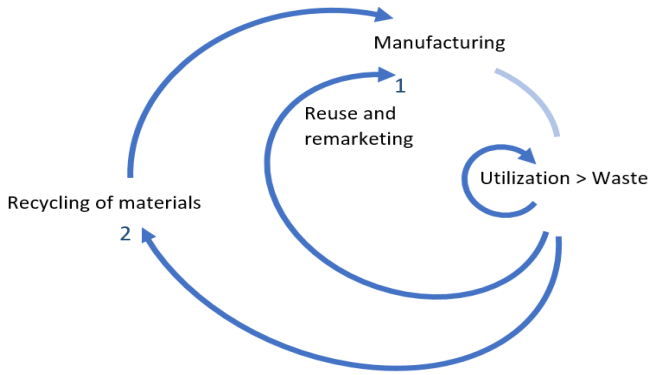

Figure 2-5. Circular economic approach

Source: Adapted from Stahel (2013)

At the design phase, the product should be designed for an optimal use and be given possibilities for future reuse (Stahel, 2013). The fewer times products needs to go through reuse, repair and remanufacturing together with minor changes and the more repeating cycles of re-use, repair and remanufacturing indicates the products high potential material use. It should also design out waste and rethink waste as nutrients for another process (Hopkinson, P. & Spicer, D., 2013). Therefore before entering a market products should be considered for long utilization. Such an approach may require a new relationship and correlation between the supply and demand of supply channels to reach a longer product lifecycle (Stahel, 2013). The remaining two opportunities explain the actual product on the market side. The first loop explains product's life-extension through using techniques of reusing possibilities. Postconsumer product have opportunities to be repaired with minor spares and reconditioned to be used as a new product. The second loop describes the recycling process of end-of-life product's material into new fabricated products (Stahel, 2013).

2.4 Developing an analytical framework

The literature review provided necessary understanding in definitions and concepts in order to develop this thesis framework for use. The development of this thesis framework was based on the thesis research objectives and questions. The main frameworks have been adapted from Stahel (2013), Fleischmann (1997) and Carter and Ellram (1998).

Adding to the framework

RQ1. What are the key functions that must be in place in order to stimulate a significant increase of circularity and post-consumer reuse and recycling in the footwear sector?

RQ2. What functions are in place today and which actors are engaged in these functions?

Potential key functions for a circular flow within a product category was identified from reversed logistic theories. Based from reversed logistic theories five main function were added to the framework for use: (1) collection, (2) test/sort, (3) repair, (4) reprocess, and (5) distribution (Fleischmann et al., 1997., Flapper, 1996; Barker and Zabinsky, 2011; Krumwiede and Shue 2002).

A typical reverse logistic model does not provide an understanding of material circularity nor potential relation between involved actors. Therefore, to understand functions possible and necessary involvement to increase material flow, Stahel's model of circular economy approach

was added. Though, this model will only be used to understand how actors are involved and potential pathways of material flow, and it will not explain neither the economic nor business relations between actors. Therefore in this research it will be hereinafter continued referred as circular approach.

RQ3. Within a Swedish context, what are the drivers and barriers for relevant actors to engage to increase circular flow of material in the footwear industry and what actions may be required to enhance a circularity of material?

In order to understand how actor's engagement and involvement in respective function are influenced by its surrounding and internally, drivers and barrier's where implied. As functions were identified from reverse logistic theories it was fundamentally to continue using same theory background to identify possible drivers and barriers. Therefore, six main drivers were established to have an influence the functions activity of reverse logistical system, which acts as constraints if not presents. The drivers were categorized to external and internal drivers; (1) regulation versus customers, (2) quality of input, (3) vertical coordination, (4) stakeholder commitment, (5) policy entrepreneurs versus top management, and (6) incentive system.

The analytical framework for use

The figure 2-6 illustrates a model with adapted criteria to analyse circularity of material flow for postconsumer footwear. The model demonstrates functions in a circular flow together with drivers from external and interal environment.

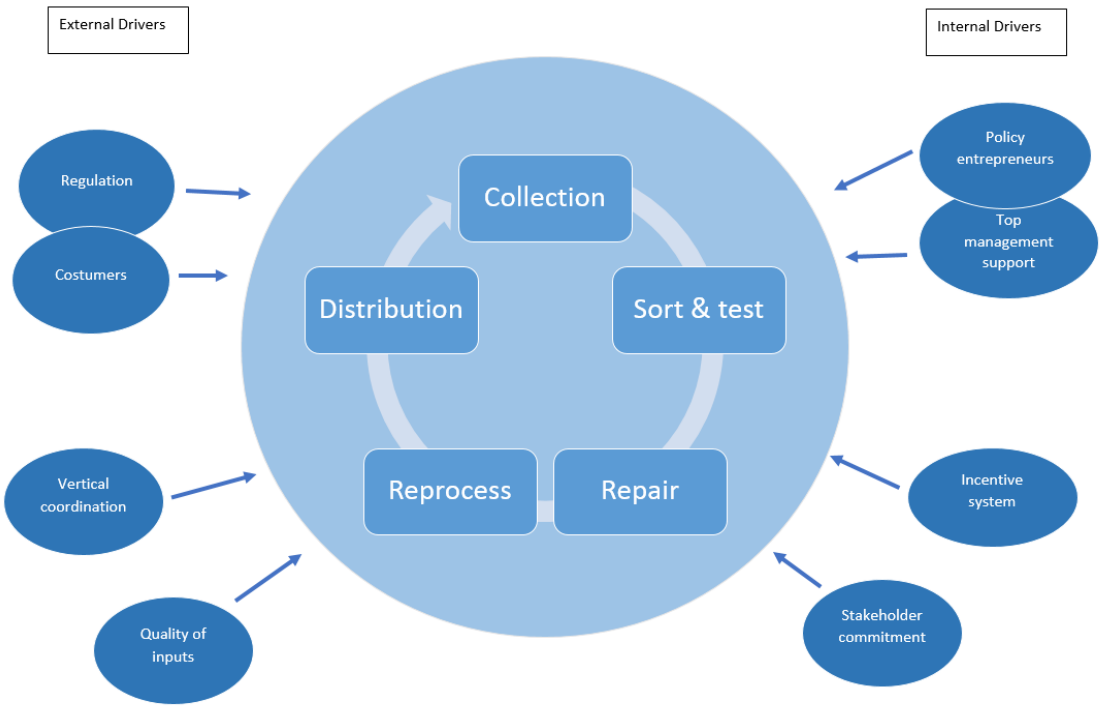

Figure 2-6. The analytical framework for use.

Source: Adapted from Carter and Ellram, 1998, Fleischmann et al. (1997), Stahel (2013)

3 Methodology

The chapter covers description of three main methodological approaches applied for this research. These are the overall research approach, the data collection approach and later data analysis approach.

3.1 The research approach

As mentioned in the introduction chapter, this thesis is mainly focusing on potential to enhance circular flow of postconsumer footwear within the Swedish footwear industry. The literature review provided an illustration of potential key functions to such system and drivers to its maintenance and creation. The following sections will demonstrate this research approach to provide the perspectives from identified actors with either functional or influential involvement to enhance circular flow of footwear material in Sweden.

3.1.1 Mapping of cases (actors)

As mentioned above, the first step was to identify actors behind functions of a footwear's circular material flow. Three functional actors were recognized and are illustrated in figure 3-1. Naturally, as it involves postconsumer footwear it is fundamental to include producers and retailers, and third party organizations. The reason why to include both producers and retailers is because in the overall apparel industry it is common that both producers and retailers have a collection system for postconsumer products.

Such collection system could either be implemented by the originally company as an "in-house" reverse logistic model or the activities are "outsourced" to another company as a "customized" reverse logistic model provided from a third party organizations. Meaning, producers and retailers that cannot implement reverse logistic activities can outsource the responsibility to a third party who in turn provides a customized model after the companies' capabilities. In this case, the third party providers could be either textile collector, second hand-shop or charity organization (Carter and Ellram, 1998; Fleischmann et al., 1997; Hvass, 2014; Flapper, 1996). Note though that these companies will be addressed as a "provider" when referred to producers or retailers customized reverse logistic model and as an "organization" when referred to other models used by the company such as outside located collection containers.

Another type of an actor who potentially could have a functional figure in the reverse system are shoemakers. The shoemaker's business reflects the activity of repair and refurbishment in the reverse logistic system (Fleischmann et al., 1997; Flapper, 1996). With their expert repair-service postconsumer footwear has potentials to extend its life-cycle. Therefore shoemaker's business becomes an interesting part to evaluate by its functional possibilities to be included in a footwear circular material flow.

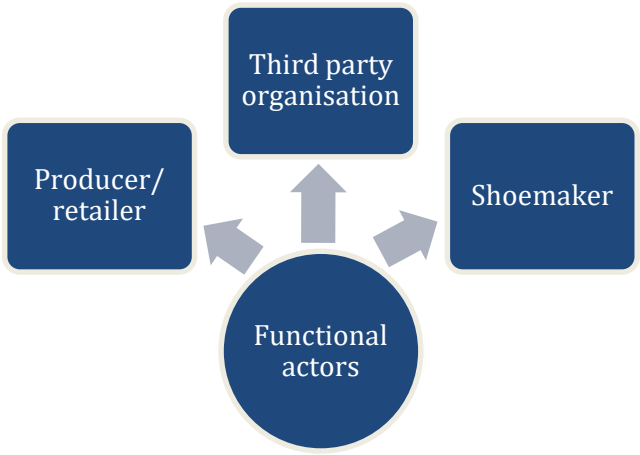

Figure 3-1. Potential actors from the footwear industry with a functional task within the reverse distribution channel

The second step was to identify actors influencing functional actor's involvement in a reverse distributional channel. In this step three major actors were identified which are illustrated in the figure 3-2. The first identified influencing actor to footwear's potential circular approach are customer's willingness to participate (Carter and Ellram, 1998; Birtwistle and Moore, 2007). Without having the users returning postconsumer footwear or asking for repair service, the whole reversed system would be incomplete. For that reason it is crucial to understand customers/users perspectives of their participation and potentially involvement in a reverse distributional system.

Government and other institutional organization have mostly the power by command and control steering and influence activities on the market (Fleischmann, 1997; Carter and Ellram, 1998). Through directives and regulations a circular flow of footwear material can potentially be influenced with more responsible act from functional actors in the whole reverse distributional channel (Carter and Ellram, 1998).

Other important influences are the logistic and technic support to enhance a circular approach and maintain the reverse system (Fleischmann et al., 1997). Without such support a reverse system may not be strong enough to be maintained.

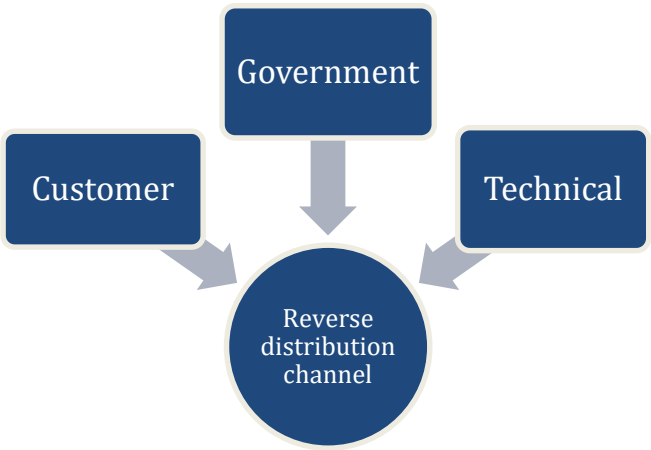

Figure 3-2. Potential actor that may influence the reverse distributional channel within the footwear industry

3.1.2 Selection of cases (actors)

As the mapping process of actors demonstrated to involve multiple various actors this research selected to use a multi-case study. Based on the research aim, a multiple case study could identify key functions necessary place, which actors have an important part and what drivers needs to exist to enhance a circular flow for footwear material.

Totally, six main actor groups were identified from the mapping process. These six actor groups are: (1) producers; (2) third party organizations; (3) repairers; (4) customers; (5) government and (6) reprocess and recycling. As the research aims to take a Swedish perspective each actor was intended to be selected from Sweden. Only one actor group distinguished from all groups and was not recognized specifically to the Swedish market, namely the reprocess and recycling actors. Currently, the recycling systems for material recovery of end-of-life footwear are rare as the technique have many times been identified as not efficient enough or economical feasible. After a large web-search three main recycling systems were recognized on the market: Nike's grinding technique for athletic shoes; A pilot recycling system under development based on Rahimifard and Lee research at the Loughborough University together with AIR and Soex Group; And an European Commissions Eco-program together with the Spanish company El Nautralista shoes made a research how to recycle shoes.

However, the remaining actors were able to be found in Sweden. The criteria for selection of footwear producers or retailers were based on if they have either an in-house or outsourced reverse activates. As a snowball method, this selection in turn recognized third party organizations, as those producer or retailers had out-sourced their activities which automatically the provider was the third party organizations. The repairers for footwear were selected from one city in Sweden, Lund. The searched value from shoe repairer's perspective was to understand their potential function in the system and to give an overview of drivers and barriers for their business. To reach customer's perspective a survey was developed. This survey was conducted in Lund. Actors from government together with other expert were selected due to their potential of influence or to give other important perspective to the potential circular flow of footwear material.

3.2 Approach for data collection

Realization of variety of actors brought the attention to gather data in such way that could easily provide an in-depth understanding of actors' perspectives and actions of their activities within the footwear's circular approach. Therefore interviews and literature review was firstly prioritized. It allows the author to reach deeper data from different actors on the market and also specific information from actors (Kvale and Brinkmann, 2009). In order to reach customer's perspective of the field, a survey was conducted. The following sections will describe how data from interviews and survey were collected for this research.

3.2.1 Interviews

Totally 30 companies were contacted for participating in interviews and 16 interviews were concluded. The contacted actors for interview were producers/retailers, third party organizations, shoemakers, organizations behind footwear material recovery and recycling, governmental organizations and other expert actors. All interviewees were contacted through phone and email, with an introduction about the research and why they as an actor have been selected and thereafter been asked to participate. The interviews were conducted either through an Internet connection as Skype or through telephone and some interviews were conducted face to face. The actors that were not based or settled in Lund were automatically

asked for a Skype or telephone interview while the actors based in Lund were asked to have a face to face, which primarily was shoemakers in Lund.

All interviews were conducted with semi-structured questions in order to retain actors' perspectives and currently involvement to reach a circular approach footwear material. The questions were formulated and focused to reach in-depth knowledge and gave space for follow up questions. The interview questions were also developed for each actor group and accordingly to their profession. Most of the questions were based from what was found in literature review but also from the lens of analytical framework.

The recognized experts for this research had a bit different questioning compared to other actors. The expert interviews were conducted to gain certain knowledge and expertise on the field and as well as confirming the empirical data truthfulness and value. Their questions were either constructed after something identified from other interviews or to confirm and add consideration for the overall research. Many times, during an expert interview, actors gave valuable suggestions and further and important approaches for the research.

All the interviews with shoemakers were conducted through face-to-face meetings at the shoemaker's shops in Lund. The aim was to obtain their perspectives and understanding of the market and what kind of barriers they may have been challenged with during their years as a shoemaker. Note, as these shoemakers come from the same city and have some collaboration with each other. Though all the opinions and knowledge regarding the field which were commonly presented by all shoemakers have been concluded from the Swedish Shoemaker Organization (Sveriges skomakarmästarförbund), an organization for professional shoemakers with the aim to facilitate interaction among members and to work for craftsmanship expertise and survival (Sveriges skomakarmästarförbund, 2015).

3.2.2 Survey

The survey was conducted to gain customer's perspective regarding their willingness to participate and their view of a footwear material's circular approach. The survey contained 10 questions on an A4 paper. Questions were included such as: customers treatment of their shoes with shoe care; how customer are maintaining postconsumer shoes and what is required from customers to increase their participation to leave postconsumer shoes back to retailer or other organizations.

The survey was conducted in Lund at two shopping areas, Lund City and Nova Lund Shopping Centrum. In these two places surveys were handed out to passing customers. All customers were introduced to the field by the author and thereafter asked if they were willing to participate to the research. During these two days, around 40 customers were asked to fulfill accordingly to their perspective of the case. The number of participants is too low to present all shoe customers in Sweden. Instead the survey would be used to understand potentially customer's perspective regarding this field.

3.3 Approach for data analyze

This section will describe a deeper disposition and how following chapters will be presented. The main point is to provide the reader an understanding of the method behind the overall research design. The figure 3-3 illustrates the overall research design in three main parts.

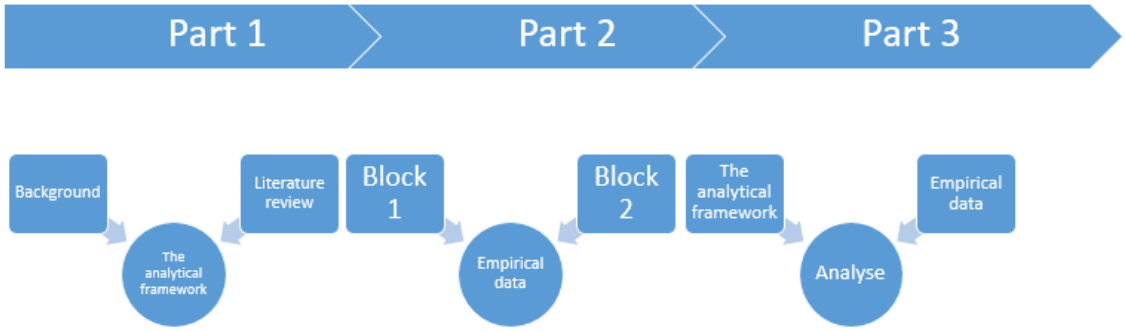

Figure 3-3. The overall research design

The first part covered a research in definitions and frameworks which background is important to evaluate in terms of developing the analytical framework. This part takes place in the literature review.

The second part collects main findings to cover empirical data for this research according to recognized blocks as explained in section 3.1. This part have mainly been based on interviews and survey from participates for this research.

The third part answers and discuss the research questions accordingly and uses the analytical framework to analyze empirical data. The first research question offer the understanding on how potential of an optimal circularity could be visualized for the Swedish footwear industry. This section use identified definitions and terms from the literature review, the analytical framework and necessary empirical data to discuss and analyze this question. The second research question compares the identified optimal approach with the actual Swedish situation for the footwear market's functions and influencer actors. The third research question elaborates further by using the analytical framework to analyze the involved actors drivers and constraints in a potential footwear circular material flow in the Swedish industry.

4 Findings

This chapter aims to investigate the two blocks of functional actors and influence actors, as explained in the methodology chapter. Each block will present three main sections which cover the findings from data collection.

4.1 First block

4.1.1 Producers and retailers

Under this section producers and retailers perceptions together with experienced drivers and barriers of the footwear market will be presented. Producers and retailers play an important role for the overall reversed logistic system as they put the product on market. Several functions are related to these actors plus their actions and contribution to the system's efficiency. Three companies were contacted and interviewed for this part: Stadium, Gekås and NilsonGroup AB. The companies will be presented separately including information regarding their current reversed logistic model and what are/have been drivers and barriers towards the system. The table 4-1 demonstrates each companies functional responsibilities in their reversed distribution system.

Table 4-1. The producers and retailers functional responsibilities in the reverse logistic system

	Collection	Transportation	Testing & Sorting	Resale	Redistribution
Stadium	X	X			
Gekås					
NilsonGroup AB					

Stadium

Stadium is a sport chain retailer and is the largest in Sweden within its category and has been on the market since 1974. Stadium offers all kinds of sports products whereas clothing and footwear are the biggest product categories (Stadium, 2015).

The reverse logistic system at Stadium?

Stadium was the only company among the interviewees that had developed their take-back system (the first step of a reversed logistic model) of customers' postconsumer items, which is also steered by them. It began with collecting reclaimed but reusable products which were further donated to the Swedish charity organization Human Bridge. (See section *Human Bridge* for further information about Human Bridge). After understanding the pathways of current supply chain, Stadium together with the logistic and environmental manager succeeded to develop an in-house reverse logistic model – a take-back system – for postconsumer products. It includes collection boxes at all Stadium's stores, further collection in storage and thereafter transportation from store to Human Bridge's collection facility (D. Johansson, personal communication, June 26, 2015; Stadium 2015).

The take-back system was firstly introduced as a campaign program under the market name Re:activate in terms of increasing collection of postconsumer products. By this campaign customers received a voucher when leaving their used products before purchasing new product. Because of the success, the concept of Re:activate exist all year around and customers

can leave the postconsumer products in Stadium's take-back boxes at any time (D. Johansson, personal communication, June 26, 2015; Stadium 2015).

What are the perceived internal and external drivers and barriers for the reverse logistic system?

Stadium perceives this initiative to be very successful, both in terms of generating high sale profit and high levels of collection and also a strong customer commitment. By giving customers alternative to leave their postconsumer items when purchasing a new one product provides customers the alternative to "do the right thing" (D. Johansson, personal communication, June 26, 2015). Stadium also gained stronger internal commitment among employees after the systems implementation. All employees have received an internal education in terms of maintaining the take-back system from its collection all the way to its transportation from storage. Employees' in-stores are controlling the collection boxes and making sure that boxes are being emptied. When storage is filled it is later transported by Stadium to Human Bridge's sort facility. Stadium collaboration with Human Bridge is contracted that all textile and shoes that are collected by Stadium should be donated only to charities (D. Johansson, personal communication, June 26, 2015).

The decision to implement take-back model at Stadium was derived internally. Stadium's board are highly engaged to do good both for environment and people. Johansson (personal communication, June 26, 2015) the logistical and environmental manager at Stadium remark without the board's commitment the system would not have been successfully implemented. Stadium has invested much time and resources to develop and maintain the system. The process has required much patience as all steps in the take-back must function smoothly as if something goes wrong it can stop the whole process. By the time the system was successfully implemented it had increased the motivation and team spirit among employees and increased their environmental consciousness.

At the market side a main drivers have been to create a value for their customer and a differentiation towards other companies in the same market. The implementation of the take-back system purpose was to contribute and support reusable clothing to not be wasted as well as making customers not feel bad to purchase a new item, without providing them the option of leaving their postconsumer clothing back. Johansson points out that *customer feel well by doing a difference, we earn by selling in exchange and Human Bridge receives more clothing for their organization. In the end, everybody wins* (D. Johansson, personal communication, June 26, 2015).

So far, there have not been any significant drivers for Stadium having the take-back system in-store. Johansson (personal communication, June 26, 2015) mentioned that the potential drivers for Stadium was most apparent during the implementation of the system as it required time, all employees involvement and all activities works under each function in the reversed logistical model. Further Johansson indicates that internal forces and commitment for doing the right thing have been the reason why it is successful and without commitment from both board and staff it would not work as efficient as it does today (D. Johansson personal communication, June 26, 2015).

Gekås Ullared AB

Gekås Ullared AB is Scandinavians biggest department store with 4.8 million visitors every year. They have a wide range of all kinds of product categories, all from clothing and footwear, interior products and technical device and parts. Gekås, also called, offers accommodations for customers who travelled far and wants to stay over the night (Gekås, 2015).

The reverse logistic system at Gekås Ullared AB?

The initiative to introduce the take-back model at Gekås originally started from a research project at Borås University. The researchers at the University studied strategies to increase customers' return of their postconsumer clothing back to original producer or retailer. The researchers created a network whereas Gekås and Human Bridge were included. After the research was finished the contact between Gekås and Human Bridge remained which later developed into a collaboration between the partners (P. De Filippo, personal communication, June 24, 2015).

Human Bridge develops a customized reverse logistic model for Gekås' customers to leave their postconsumer items. The system is maintained and controlled by Human Bridge while Gekås offers a location for Human Bridges' facilities to collect and manually sort the items. The collection occurs outside the warehouse in collection containers, which are located at different spots: close to the entrance, parking, camping area and at Human Bridge's sorting building.

Many of Gekås' customers planning their trips for a long time and usually travel far to reach the department store. The idea is encourage customers to not travel with an empty car instead travel to the warehouse with postconsumer items. It also gives customers a chance of doing "the right thing" for the environment and other people in need before (P. De Filippo, personal communication, June 24, 2015).

What are the perceived internal and external drivers and barriers for the reverse logistic system?

De Filippo (personal communication, June 24, 2015), the CSR business and environmental manager at Gekås remarked that there are two main reasons why implementation of the take-back system began: collaboration between partners already existed and that Human Bridge customized the take-back system to Gekås. Before the collaboration with Human Bridge Gekås did not consider to develop a take-back system for postconsumer items. De Filippo does not think that Gekås could manage to create such system without a help from a third party provider as it requires much time and resources.

De Filippo explains that the underlying drivers for this collaboration was mainly internally driven and that proposed regulations have not affected their decision. There has not been any big barriers with the system so far accordingly to De Filippo (P. De Filippo, personal communication, June 24, 2015).

NilsonGroup AB

NilsonGroup AB are, together with their store concepts – DinSko, Nilson Shoes, Skopunkten, Jerns, Radical Sports and franchise of ECCO Stores – the Scandinavia's leading footwear group. NilsonGroup was established 1955 and ever since then mainly focused on footwear (J. Burman, personal communication, June 23, 2015).

The reverse logistic system at NilsonGroup AB?

In 2014 NilsonGroup started a collaboration with Textile Recycling. Textile Recycling offered a customized reversed logistic model for NilsonGroup. The collaboration started with six stores from DinSko and Skopunkten within Skåne region. Later, the reverse logistic system expanded and today it includes 19 stores within Skåne region. The system is developed to manage reclaimed and reusable footwear from customers. Meaning that customers cannot

leave postconsumer footwear to these store instead the system works only internally. Though, the goal is to develop the system to manage customers' collection of postconsumer footwear through a take-back system at in-stores. Though, the current system is still under a pilot test which is under investigation both for NilsonGroup and Textile Recycling (J. Burman, personal communication, June 23, 2015).

What are the perceived internal and external drivers and barriers for the reverse logistic system?

The initiative to start the collaboration with Textile Recycling came from the board at NilsonGroup. The CSR coordinator Burman (personal communication, June 23, 2015) explains that the NilsonGroup wanted to find solutions to not waste reclaimed footwear that still were reusable. As NilsonGroup did not have resources to develop a reversed logistic system, they started to search for a third party provider that could offer them a customized model suitable for their idea.

Burman (personal communication, June 23, 2015) remarked that NilsonGroup's awareness of the possible upcoming extended producer responsibility for textile but indicates that it was not the main reason behind their collaboration. Rather the trend at other clothing companies who introduced take-back models for postconsumer items inspired them (J. Burman, personal communication, June 23, 2015).

4.1.2 Third party organizations

In this section third party provider's role and responsibility in both customized reverse logistic models and with their other reverse logistic models for postconsumer collection will be presented. Their perceptions and experienced barriers and drivers will be described under each company presentation. The third party providers have been identified from the literature review many times to play a key role for reversed logistic activities. They can provide a complementary function for producer and retailers both saving cost and time by providing service that allows producers and retailers to continue their core business. The table 4-2 demonstrate each company's functional responsibilities in reversed distribution system.

Table 4-2. Third party organizations' functional responsibilities for producers and retailers reversed logistic system

Third party provider	Collection	Transportation	Sort	Test	Resale	Redistribution
Human Bridge	X	X	X	?	X	
Textile Recycling	X	X	X			
I:CO (I Collect)	X	X	X			

Human Bridge

Human Bridge is a charity organization and well-known in the Swedish market for collecting items especially clothing to aid operations and for their second hand shops in terms of generating monetary aid for charitable purposes. Human Bridge collects most of their clothing by collection containers located at recycling centers or close to properties (Human Bridge, 2015). Human Bridge has recently started a collaboration with two retailers, Gekås and Stadium.

What are the drivers and barriers to offer a customized reversed logistic model?

The main aim of Human Bridge's organization is to collect items that are still reusable. Every year around 10-15% of collected postconsumer items are not in a reusable shape. Due to environmental concerns Human Bridge have started a collaboration with Boers Group in Netherlands to find solutions to recycle non reusable textile. Boers Group are specialized in recycling and reprocessing textiles and only includes textiles and not footwear. Though, non-reusable footwear are identified during Human Bridge test and sort process and are thereafter treated as combustible waste (U. Grahn, personal communication, June 26, 2015).

For being a charity organization the main drivers are to keep the core business and to continue the collection of reusable items to provide their aids channels with necessaries. Though they are not the only one on the market. The competition to collect postconsumer textile have increased as more commercial organizations enter the market. The logistics manager at Human Bridge, Grahn (personal communication, June 26, 2015) remarked that many of these new commercial organizations have different and complicated collection strategy compared to traditional charity organization. Grahn remarked that it is important for them as a charity organization to follow market trends and develop similar strategies to maintain collection channels and to increase collection of postconsumer products (U. Grahn, personal communication, June 26, 2015).

Textile Recycling

Textile Recycling collects clothes as textiles and footwear for reuse and recycling. Though, footwear that cannot be reused is handled as compostable waste. Their originally purpose was to start a social company to collect postconsumer clothing by creating job opportunities for people who need of fulltime work. Today, the company has successfully developed and has created more jobs than expected. Textile Recycling collects mainly postconsumer clothing through located containers, collection at homes, collection from estates and collection from NilsonGroup. All collected clothes are tested and sorted by Textile Recycling and thereafter send to a reprocessing company (M. Gaspar, personal communication, June 16, 2015).

Due to contract all collected items prerequisite to be treated or further used outside the Swedish boarder. This is mainly for two reasons. First due to respect for families and friends of a person lost, as it may involve personal feelings for the relative's belonging. The other reason is signed contract with NilsonGroup, as there may be a risk to misuse the retailing system and ask for service such as reclaim or withdraw (M. Gaspar, personal communication, June 16, 2015).

What are the drivers and barriers to offer a customized reversed logistic model?

The regional manager at Textile Recycling, Gaspar (personal communication, June 16, 2015) indicated that the main barrier against the customized model to NilsonGroup was most apparent at beginning of the process. It required many resources to set up a good logistic system for transportation and pick up strategies for collected footwear. As soon as Textile Recycling understood the pathways it became easier for them to develop the model, which today is the company's main benefit. Gaspar hopes to see the model to be further developed and cover more regions for NilsonGroup as well as to become an option for other companies within the same category.

The identified driver is that customized reversed models are convenient and that retailers like the "free service", explained Gaspar (personal communication, June 16, 2015). Though, Textile

Recycling are challenged to find solution to make it easier for retailers to implement a take-back system in-stores and to reach even collection of customers' post-consumed footwear. Though, this will require that NilsonGroup to invest resources to implement a suitable take-back system and to educate employees regarding maintenance of the system.

A different issue that challenges Textile Recycling is the outside located collection stations. Currently, there is no infrastructure that can control the amount collected items in these collection containers. Therefore it becomes problematic to keep infrastructure on a profitable level as it is hard to predict the containers volume. Although, Textile Recycling is involved in a research project to develop a sensor in containers in terms of revealing amount collected clothing which will improve the infrastructure's efficiency (M. Gaspar, personal communication, June 16, 2015).

Another concern is to protect the collection containers against thieves. Textile Recycling is constantly working close with the police to minimize the attacks on collection containers from thieves (M. Gaspar, personal communication, June 16, 2015).

I:CO (I Collect)

I:CO is a part of the Soex Group and is based in Switzerland. They operate in more than 90 countries and collaborates with global companies as H&M, Puma, The North Face, American Eagle and many more. I:CO is also involved in different kinds of global projects to enhance collection of postconsumer items. For example: city initiatives, factories and projects to exchange knowledge and expertise about recycling systems and collections strategies. They are most known for *I:CO collection* in stores. Their business model is to provide clothing companies with a reversed logistic model, which system is controlled and steered by I:CO. Collaborated companies receives goodwill and contribute to a good social and environmental contribution whereas I:CO receives postconsumer items. Some of the companies that collaborate with I:CO give vouchers to their customers as a compensation for leaving postconsumer clothing (I:CO, 2015; T. Zwart, personal communication, June 16, 2015).

All postconsumer items that are collected by I:CO customized take-back systems are transported by I:CO to the closest sorting facility. The sorting and further processing of items are done by Soex Group. Soex is present globally and have sorting and reprocessing facilities in many countries. At the sorting facility textiles are sorted up to 400 different criteria (Racked, 2015). Today, only textiles can be recycled but the aim is to reach zero waste by 2020, meaning that all clothing – including footwear – will be recycled. The recycling that exists today is only available as a mechanical recycling but there are many research projects such as chemical recycling that are running simultaneusly. (I:CO, 2015; C. Gupta, personal communication, October 16, 2015).

What are the drivers and barriers to offer a customized reversed logistic model?

In the beginning of I:CO's business they searched for potentially partners to collaborate with. Today, companies contact I:CO for a collaboration. I:CO (C. Gupta, personal communication, October 16, 2015) remark that a driver for these companies to implement I:CO system is because I:CO can offer a simple take-back model. The model does not require anything from the collaborated companies except space for the collection box in-stores. The remaining functions as control, collection-treatment and transportation from stores are maintained by I:CO. Many of the companies that have a contract with I:CO are aware of environmental concern their company cause and therefore are searching for compensating actions. By

implementing I:CO's take-back model it provides these companies goodwill and provides their customers with an alternative to "do the right thing".

However, even if some companies find it simple and easy to introduce collection boxes in stores, there are still many that find it problematic. As retailers' shopping floors are designed for maximum sale a collection box may become a barrier. Other retailers have identified that their customers view the collection box as a waste bin and address the store as "cheaper with lower quality products" (T. Zwart, personal communication, June 16, 2015). For these reasons, many retailers choose not to introduce a collection system at all.

4.1.3 Shoemaker

Repair and refurbishment is another form of reuse activity, which means that the used product are fixed in a such way that it is possible to reuse without major changes (Rahimifard et. al. 2007). Within a reversed logistic model and circular economy this activity is an essential function to the system in terms of reaching a higher utilization of products. Shoemakers' business have a comparable role in the footwear industry. With their expertise and knowledge footwear's life-cycle can be prolonged for further use. This section present four different shoemakers' perspectives for a footwear's circular approach. In the table 4-3 a presentation of each interviewees company is described.

Table 4-3. Description of the interviewed shoemakers'/shoe-repairman's company

Name of the interviewee & company	**Profession**	**History of the shoemakers'/shoe-repairman's company**
Tages Skomakeri, Tage Månsson	Shoemaker	In 1993 Månsson started his carrier as an apprentice to a shoemaker master. After he received his title Månsson started his owned shoemaker business in Malmö. However, due to tough competition Månsson decided to move his business to Lund in 2003. He bought a shoemaker shop situated on the outskirts of Lund, called *Tages Skomakeri*. Månsson shoemaker shop provides services from minor shoe-repair as gluing textile fibers on footwear to stitching together leather cracks and difficult resoling processes. He also offers key services. In the shop customers can necessary shoe-care products, associated accessories and small footwear collection from Crockett & Jones'.
Skomakaren Henry, Henry Soomus	Shoemaker	*Skomakaren Henry* is located centrally in Lund city where the owner and his co-worker works together. Both have 25 years of experience as a shoemaker. They provide classic repair and refurbishment for footwear. The owner of the shop is more specialized in difficult repair and shoemaking, while the co-worker is specialized in key services. Soomus has during his years as shoemaker created a small collection of footwear and receives order from customers to create footwear for different purposes – most of the times for costumes to theatres. Soomus also provide orthopedic support to footwear. In the shoemaker shop they offer customers classic shoe-care products, associated accessories and small footwear collections from Crockett & Jones and Loake Shoemakers.
Olles Skomakeri & Son, Bengt Nilsson	Shoemaker	Nilsson started as an apprentice to his father in his shoemaker shop, which originally was called *Olles Skomakri*. Nilsson continued his learning process at three different shoemaker masters in Stockholm, Malmö and Helsingborg and has been trained into different ways of thinking and specialization. In 2000 Nilsson took over his father's shoemaker shop and changed the name to *Olles*

		Skomakeri & Son to continue the family name with the announcement that the "son" have inherited the shop. The shoemaker shop is located close to Lund's center. Nilsson provide all classical repair and refurbish for footwear, leather purses, certain leather creation, repair of gears within the category equestrian, and is specialized in orthopedic service. In the shop customers find classic shoe-care products, associated accessories and a small collection of Crocket & Jones.
Sko-Rönne, Per-Olof Nyström	Storeowner	*Sko-Rönne* was established by the shoemaker Carl Ulrik Nyström in 1883. Back then, all shoes were created by hands of Nyström's family. Due to the rapid change of industrialism and fast fashion, the business changed from pure shoemaking into importing produced shoes. This to answer customers' demand and to survive the markets competition. The first shoe store was opened in Klippan at the beginning of 1900th. In 1983 Per-Olof Nyström became the owner and today Sko-Rönne is a store chain in shoes including five shoe store. Before taking over his grandfather's business, Nyström had worked in different shoe manufacturing but never completed a shoemaker education. Even if the core business of today's Sko-Rönne is to sell shoes, their policy has always been to provide their customers with traditional shoe-repair service. Compared with many other shoe stores, Sko-Rönne have a higher range of shoe-care products, associated accessories and offer their customers good and specialized shoe-care information.

Background - what is a shoemaker

The shoemakers have been apparent since long time, but their character and position in society has changed tremendously during the last century. Before 1900 century the only footwear production was from a shoemaker. When a customer needed a pair of shoes they asked the village's shoemaker who thereafter made a pair of shoes accordingly to customers' feet. But as industrialization grew and customer demand increased alongside with fast fashion, the shoemakers business radically changed. With new possibilities of more efficient production footwear has now the chance to be produced in a higher capacity. Eventually the central role of shoemaker in the village slowly disappeared into what we more are familiar nowadays as a shoe-repair business (Sveriges Skomakarmästarförbund, 2015).

To become a shoemaker

There are no laws in Sweden that regulate the title "shoemaker", meaning that anyone can state to have this profession (S. Lindvall, personal communication, October 19, 2015). There are education that offers certificate to those who would like to become a professional shoemaker. There are two optional education either that a person walks as an apprentice with a shoemaker master during three years or through shoemaker education through school.

Within the profession of shoemaking there are three main disciplines a shoemaker can focus on: repair, orthopedic and custom/production. A shoemaker can decide to take more than one discipline certificate. To finish the education apprentice need to conduct an examination work based on learned skills. During examination time two shoemaker master are present to control and inspect apprentice's work. When examination work is approved apprentice receives its journeyman certificate. After six years in the shoemaker business, a journeyman can complete an examination to become a shoemaker master. A shoemaker master examination is different depending on the selected examination discipline. The examination is similar as the first test, but during the second test journeyman must demonstrate good experience skills of shoemaking

plus prove knowledge within business and economy as accounting and costing. When master examination work is approved, the journeyman becomes a shoemaker master (S. Lindvall, personal communication, October 19, 2015; Sveriges Skomakarmästarförbund, 2015).

To work with todays produced footwear

All interviewed shoemakers began their business based on interest and hobby of shoemaking (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015). Though, there are some constraints to be a shoemaker in todays' society. Accordingly to the Swedish shoemaking alliance a lot have changed since early 1900 century (Sveriges Skomakarmästarförbund, 2015). The fast fashion has changed both footwear's construction and containments in terms of responding higher demand and lower prices. In past shoemakers worked mostly alone with slower tempo while nowadays it requires more modern equipment and rational thinking from shoemakers to keep up with today's manufactured footwear. Many of the equipment and machines need to have an air-cleaning function for dust and other dangerous particles. If shoemakers do not use such technique it may cause huge harm to them (Sveriges Skomakarmästarförbund, 2015).

Currently, there are no requirements on a footwear producer to provide information regarding the amount of chemicals and what kind of chemicals have been included during the production process. This makes it hard for a shoemaker to identify right instrument in terms of conserving possible chemicals that still are around the footwear during repairing process (Sveriges Skomakarmästarförbund, 2015). The biggest issue is usually the outsole as soles usually are attached with glues containing highly dangerous chemicals. These glues are already dangerous to inhale for the workers who work firstly with it, but it may be dangerous for shoemakers who provide repair on the sole (Naturskyddsföreningen, 2009; WWF, 2015; B. Nilsson, personal communication, August 13, 2015). Therefore are all shoemakers recommended to use proper protection when working with all kinds of shoe-repair[3] (Sveriges Skomakarmästarförbund, 2015).

The quality of footwear

Nyström (personal communication, August 13, 2015) stated that during his years of working the major difference he has noticed is the footwear's material. Today, more footwear on the market contains synthetic or plastic materials. These materials are typically harder to be "worn-in", meaning it requires a longer time for customers to make their shoes comfortable accordingly to their feet. And synthetically and plastic materials are difficult to treat with shoe-care which may complicate footwear's potentials to receive further repair or refurbishment. Also, fashionable trends with applications of components as rivets and glitter may destroy footwear's material and continuously complicates the refurbishment process (P. O. Nyström personal communication, August 13, 2015).

Further observations are the larger extend of footwear entering the market with thinner soles and bad construction but also with misleading market price. This usually confuses customers as they believe the price reflects a certain quality of footwear (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015; P.O. Nyström, personal communication, August 13, 2015). All shoemakers referred to valuable differences of quality and less quality

[3] Månsson remarked that previous owner suffered from glue-allergy as for many years being exposed to highly toxic glue, which eventually lead him to resign and sell the shop (personal communication, August 12, 2015).

shoes in terms of providing right repair and refurbishment service. The better quality and choice of material the footwear contains the easier it is to keep footwear longer by simple repair during longer time intervals (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015). While less quality shoes, usually cheaper produced with planned obsolescence, requires more specific repair during frequent time intervals.[4]

Another observation is that much footwear is made of plastic soles, which usually are found with warm based glue. A found sole without any sewing will eventually fall apart as glue breaks down with time which will occur in any quality condition. Depending on which condition the shoes have been exposed, the durability of the sole could either be extremely short or continue for a longer time. Anyway, a sole that falls apart will, by repair, be replaced by a new sole which is either glued or sewed back, depending on footwear's current construction and original material (B. Nilsson, personal communication, August 13, 2015).

The typical repairs made from shoemakers

The most common repair done by shoemakers, regardless of quality, are on shoes' outsole and upper part. The outsole is most exposed as this part is in constant contact with the ground during the use. The usual fault is that the sole has been "worn down", meaning until the footwear is not reusable anymore. The damaged parts usually include burst heel part or a sole. In such cases a customized sole could be adapted or in worst cases the whole sole need to be replaced with a new one. Another common fault is on the upper part of footwear such as broken seams and edgings on the shaft and heel's side part, which mostly are easy to be repaired (Sveriges Skomakarmästarförbund, 2015; B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015; P.O. Nyström, personal communication, August 13, 2015).

Accordingly to all interviewed shoemakers most of the footwear is repairable (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015). Though, repair is different depending on footwear's material, construction and current condition. If footwear is not repairable the shoemaker will make sure customers are aware about the issue. Mostly, all types of footwear can be repaired but the question is rather if it is feasible to repair all footwear. As a lower quality shoe tends to have a lower functional structure a repair may not be reasonable option as it may require same and frequent repair. This is usually the case when footwear's outsole has been found and construction's quality is lower to be replaced by a new sole. If that is the case a shoemaker will make sure customers understand the reasons before making an agreement (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015).

Who are the customers?

The amount of work for shoemakers varies on seasons. It tends to be more customers during autumn than spring because in that time customers bring out their winter collection from the closet. Often customers have forgotten to treat their winter collections with shoe-care before

[4] To understand differences between qualities of footwear can explained from a dressing shoe. Quality dressing shoe have a filling in sole of cork as it is a preserving material with long durability. Less quality dressing shoes are usually stuffed with paperboard, which break quicker and flattened down. This create an empty space in soles gives an annoying sound when walking. To repair the fault, it need to open outsole and fill the empty part with filling, usually with cork. Quality dressing shoes also have a metallic "holder" to hold the sole in right shape. In less quality there is instead wood board and after frequent use the wood board will eventually break down (B. Nilsson, personal communication, August 13, 2015).

using next seasons' collection. Another reason could be that customers are more obliged to treat their winter collections compared to summer collections due to original purchase cost differences (T. Månsson, personal communication, August 12, 2015).

None of the interviewed shoemakers mentioned a specific type of customer. Instead, all described their customers with all kinds of backgrounds. Customers could be all from students, middle-aged and seniors (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015). For instance, customers could be a student that would not like to replace their best pair of sneakers with a new pair or a senior with their favorite pair of dressing shoes which they never will find on market again (T. Månsson, personal communication, August 12, 2015). Some customers are environmentally conscious and aims to prolong footwear's lifecycle as much as possible. Other customers have a personal connection to their product, as inherited from a family member (B. Nilsson, personal communication, August 13, 2015).

Further important reasons are footwear's comfortness. After time of use the footwear may reach perfect fitting to customers' feet. Therefore many customers ask for a shoemaker service to prolong their footwear (T. Månsson, personal communication, August 12, 2015). Customers also request changing design of their pair of shoes, as shape of the heel, add a rubber outsole, rearrange innersole for orthopedic reasons and change the shoe's original color and so forth.

Potential drivers identified by the shoemakers

All interviewed shoemakers agreed that the first potential improvement to reach a higher footwear utilization is by pushing customer taking more care of their footwear. Moreover, it is important that customer also recognize in time when to ask for repair service before the pair of shoes are completely worn out (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015; P.O. Nyström, personal communication, August 13, 2015). Månsson (personal communication, August 12, 2015) points out that shoe-care information should firstly be provided during the purchase transaction to customers. Also, customers need to understand what kind of footwear they purchase. As most footwear models, in any material or construction quality, can be treated with proper shoe-care. To not listen to shoe-care advice may shorten footwear's life-cycle significant. At the same time, as much it is on the customer to become more aware, it is also important that producers change he material and construction of footwear to reach higher utility (T. Månsson, personal communication, August 12, 2015).

All interviewees agreed that if customers become more aware about quality differences they will be able to put more pressure on footwear producer (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015; P.O. Nyström, personal communication, August 13, 2015). Customer need to gain more knowledge to better recognize the difference of quality footwear. A suggestion from Soomus (personal communication, August 19, 2015) is to create a certification system that provides information of footwear's quality and ability for further repair and refurbishment. Such certification may contribute customers becoming aware of their product and therefore leading to take more action by using proper shoe-care more frequently (H. Soomus, personal communication, August 19, 2015).[5]

[5] All footwear are requested to be labelled regarding material containments. Three footwear parts must be claimed: upper part, innersole and outsole. Four signs exist to reflect the material containments which are: leather, plastic/rubber/synthetic, leather treated with plastic/synthetic and textile.

4.2 Second block

4.2.1 Customer's influence

The following section present customer perspectives and behavior in relation to use and disposal of footwear. Costumer's decisions to repair, take-back or discard products during use-phase affects its life-cycle (King, et al., 2006). In this research a survey was made to understand how customer act and reflect during footwear's use-phase and disposal. The results from survey are presented accordingly: each question has a background description regarding the issues relevance, measurements used to answer the selected questions and finally the results.

Customers' maintenance of footwear

Background: By using shoe-care products, such as shoe creams and shoe-blocks, it can help to prolong the life-cycle of footwear. The user can be ensured by providing proper care to shoes it increases the longevity to wear. (Crockett and Jones, 2015). Footwear's use-phase in general has less environmental impact during the use-phase, therefore it is of interest to prolong this stage of the life-cycle as long as possible. Accordingly to interviewed shoemakers agreed that customers often are less likely taking care of their footwear. Even with guidance customers choose many times to purchase new pair of shoes than taking care of their old pairs (B. Nilsson, personal communication, August 13, 2015; T. Månsson, personal communication, August 12, 2015; H. Soomus, personal communication, August 19, 2015).

Measurement: Two main questions were developed based on aforementioned background. The first question asked how much shoe-care consumers put on their shoes: "regularly care for all shoes", "care only when it is necessary on all shoes", "care for specific pair of shoes" or "never used shoe-care for any shoes". The respondents were only allowed to select one option. The second question asked if respondents have received shoe-repair or refurbishment service from a shoemaker. If answering yes, the respondents were given multiple answers; "The pair had a fault, but were still usable", "I liked the pair of shoes and did not want to discard them" and "I found it important to prolong shoes life-cycle as much as possible".

Results: Figure 4-1 provides the percentage of customers' frequent use of shoe-care. Only 3% used shoe-care regularly for all pair of shoes. The majority of 43% used shoe-care only for specific pair of shoes and 41% used shoe-care on all shoes only when it was necessary. 13% of respondents had never used shoe-care on any of their shoes.

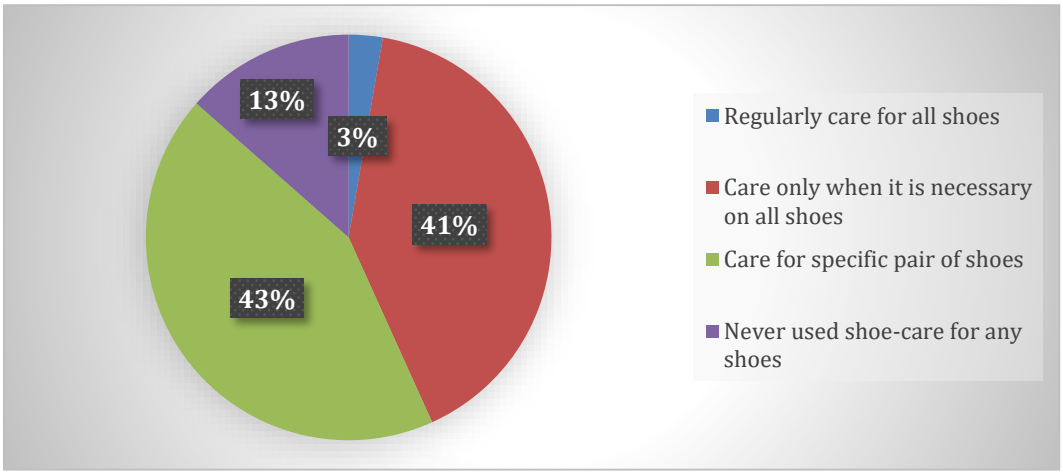

Figure 4-1. How much time is consumed for shoe-caring.

Almost 60% of respondents have received shoe-repair or refurbishment from a shoemaker. (The remaining 40% had never received shoe-repair or refurbishment for their pair of shoes).

The second question covered reasons why respondents have received shoe-repair service. The majority 43%, answered that the pair of shoes was still usable and needed a simple repair. 38% had a personal connection with their pair of shoes and did not want to discard them. And 19% considered it is important to prolong the life-cycle of the pair of shoes as far as possible.

Customers willingness to participate

Background: Customers' participation to increase collection of postconsumer products have been many times recognized as a barrier (King, et al., 2006; Rahimifard, et al., 2009). Their participation is the key to a business' reversed logistic model and without their participation the system would become inefficient (Carter and Ellram, 1998). Customer control their own perception which affects their action and behavior regarding how to discard postconsumer products. A study about sustainable consumption and consumer behavior made by Mistra Future Fashion (Gwozdz, Netter, Bjartmarz, and Reisch, 2013) studied textile recycling attitudes and reasons for discarding. The study resulted that people are more obliged to donate than reselling their clothing items. Although, if people choose to resell their own items the reasons were due to items being out of style and to recoup some of original cost of the items. The researchers also covered different favorable disposal options among the respondent. It resulted in almost 73.7% of the clothes were passed on to family and friends and the second most favorable option was donation to charities 60.9% (Gwozdz, et al., 2013. p. 54-56).

Measurements: Based on this background, three main questions were developed. The first question covered different discarding options for postconsumer footwear. The question allowed multiple answering and five options were given: "donating to charity", "selling on second hand", and "passing shoes on to family/friends", "take shoes back to store/producer" and "throw shoes in household trash.

The second question asked if there existed an interest to return postconsumer footwear through a take-back model at retailer or producer with options of "yes" and "no". If no was selected the respondents had multiple choices why they would not like to return shoes back. Respondents were given four options: "hard to go back to the store with the pair of shoes", "embarrassing to go back to the store with your used pair of shoes", "rather donate the pair of shoes" or "rather sell the pair of shoes on second market".

The third question asked if customers may be more willing to use the footwear take-back model at retailers and producers if customers were awarded with a compensation.

Results. The figure 4-2 illustrates the first question's answers. Up to 33% of respondents were obliged to donate their pair of shoes. 22% rather sold their shoes on a second hand market. 20% would pass their reusable shoes to family and friends. 22% considered to throw their shoes in the trashes. And barely 2% considered to leave shoes at producers and retailers.

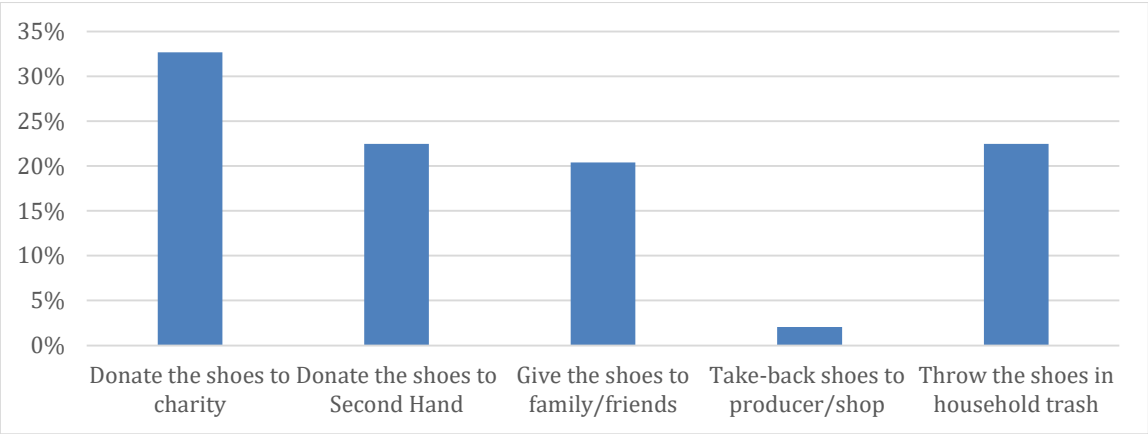

Figure 4-2. What ways the respondents selects when discarding their postconsumer footwear

From the second question the attitude regarding leaving postconsumer footwear to a retailer demonstrated a different scenario. Based on this question 54% of the respondents selected that they were willing to go back with their old pair of shoes.

The figure 4-3 shows the percentage of respondents' choices why discarding postconsumer shoes at retailers or producer would not be an option for them. The dominating answer was that customers rather sold their pair of shoes on second hand market or donation.

The last question was developed to understand if customers were more obliged to use footwear take-back model at a retailer and producer if a compensation was given. 81% of the respondents were more obliged but 5% would not return postconsumer shoes even with a compensation. 14% of the respondents would have participated in a take-back system regardless if compensation was offered or not.

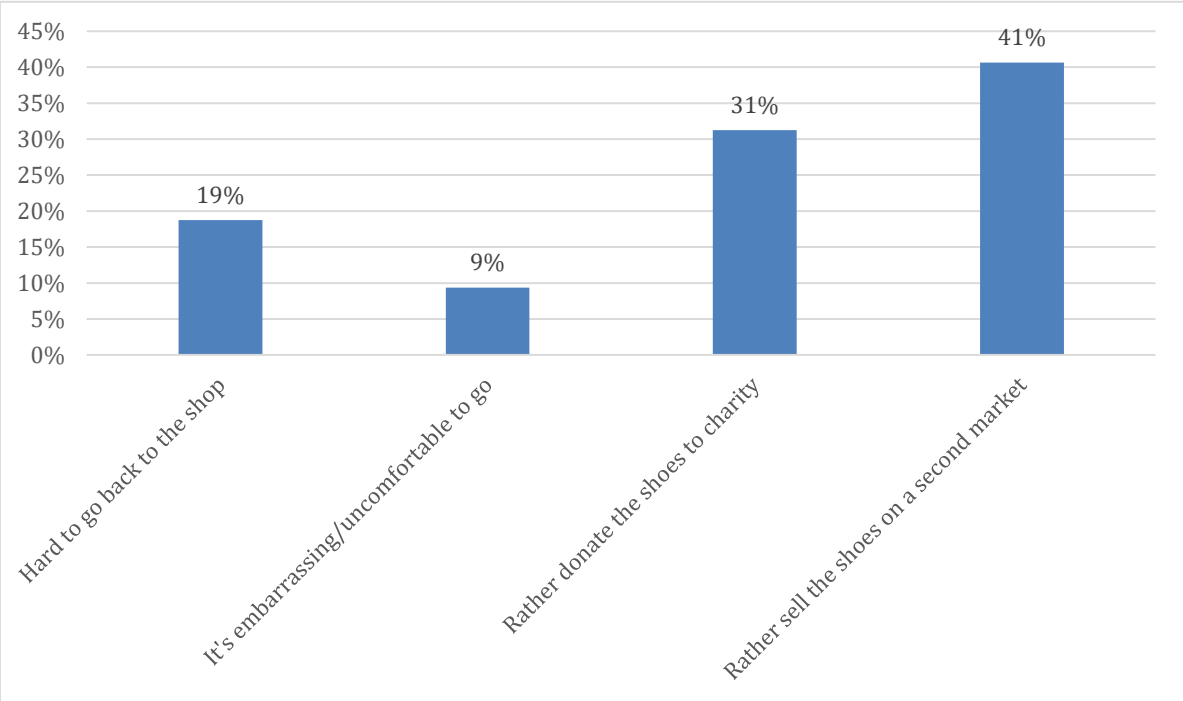

Figure 4-3. The attitude towards leaving postconsumer footwear at producer/ retailer

4.2.2 The technical influence

This section presents recognized reprocessing and recycling techniques for footwear. A product that is no longer reusable and contain material of high value should be recycled as raw material for new products. Recycling reduces not only amount of waste and use of traditional raw materials but also saves energy (European Commission, 2010).

The table 4-4 demonstrates the findings of reprocessing and recycling techniques that have been identified based on internet searching. Some techniques are currently in process and function while the others are at present under pilot testing. The table also provides information regarding recyclable footwear models by each technical system, process of separation and recovered materials' end market.

Table 4-4. Identified actors and reprocessing/ recycling techniques for footwear

Company/ Project	Technique	Footwear models	Separation process	End market
El Naturalista & European Commision (A two year project)	Supplies a company with postconsumer footwear	Footwear from El Naturalista	Crushes and separates components for further material reuse	Recovered material used in different fields as paving, speed reduction devices, children's playgrounds etc.
Nike	Grinding (A recycling equipment only set for materials from athletic footwear)	Athletic footwear from Nike and other brands	Three slices: (1) Rubber outsole	Nike Grind Rubber: Material use in surfaces as track, playgrounds, gym flooring tiles, trim items as buttons, zipper pulls and in some of Nike's products as outsole of Nike's Pegasus or Jordan XX3.
			(2) Foam midsole	Nike Grind Foam: Used as a cushion for tennis court, futsal fields and in outdoor basketball.
			(3) Fiber upper	Nike Grind Fiber: Used in creation of cushioning pads for facilities as indoor wood and synthetic courts.
Footwear Recycling Pilot	Air-based recycling technology (Second step – material separation)	As a start, all footwear waste comes from sorting plants of SOEX Group. (2015-17.)	Currently mainly 6 steps: (1) Shredder: Footwear can only go through a mechanically separation.	The recovered materials potentially end markets are: Leather: to produce leather sheets. Could also be used as a fertilizer (depending its containments of
			(2) Metal separator: Separating metals by a sensor detector.	
			(3) Delamination mill: Separating textile and foam.	

			(4) Air Separation: Remaining particles goes through a vibrating air table. Supplied air separates leather by lifting particles up. Rubber, which particles are heavier, falls off the table through vibration.	chromium). As insulation material Rubber. Surfacing products, matting and decking Foam: Be used as an underlay material for floors and carpets. Textile. To construction work, into sound proofing products and insulation materials for buildings. Metal. ?
			(5) Leather process: Proceeds through a fine grinder to turn into leather powder. Rubber process: Proceeds through a granulator and later a fine grinder to turn into rubber powder.	
			(6) Extruder: Extruding each material powder into pellets – leather polymer pellets and rubber pellets.	

Source: El Nautralista 2012; European Commission 2015; Nike 2015; The Guardian 2015; Marias and Lee, 2015; Lee and Rahimifard, 2012

El Naturalista

El Naturalista is a footwear company and it has been involved in many environmental projects and research. During 2010-2012 the company was involved in a project called Eco-Innovation together with European Commission. The projects aim was to reuse footwear without the need of separating components and thereafter add it to footwear products, such as sports and safety sectors. The purpose was to not lose material and components natural value (European Commission, 2015; El Naturalista, 2012). The projects results were: new grinding systems to obtain a milling compound; new products of footwear sectors (soles and insoles) that use recycled post-used shoes; new products of other sectors (flooring, safety articles) that use recycled post-used shoes. The material from grinding can either be used for El Naturalista's footwear products as into soles and insoles. Remaining of outcomes is not used by El Naturalista instead sells to other industries as flooring or safety articles (European Commission, 2015; El Naturalista, 2012).

Nike

Nike's grinding technique is world known, mostly because Nike is the only large scale producer that has all functions that is required to steer up their own grinding facility. Since the early 1990s, Nike's recycling program "Reuse-a-shoe" have been collecting outworn athletic shoes – both from Nike and other brand's – to reprocess it into new products. Nike has used the recovered material into a few footwear collections and create different athletic surfaces by working closely with related organizations (Nike, 2015). The program has been a success since the start and over than 28 million pairs of worn-out athletic footwear have been collected, which yearly are around 1.5 million pairs. They only focus to receive worn-out, as the mission is to decrease their worn-out footwear ending in landfills. Nike is encouraging their customers to donate footwear that are still reusable (Nike, 2015; The Guardian, 2015).

Footwear Recycling Pilot

The footwear recycling project was founded in 2012 at a lab scale, where the separation technique for footwear was firstly tested. At that time the separation could only be used at a small scale. In 2014 the technique was developed at Wolfen in Germany and it succeeded to separate footwear materials in larger extent. This technique is able to separate all kinds of leather and rubber footwear. Although, the whole concept is still observed as a research project. The project's aim is by 2017 to improve purity of material separation, especially for leather and rubber footwear. The project also aims to discover possible market for recovered material and developing network with end-users. Lastly, the project intends to create an eco-design guidelines for footwear producer in terms of reaching higher separation efficiency and cleaner end material (Marias and Lee, 2015; B. Marias, personal communication, June 26, 2015).

4.2.3 Government influence

This section covers important interviews with identified experts for this research. Their perspective of the thesis objective is described together with their observations from the Swedish footwear industry.

The Swedish Environmental Protection Agency - Naturvårdsverket

Currently, there is no regulation in Sweden regarding waste responsibilities for the product category textiles and footwear. Although, there is an EU directive regarding waste treatment providing all member states to implement a waste prevention plan including goals and aims of how to minimize environmental impact by waste and amount waste including toxin substances in material and products (2008/98/EG). In Sweden the Swedish Environmental Protection Agency has the responsibility to create this prevention plan. So far, the prevention plan contains 8 main goals together with over 160 measures for all sectors included. The measurements aim to increase recycling, reuse and contribute to toxic free cycle (Naturvårdsverket, 2014a).

The Swedish Chemicals Agency - KemI

The Swedish Chemicals Agency KemI, are constantly working closely with Naturvårdsverket with many of the projects regarding producer responsibility and other similar research. A legal research made by Kemi included environmental quality goals in terms toxic free cycling of materials. The research investigated if same requirements of toxic free containments should be on new produced products as on products produced from recycled material. Products produced from recycled materials have proven difficult to confirm its nontoxic containments. There might always be a chance of impurities or other additives that no longer are in use for new produced material and therefore could cause problems during recycling process. Consequently, to accept recycled material without questioning its containments of toxic substances will not reach the goal of toxic free cycling. Accordingly to the government's decision there is no clear description whether to allow toxic containments to be continuously recycled. What complicates the process is new produced products which can contain substances of dangerous ingredients but must be included for the products possible composition or existence (Kemi, 2014).

Even though there are no certain controls or regulation of toxic substance from EU or Sweden there exists goals to eliminate certain dangerous substances from the recycling. This is also important from the issues that can occur at waste treatment (Kemi, 2014).

4.3 Summary

Actors	Regarding	Drivers	Barriers
Producers and retailers	In-house reverse logistic model	The main driver for the company to create and implement an in-house reverse logistical model was due to a strong commitment from the company's management and board. Also, the model was successfully implemented due to an internal employee in the company who had the required knowledge and expertise related to logistic management.	No recognized barrier.
	Outsourced reverse logistic model	The main driver to outsource the activities and key responsibility for the reverse logistical model to a third party provider was due to save resource. The underlying reason why the company asked for the model was due to a strong management commitment in sustainability questions.	No recognized barrier.
Third party organizations	Provide customized reverse logistic model	All interviewed third party organizations have traditional collection stations such as outside located containers. However, to reach higher market and to increase the collection rate organizations also provides customized reverse logistic models to producers and retailers. The customized model is create to provide a convenient option for producers and retailers without controlling or maintaining the system.	To introduce the collection station in stores. A main issue is that a collection box may provide an unattractive signal for customers and taking important retail floor. To manage logistical process with efficient collect and transportation of stored postconsumer products back to the test and sort facility.
	Other collection options	To receive higher collection the organizations offer their customers also traditional collection options. These are outside located collection containers, local charity shop or location and doorstep collection. They collect all from clothing to household's items.	To keep infrastructure up behind outside located collection containers. The main issue with containers is that the organizations are not able to track the amount of collected postconsumer products in the containers. This in turn contribute to high inefficiency. Another issue is to control thieves to the containers and not loose collected items.

Shoemakers	To become a shoemaker	There are education either through school or by walking as an apprentice with a shoemaker master and after completing the education the person becomes a shoemaker.	There is no law that regulate the title to become a shoemaker, instead any person can name themselves and their business accordingly.
	Today's produced footwear	More footwear can be produced at lower price.	Many modern footwear have received changed construction and containments which complicate the repair of footwear. Today's repair requires that shoemakers have right equipment installed as dust and other particles from repair and refurbishment process are dangerous to inhale. As there are no requirements on producer to provide information regarding containments in footwear, it complicates the shoe-repairer to identify right instruments to continuing treating the damaged footwear. Therefore all shoemakers are recommended to use proper protection to all kinds of repair.
	Footwear with different "quality"		Footwear of synthetic and plastic are hard to "wear-in" for the user and also difficult to provide a repair-service for the shoemaker. Footwear with lower "quality" requires often frequent and difficult repair while footwear with higher quality requires repair with longer intervals and easier to provide repair-service. Footwear constructed for higher "quality" provides often healthier working condition for the shoemaker.
	Shoemakers' customers	All kinds of customers asks for a shoe-repair service.	Shoemakers recognized many customer to have low participation to use proper shoe-care for their footwear, which complicates the repair-service and the footwear's chances for a long "life-time".

Customers	Maintenance of footwear	*Customer's frequent use of shoe-care*
		3% used shoe-care regularly for all pairs of shoes. 43% used shoe-care only for a specific pair of shoes. 41% used shoe-care on all shoes but when necessary. 13% have never used shoe-care to any of their shoes.
		Received shoe-repair service
		60% have received shoe-repair or refurbish from a shoemaker. 40% have never received shoe-repair or refurbishment.
		Why customers received the shoe-repair service?
		43% answered that the pair of shoes was still usable and needed repair. 38% had a personal connection with their pair of shoes and did not want to discard the shoes. 19% considered it is important to prolong the life-cycle of the pair of shoes as far as possible.
	Customers willingness to participate	*Discard options for postconsumer footwear.*
		33% were obliged to donate their pair of shoes. 22% rather sold their shoes on a second hand market. 20% rather passed their used shoes to family and friends. 22% considered to throw their shoes in the trashes. 2% considered to go back to the retailer or producer with their shoes.
		Regarding returning postconsumer footwear back to retailer or producer.
		54% of the respondents selected that they were willing to go back with postconsumer footwear. 46% were not willing to leave old pair of shoes.
		Why costumers were not obliged to leave postconsumer footwear to producer or retailers.
		19% found it hard and complicated to go back to the store with the pair of shoes. 9% found it embarrassing to go back to the store with the used pair of shoes. 31% rather donate the pair of shoes. 41% rather sell the pair of shoes on second market.

		Costumers willingness to leave postconsumer footwear to retailers or producers if compensation was given
		81% were more obliged. 5% would not return postconsumer footwear. 14% would have participate regardless compensation or not.
Reprocess techniques for footwear	Available recycling technique for footwear	The only big implemented recycling technique for footwear is Nike's recycling system for athletic footwear. The reprocessed materials are mainly downgraded into new products categories. Nike provides some athletic footwear models containing reprocessed material.
	Researched and tested recycling technique for all kinds of footwear model	The footwear recycling pilot is still under a testing process. The main limitation is material purity and efficiency to reach higher reprocessed material during less time. Also to reach higher pure and clean reprocess material as it may reach bigger end-market. The main issue is to tackle current footwear industries' high use of chemicals and other hazardous substances which follows the footwear to the reprocessing. Many identified end-markets requires a high purity reprocessed material with less chemicals and hazardous substances. Another issue is to identify right end-market for reprocessed materials and to find solutions to use the reprocessed material into new footwear production.
Regulatory influence		No regulation regarding producer responsibility for footwear waste. No regulation on producers to provide information to customers or shoemakers regarding the chemicals use during the footwear's production. A legal reach regarding toxic free cycling of material. Recycled material may further contain chemicals and hazardous substances which during the recycling and reprocessing process will continue into the new product and can complicate the toxic free cycling target of material.

5 Discussion

This chapter discusses and analyses the empirical data based on the analytical framework for this research. The framework has been used to reach the empirical data for this case.

5.1 The key functions to stimulate a circular approach

The theories and definitions of reversed logistic have mostly had a product and industry specific perspective. These perspectives in turn have provided the development of reversed logistic frameworks. The frameworks have mostly been structured for monotone products as paper, glass, plastic, carpets and auto parts. These products have in turn been produced from few material sources and by few suppliers. (See section 2.2). Compared to monotone products, footwear has a different structure and usually contains with several components (Ramifard, et al., 2007). The complexity of footwear reflex also the complexity to allocate activities in production, consumption and final recycle. The difficulty begins already at its production phase, as each component of footwear usually comes from various suppliers and continues in different supply channels. Although with such a product structure it complicates recycling process as each component needs to be separated and all together reflects its less energy efficient and difficult to provide material recovery options. (See sections 1.1 and 4.2.2).

To highlight the differences in traditional reversed logistic typical product structure with footwear structure, it is important to understand potentials to reach closed loop system for material circularity. As monotone product structure reflects as well its technical and logistical simplicity (based from its production to its reprocess), these activities occur within reverse logistic systems are applicable activities – functions – to companies with similar product structure. The products' monotone structure have automatically give activities its custom and placement in such system. As mentioned previously, the structure of footwear is more complex and therefore may be difficult to implement similar functions in a footwear's reversed logistic system. The activities in footwear's forward system involves already various actors and many times includes a vague or undefinable networking between actors. The previous author behind reversed logistic confirms this networking, as the more involved actors there are the difficult it is to create an efficient networking to successfully treat postconsumer products in a circular approach (Fleischmann, 1997; Carter and Ellram, 1998 and Circular economy, 2015). (See sections 2.2 and 2.3). This in turn complicates the identification of potential activities and actors in the footwear's forward system as well as for the reversed system.

Traditional reverse logistic theories provide a typical identification of responsibility for postconsumer products. (See sections 2.1.1 and 2.2). These perspectives have automatically relied responsibility on the original producer or third party organization. (See section 2.2). This reflection is also acknowledged in the definition of extend producer responsibility, as producers behind the original product should be obliged for its future waste. (See section 2.1). Observing the Swedish footwear industry such recognition was not completely confirmed. Firstly the majority of involved actors needed to produce footwear complicates such identification. Secondly as producers many times are not firstly connected with customers instead rather perform as a middle part results in difficulty to create a collection system for their customers. Thirdly, as identification of recycling process is recognized to be rare and less efficient a purpose to create reverse logistic activities may not exist. (See sections 4.1.1; 4.1.2 and 4.2.2).

However, the main reason to use reverse logistic theories was to understand what has been previously recognized as main functions and to compare this with empirical data from the

footwear industry. By observing the market from the analytical framework, certain comparisons and differences were possible to be identified. It certainly is based on the same purpose as the previous author's theories and many of the identified activities and functions from the footwear industry can be confirmed based on these perspectives. Although, observation recognized more actors within the footwear industry to have an important role to increase circular approach, based on their functional involvement. This means, producers and third party organizations are not only with a main responsibility, rather responsibility is split between all actors with a main functional part within the footwear material circular approach. This in turn automatically changes the disorder and authority behind the system into a multiple functional ownership and options. The previous identified functions are still fundamental for the overall systems' survival but other functions are necessary to increase footwear's circular approach.

5.1.1 Adding new functions for footwear's circular approach

Observations and information from the findings made it clear that there are more fundamental functions that should be included to provide a circular approach in the footwear industry. The identified functions are based on capacity and potentials from the actors behind each function. Some of the actors were noticed as an important influencers to footwear's circular approach are included in the reversed system, due to their actions itself reflects a functions part. The new order of functions are based on same grounds as the reversed logistic models theories and definitions. The following section describes each new identification.

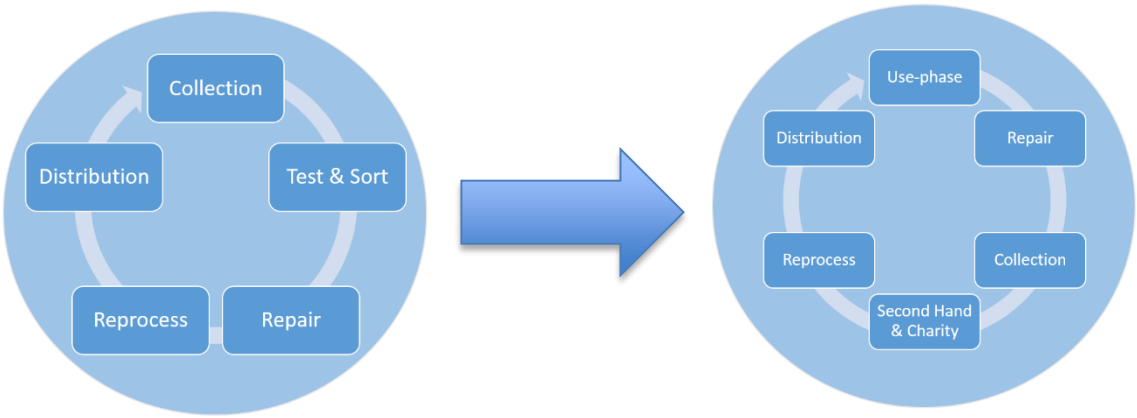

Figure 5-1. The analytical framework for use versus added functions based on the analyze of the Swedish footwear market

Use-phase

Observing the footwear market through functions in the analytical framework – from collection to reprocessing – a gap was recognized. What is missing and also included in Carter and Ellram's (1998) research is the actor on the market who consumes the actual product, namely the customers. Customer's participation reflects a certain function of the whole closed loop system which is consumption of the actual product. As consumption is the main reason for products being produced, a recognition of its activity as function becomes necessary.

Customers by their participation, provide the system an important part as they are the target to use the product. By using footwear they are obliged with power whether how to use it and whether its disposal selection. Through the way of using the product customers are responsible of product's potential survival on the market. Through selection of product's disposal option customers decides whether the product will be recycled or not.

In the sphere where customers participate – "use-phase" – can be viewed as an important function to the reverse logistic system. The product's function of use-phase is not only dependent on how customers treat the product, but also by the designable option given to it from producer. The design option can be alternatives of repair, refurbishment and recycling. Customer remains the main actor in this function as they are the actors who consume the product during its use-phase. Though, other actor's involvement to increase product's potential survival on market and potentials to reach a circular material flow are also important pay attention to. Therefore, to identify use-phase as a function becomes crucial in terms of understanding how activities during the use-phase can be improved to increase footwear's ability to enhance the overall circularity. (See section 4.1.3).

Including use-phase and customers as a function and an actor to the system offers the circularity a different approach. It could potentially provide the perspective of potentials the product have while it is being consumed. Potential in this case are not only the use option customers have but also option given to footwear during its design and production. Footwear producers decide firstly its potential survival on the market by choice of material and construction. By designing and producing footwear with options of longer utilization it would provide higher chances for longer life-cycle. Also, by designing footwear with option for reprocessing it enhances the chances for repairable and recyclable. (See sections 2.3 and 4.1.3).

Repair

The repair function was already recognized from previous authors as an essential part in the reverse logistic system. It has many times been identified as an included part and to be maintained under producers or third party providers' responsibilities. (See section 2.2). The footwear industry gives another perspective of this. Here it is not necessary that repair is provided by producers or third parties providers. In this case repair would usually be included part by the retailer as they are mostly the main connection between the customer and producer. The retailer usually provides their customer with repair if the product has proven to be defected from its production. Third party organizations arrange simple repair if necessary for further use as to second hand or charities. (See section 4.1.1 and 4.1.2). By observing the footwear market the repair function was recognized as an external activity and not necessary included at neither retailers nor third parties organizations. Instead as a handcraft business market specialized in footwear namely shoemakers or shoe-repairers. (See section 4.1.3).

Shoemaker's role together with their expertise within repair and refurbishment of footwear reflects the requirements of what the previous author behind reversed logistic theories identified the function's purpose. (See section 4.1.3). Shoemaker's business reflects its own industry. Accordingly to the findings this industry has not been allocated to complete a closed loop system nor collaborated with other actors to complete the systems purpose. Though, their service provides the option of professional repair and refurbishment of any kind of defected footwear which therefore becomes a crucial actor and function for the potentials to reach a circular approach in the footwear sector.

Resale and charity

The third party organizations that were interviewed for this research identified themselves with more core business than being just a provider to retailers. All of these organizations had a core business to collect postconsumer products for further second hand, charity or reprocessing. By providing customized solutions to retailers gives third parties organizations a bigger market in terms of increasing their collection rates. Though, besides collection at retailers these organizations have several other optional collection stations for customers to select in terms of leaving postconsumer items. These collection option have further been recognized as more

favorable option by customers, as trust to retailers collection station are low compared to donating straight at charities. (See section 4.2.1). With this indication the activity of resale and charity are necessary to be accepted as a function in terms of providing a fair reflection of footwear potentials to reach circularity.

5.1.2 The optimal circular approach for the Swedish footwear sector

The identification of functions importance for footwear's reversed logistic system can also be confirmed in Stahel's model circular economy approach. A circular economy includes all stages of a product's life cycle and attempts to find preventative option of waste being produced and products continuously circular use, reuse and recycling. (See section 2.3). The identified functions from the footwear industry theoretically reflects this aspect. Functions can basically be explained and understood under same path as circular economy approach. Figure 5-2 visualizes the optimal opportunities for the Swedish footwear industry to reach circularity.

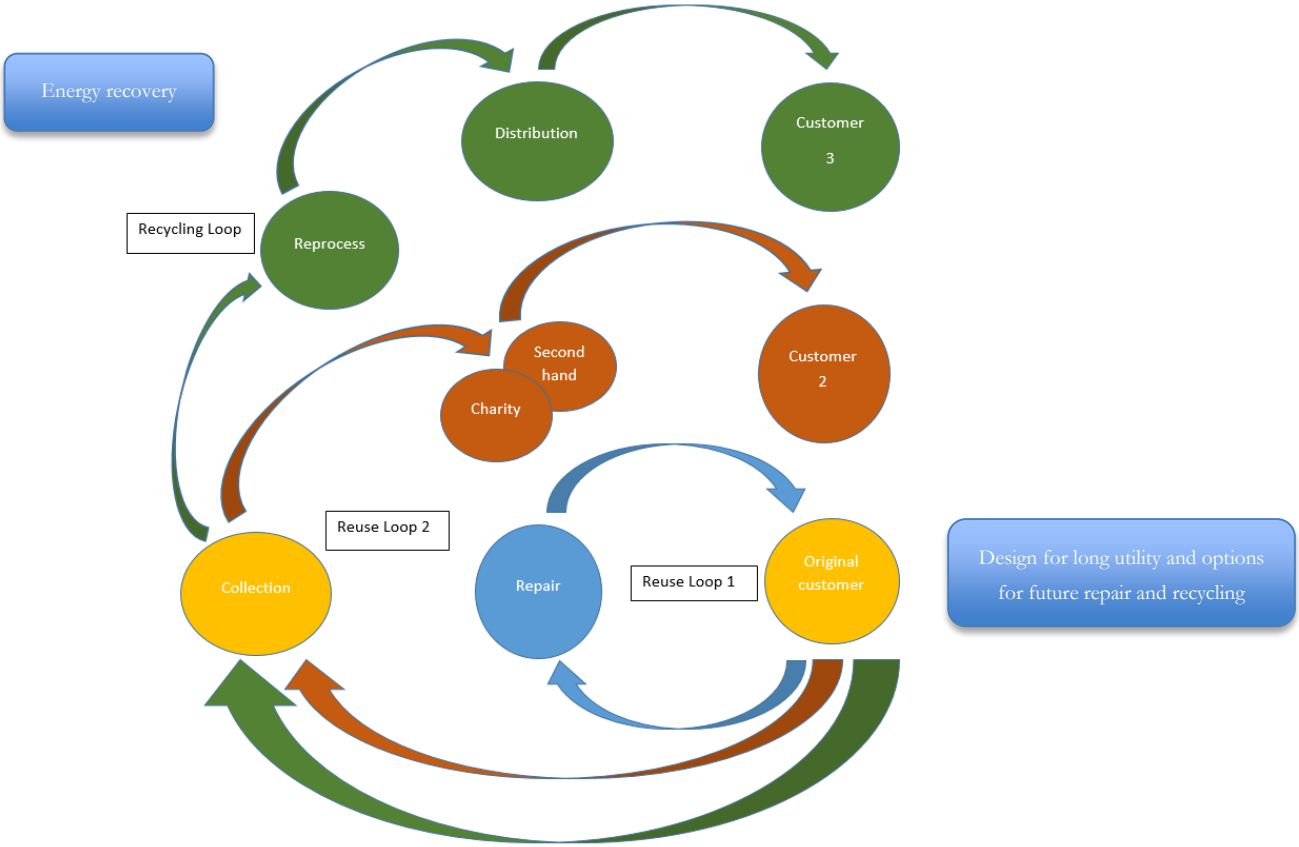

Figure 5-2. An optimal circular approach within the Swedish footwear sector

Source: Adapted from Stahel (2013), based on expert interviews

The visualized "loops" reflects different flow streams of footwear's optimal travel in a circular approach. The footwear status on the life-cycle is not reflected in the figure, instead it explains either a new pair of shoes or reused pair of shoes optimal flow stream from one user to another. The reason behind this figure is to illustrate the reader a demonstration of how actors behind each functions may potentially be connected in a footwear's circular approach.

Based on Stahel's circular approach producers are responsible to design footwear with long utilization and possible options for repair and reprocessing. (See section 2.3). Thereafter the

first flow streams begins after first user have consumed the pair of shoes until it needs repair and refurbishment. Based on the facts that shoemakers can provide this service, the footwear receives firstly a repair service. The shoe-repairer can repair or refurbish the pair of shoes with spares to make footwear reusable again. Afterwards, the repaired or refurbished footwear returns to original customer for further use. This option becomes the first optimal, not only because of chances to be reused, but also because it automatically eliminates purchase of new footwear. (See sections 2.3; 4.1.3 and 4.2.1).

The second optimal flow illustrates a reuse stream of footwear. It demonstrates first user's choice to not keep footwear due to several reasons, but also the alternative for first user to purchase a new pair. It defines footwear's flow from first user to a second user. This flow stream defines footwear's status to still be in a reusable shape. In order for used shoes to reach a new user first user have to select among several reuse options. The identified options are either through returning used footwear to retailers or producers with a take-back system, or donate to charity organizations and the last option to sell through second hand channels. If used footwear are handed to a retailer the footwear are either donated to aid purpose or sold through a charitable second hand channel. (See sections 2.3; 4.1.3 and 4.2.1).

The third flow illustrates the pair of shoes either from the first user or other users that are neither repairable nor reusable. As explained in Stahel's circular approach, the product should have been produced in such way that reprocess also becomes possible and therefore identifies this as the last optimal flow. (See section 2.3). This flow stream illustrates the non-reusable footwear's travel, from users through collections to its reprocessing of material into new products and finally reaches new markets. Note though, that optimal approach does not explain the network between actors from the function. This order of actors are based on the facts from reverse logistic theories as actors identified on the footwear market have potentials to fulfil the theoretically activity. The main point of the last flow is to visualize the option of non-reusable footwear to be recycled into new products. Products that neither are reusable nor recyclable should be treated for energy recovery. (See section 2.1) However, this option should be only marginal as the optimal approach is firstly to design footwear with option to be reused and recycled.

5.2 The current circular approach in the Swedish footwear industry

It should be noted that the figure 5-2 reflects the "optimal" approach for the Swedish footwear industry. By optimal it indicates that a product is expected to be first designed for long utilization together with ability to be repaired and recycled. (See section 2.3). It also indicates an ideal networking between actors within their functions. (See section 2.2). Without their participation in each function and without their collaboration between each other it would complicate the footwear material circularity. Basically, the optimal approach reflects a theoretical perspective based on ideas and theories from previous mentioned authors together with visualized coherency from the Swedish footwear industry. Although, this is not rational reflection of the current practical situation. Instead, the actual market is demonstrated differently. Figure 5-3 present the current situation of the Swedish footwear industry. It visualizes the collaboration between actors and how they are connected starting from the original customer.

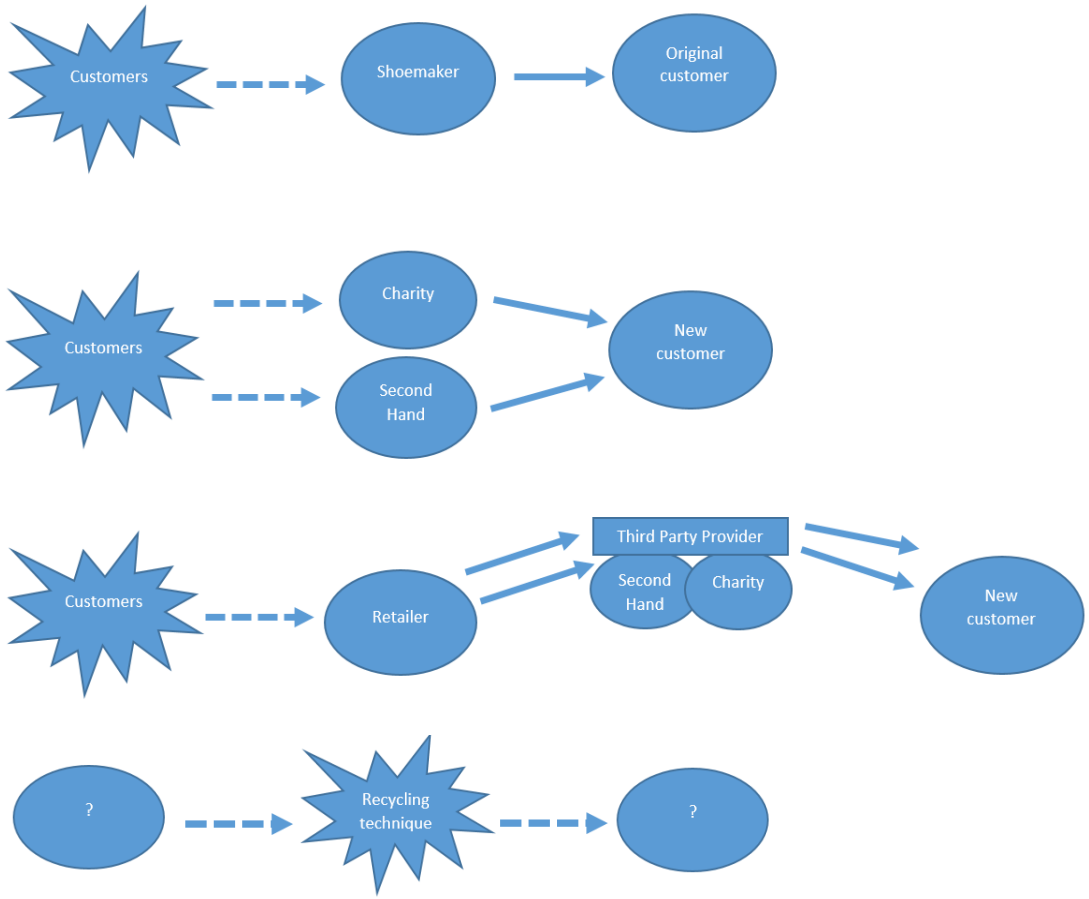

Figure 5-3. The reflection on current circular approach within the Swedish footwear industry

The following section describes deeper the missing part in terms of the potentials to reach a footwear circular material flow.

Customer lack of participation

One of the first observations was the difficulty to involve customers. The interviewed shoemakers indicated that they often had to deal with difficult repairs due to lack of care from the footwear's user. Customers are responsible to treat their footwear with shoe-care but they are not obliged to fulfill this duty. Their participation and contribution are a reflection of footwear's potential prolonged life-cycle. The recognition from shoemakers was that many customers do not take additional advice in terms of maintaining footwear properly. (See sections 4.1.3 and 4.2.1). This together with the background of increased footwear with planned obsolesce and less customer involvement to extend footwear's life-cycle, complicates the shoemaker's work.

An interesting point is that footwear are valuable products for charity and second hand organizations and many postconsumer collection streams are searching for option to increase collection of reusable footwear (C. Sundin, personal communication, 17 June 2015). This reflects the currently collection of reusable shoes to be low and all of the interviewed third party organizations for this thesis are searching to increase collection rate of reusable shoes. (See section 4.1.2).

Customers on the other hand indicated based from the survey to provide a low participation regarding leaving footwear to either collection stations, and especially to retailers. (See section

4.2.1). Therefore, without higher participation from customer together with their willingness to leave used footwear, the system may not be successfully complete.

Weak networking between actors and respective function

One of the recognitions was a weak connection and networking between functional actors in the potential footwear material circular approach. (See chapter 4). Observing the current situation in Sweden functions of reprocessing are missing to complete a circular of material flow even though it exist on the international footwear market. However, functions are not in collaboration with any of the Swedish identified actors.

Also, there are no certain collaborations between the functions in Sweden either to reach an overall circular approach. Instead, each actor behind these functions operates separately to reach their own business sustainable goals and aims. The interviewed retailers and third party organizations have a collaboration, in one way or the other, to reach some certain sustainable goals. (See sections 4.1.1 and 4.1.2). The actors in this group had a clear designed reversed logistic systems which either are hold in-house at the actor or outsourced activities to third party providers. All of these systems are operated to collect reusable and recyclable items (not only for footwear but also other items from their customers). Though, the flow of the system looks differently depending on which actors are in collaboration from the beginning and what aim they have with their organization.

The collaboration between other functional actors in terms of reaching optimal flow of circularity is vaguely recognized. For instance, shoemakers were observed as an own market segment within the footwear category rather than being included in footwear market's potentials to reach a circularity. (See section 4.1.3). The interviewed producers and retailers, and third party organizations had an implemented reversed logistic activities but did not include an advance repair service for damaged footwear. Instead, their purpose for the logistic activities was to reach a longer utilization of collected postconsumer products and provide reusable products a second change. Though, their identification for longer utilization did not include an advance repair and refurbishment, as this many times requires many resources to be conducted. Instead, footwear that can pass with simple refurbishment is treated while footwear which cannot is being disposed. (See sections 4.1.1 and 4.1.2).

Available reprocessing technique

On the Swedish footwear market, there are no current reprocessing systems for footwear material. Observing aboard there are few companies and organizations that maintain and develop footwear reprocessing technique. Nike is one and only footwear producer that collects and recycle athletic shoes in a big scale. Nike has also a certain distribution market for the reprocessed material but most of the reprocessed material are downgraded than upgraded. (See section 4.2.2). Compared to Nike's market and big scale of collection and recycling, there are no comparable company with similar recycling option. As an alternative, there are projects on the market aiming to increase the recycling for all footwear models. AIR's footwear recycling projects are testing potential recycling technique for all postconsumer footwear models. They have few investors from other recycling companies and research's organizations that supporting the project with interest to increase reprocessing of footwear material.

Even though with Nike's specific footwear recycling systems and other smaller footwear reprocessing projects the awareness of these existent was not confirmed from none of respondents for this research. (See sections 4.1.1; 4.1.2 and 4.2.1). Instead, many of the respondents, both from interviews and customer-survey, referred that a recycling system for footwear is technically impossible. Instead, many stated that the only possible recycling process

within the clothing industry is only suitable for textile products. To not be marketable available on the market nor surely potentials of succeeding, it becomes difficult to include this technical function in the footwear circular approach (See section 4.2.2). Although, there existed a willingness among the interviewed producers, retailers and third party organizations to implement or to collaborate with a recycling partner if the system becomes successful and convenient.

5.3 Drivers and barriers to reach footwear circularity of material flow

By adapting the analytical frameworks "lens" it was possible to identify ho drivers affected each actor and function in the reversed logistic system. This section is divided into two parts. The first part will give an analysis on retailers and third party organizations through the "lens" of drivers adapted in the analytical framework. The second part will analyze the remaining actors by using same criteria to identify potential enablers to reach a circular approach for the Swedish footwear market.

5.3.1 The perceived drivers for producers and retailers and third party organizations

In this section the perceived drivers from the interviewed producers/retailers and third party organization will be presented. In the table 5-1 describes the perceived external and internal drivers at the interviewed retailers and third party providers. (See section 2.4).

Table 5-1. Perceived external and internal drivers on producers/ retailer and third party organizations

		Retailers/producers			**Third party providers**		
		Stadium	Gekås	Nilson-Group	HB	Textile Recycling	I:CO
External drivers	Regulation						
	Customers						
	Quality of input				X	X	X
	Vertical coordination		X	X	X	X	X
Internal drivers	Stakeholder commitment						
	Top management	X	X	X	X	X	X
	Policy entrepreneurs	X			X	X	X
	Incentive system	?					

Perceived drivers and barriers from retailers

The interviewed producers and retailers for this research either had a developed in-house reverse logistic model for postconsumer items or an implemented customized reverse logistic model provided by a third party provider. Whichever, by having a collection function makes the producer and retailer vulnerable to external environmental pressure and influence. (See section 2.2.2). Meaning, regulation and customers have an important influence on the reverse

logistic system. However this was not confirmed accordingly to the findings. None of the producers or retailers had identified a pressure from regulations or from customers. (See sections 4.1.1 and 4.1.2). Currently there are no regulation to steer the footwear market in such way that companies will take responsibility for their product's waste. (See section 4.2.3). Even with an upcoming textile responsibility proposal, whereas footwear is included, none of the respondents recognized regulatory pressure before implementation of reversed logistic model. The pressure from customers was also perceived to be low. Instead, the aim behind the implementation of product take-back was basically to make customers "feel good" in terms of continuing their shopping. With the alternative of returning unwanted but reusable footwear provides the option for a second user to reuse the pair of shoes. (See section 4.1.1 *Stadium*). However, Stadium worked closely with their customers by initiating campaign days to receive higher rate of collected footwear. This initiation has not been initiated by a pressure from their customers instead due to an engagement commitment within Stadium. Without the campaign days the collection rate would have been significantly less. All together this underlines the influence from regulation and customer to be low and the reasons of the implementation are due to internal decision.

From all respondents it was specified that without companies board commitment the reversed logistic model would not have been implemented. (See section 4.1.1 *Stadium*). The commitment from top management was said to have most influence and acted as an important factor for reversed logistic model implementation. (See section 2.2.2). On the other hand, Stadium had developed reversed system in-house together with a person with expertise and background within logistic management. This person's involvement to develop Stadium's reverse logistic system is recognized from the literature review as an entrepreneurial commitment. (See sections 2.2.2 and 4.1.1 *Stadium*). Without such entrepreneurial commitment development and introduction of a collection system could have been more complicated and even impossible. As indicated, such implementation requires much resources but it requires a good commitment from all employees. The framework points out the incentive system as a main driver for reversed logistic model with observation that during Stadium's implementation employees became more committed and engaged. This means, Stadium did not use an incentive system to engage their employees. (See sections 2.2.2 and 4.1.1 *Stadium*).

Gekås and NilsonGroup were more driven by vertical coordination as their collection system was dependent on their cooperation with third party providers (see sections 4.1.1 *NilsonGruop* and *Gekås*). The vertical coordination minimizes uncertainty for these companies and created higher level of reversed logistic activity. It must be noted that this coordination has been initiated as third party providers offered a customized reverse logistic model based on the retailers capabilities. Accordingly to the retailers, such a collection system would not been implemented if the proposal was not provided from a third party provider, as it is resource consuming both in time and costs. (See section 2.2.2).

Perceived drivers and barriers from third party organizations

The third party organizations had either their own collections stations as through located containers or they played a certain role for retailers. This means that they either are responsible for single collection station or controlling customized reverse logistic models at retailers. (See section 4.1.2). These companies did not feel any pressure from regulation or customer. However, as their business is dependent on collecting postconsumer items they become highly sensitive to customers' low participation and the products quality. If customers do not participate in terms of leaving postconsumer products, the collection will not be profitable. As well these organizations are highly dependent on the condition of collected footwear as

footwear with bad condition cannot be further reused. (See sections 2.2.2 and 4.1.2 *Textile Recycling*).

In addition, third party organizations such as Textile Recycling and Human Bridge have recently entered the new business field of collection and collaboration with retailers. As the business area and collaboration are still new, they also becomes a highly sensitive issue if collaboration would not succeed. All third party organizations had a strong commitment from the organization's board and are highly environmentally engaged. (See sections 2.2 and 4.1.2 *Textile Recycling* and *Human Bridge*).

All third party organizations had a strong and influential entrepreneur within their organization. This engaged entrepreneurship are also reflected to organizations' involvement in different research projects. The engagement is not directly effecting current reversed logistic activities, but many goals of these organizations are to reach higher efficiency for both collection at retailers and outside collection stations. Which together are recognized as a driver for the overall collection system. For instance, Textile Recycling develops how to make logistic system more effective in terms of increasing collection and to include more customer in their network. (See sections 2.2 and 4.1.2).

5.3.2 What actions may require to enhance circular flow of footwear material?

It should be notified that drivers from the analytical framework are developed for actors that aim to receive higher collection of postconsumer items. Meaning it includes and refers only producers and retailers and third party organizations, even if they do not cover all functions to complete a whole reverse logistic system. As they are the ones initiating a collection system they are also the ones to be sensitive of influences from external environment, which through the analytical framework's "lens" can be further investigated. (See sections 2.2; 2.4 and 4.1.2). For that reason, it technically excludes the possibility of using same analytical lens on customer, shoemakers and reprocessing actors as none of them are fiscally in collaboration with the initiator behind the postconsumer collection system. Although, as their functions are recognized to perform a certain role in a circular approach, all of these actors have the common core focus which are relied on postconsumer products. Reflecting back to the circular approach the main aim of a reverse logistic systems should include maximized reuse and always avoid waste. (See chapter 4 and sections 2.3 and 5.2).

By not including these actors to complete a circular flow of footwear material in the Swedish industry optimal approach may continuously become difficult to complete. Instead, these actors together with their functions should be of interest for both producers and retailers, and third party organizations to include in terms of increasing circular approach for footwear. Also in terms of reaching their sustainable goals of further reuse and potentially reprocessing. Therefore, by using the same lens from the analytical framework may be applied for the remaining actors in similar way.

Pressure to benefit customer and footwear's extended life-cycle

The regulatory influence can be observed as an enabler, meaning they will not "put pressure" on customer in the same term as "putting pressure" on producers and retailers or third party organizations. Instead, they can act as an important influencer to support customer with necessary information in terms of increasing their participation. (See sections 2.2.2 and 4.2.1). For instance, by enhancing customer's willingness to treat footwear in a whished way, will not only potentially prolong footwear's life-cycle but also simplify both efficiently and healthy way

for repair-service conducted by shoemakers/repairers. Regulatory support may improve customer's understanding of what the shoemakers refer as "quality differences of the footwear". (See sections 4.2.1 and 4.1.3). This may contribute to an increased demand from customers on producers in terms of receiving more "quality footwear", meaning footwear design for long utility, including environmentally and healthy containments, and given the reprocess opportunities.

On the other hand, pressure does not necessarily need to come from neither customer nor from regulation to enhance maximized circularity of postconsumer footwear. It could also be driven from "the other way around" that producers provide quality of inputs to customers. Accordingly to Stahel's circular approach this means that producer will provide a product with long utilization and potential to be further reused (and recycled if the technique is applied). (See sections 2.2 and 2.3). Yet, even with such inputs customers may still perform the opposite and not maintain footwear in an expected way and not participating in collection. As illustrated from the customer survey, the majority were neither willing to treat footwear with shoe-care nor to participate in collection systems, especially at retailers. (See sections 4.1.3 and 4.2.1). Though, if retailers apply vertical coordination and collaborate more closely with their customer, more customers may be engaged to take care of their footwear. As customer were more willing to return used footwear to retailers for a compensation, an incentive system could also act as a potential driver to increase future circular approach. (See section 4.2.1).

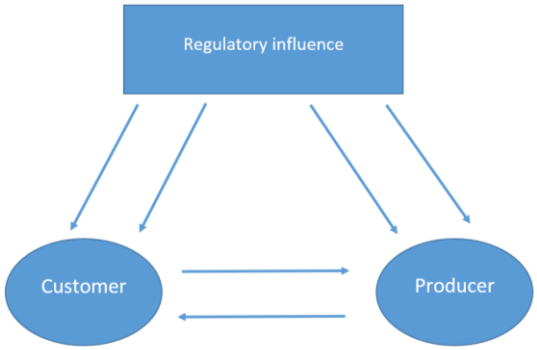

Figure 5-4. Reflection on current circular approach within the Swedish footwear industry

Pressure to benefit shoemakers future business

Similar discussions regarding the function use-phase, can also be applied for function repair. Regulation can possibly support shoemakers business and enhance their visibility and potentials to be included in footwear's materials circular approach. Note that shoemakers will benefit from regulatory pressure on producer e.g. to provide more "quality shoes" as stricter regulation towards environmentally friendlier and healthier substances in material use in footwear. This in turn will provide a healthier work place for shoemakers with less difficult repair and refurbishment of footwear. (See sections 4.1.3 and 4.2.3).

Same benefit will apply with regulatory support to customers, as more informed customers may take more responsibility regarding care treatment of footwear and possible demanding for more "quality shoes". The interesting part could potentially be a customer pressure. As identified from the survey 40% of the respondents indicated never had received shoe-repair service for their footwear. (See sections 4.2.1 and 4.1.3). This raises the question what could be done to make more customers searching for shoe-repair when necessary: Is price reduction for repair-service necessary or making more customers aware that repair is possible for just their type of shoes?

Pressure to benefit the footwear's recycling systems implementation

Regulatory pressure is not applicable in the same context regarding actors behind potentially recycling systems. According to literature the pressure could have potentially been on retailers and third party organizations. Instead, these actors may benefit from a regulatory pressure on producers or retailers. If pressure is applied it may result in increased interest to invest and research for potential recycling system for postconsumer footwear. (See section 4.2.2). Also, pressure on producers may lead to enhancing a circular approach, meaning planning for footwear's long utilization and its possibilities for further reuse and recycle which may increase the chances for actors to introduce recycling system.

One of the identified challenges for these systems today is to handle the complexity of footwear's' construction as it contains different components and chemicals. (See sections 1.1; 4.1.3 and 4.2.2). Therefore, if producers provide quality of input and aiming to produce footwear accordingly from a circular approach, it will imply higher chances for actors behind recycling system to succeed. Nevertheless, it will also increase circular flow of high quality material in footwear throughout in continuously flow. A reflection from an expert interviewee mentioned that one of the challenges today is to work against chemicals which continuously are recycled and stays closed in a circular system (A. M. Johansson, personal communication 20 August, 2015 and Kemi, 2015). (See section 4.2.3). Therefore, actors behind recycling systems in terms of reaching an end market with materials consisting high purification from hazardous substances and chemicals must reprocess footwear without chemicals. This might be necessary for a chemical free circular approach for footwear.

6 Conclusion

This chapters' purpose is to present the main findings of the research and to suggest further research in the field.

6.1 Main findings

The objective for this thesis has been to provide a better understanding of the potential to increase circularity of postconsumer footwear in the Swedish footwear industry. The aim was to identify key functions behind such circularity as well as related drivers and barriers to recognize potential enablers for the overall system. The following answers on the posed research questions were revealed:

RQ1. *What are the key functions that must be in place in order to stimulate a significant increase of circularity and post-consumer reuse and recycling in the footwear sector?*

The analytical framework for this research provided certain functions in terms of a product's reversed logistical system. It was necessary to use the framework to understand and analyze the Swedish footwear industry and its potentials to complete a circular approach. Based on the facts which built the framework proved that responsibility was rather split between all involved actors and not necessary included functions for either the producer or third party provider to maintain.

The traditional reversed logistic literature presented five major functions to be present in terms of increasing reversed logistic activities for postconsumer products. During the research it was indicated that more functions should be included in order to provide a comprehensive understanding of the footwear sector. In all, this resulted in seven main functions: (1) Use-phase, (2) Repair, (3) Collection, (4) Resale as second hand and charity, (6) Reprocessing and (7) Distribution. All these functions have a fundamentally purpose in the system and by acting together they increase circularity as well as prolonging use of the footwear product.

The circularity of reuse and recycling can be explained as three fundamental options, all starting from the original customer to the footwear in the use-phase. The first two options explain two reuse option and the last option cover recycling: The first loop explains the customer choice to prolong the life of the shoes by taking help from actors that perform in the repair function. This option is the most preferable as the aim is to prolong the products life and returned to its original owner, which eliminates the chances of purchasing a new product. The second option is another form of reuse to a new owner. The reusable product goes through a channel either through retailer, charity or second hand which later distributes the product to a new owner. If there are no possibilities for the product to be further reused the last step is reprocessing into new products and distributes to a new customer which begins a new life time and the circularity continues.

RQ 2. *What functions are in place today and which actors are engaged in these functions?*

The optimal circularity approach for footwear was proven to not reflect the actual situation within the Swedish footwear industry. Customer's participation to the footwear circular flow was identified as weak. Firstly because many of the shoemakers' responses identified a weak participation from customers regarding treatment of their footwear product. It was also because of a low interest to participate in a collection system for postconsumer footwear both at retailers and at organizations as charities and second hands. Networking between all identified functional actors was appeared to be weak. The strongest collaboration occurred

between the retailers and third party providers' partnership though no collaboration or weak collaboration occurred with the shoemakers. From the research, the only identified footwear recycling system was Nike's grinding system. However, this system only recycled athletic shoes and had mostly an end-market with downgrading. Another actor with a recycling system was also identified. This actor developed a recycling technique that aim for reprocessing all kinds of shoes. However, they are still in their development stage and many goals need to be reached before establishing the technique in function. For that reason an option for recycling in the circularity approach in the footwear cannot be a possibility.

RQ3. *Within a Swedish context, what are the drivers and barriers for relevant actors to engage to increase the circular flow of material in the footwear sector and what actions may be required to enhance a circularity of material?*

The analysis resulted that different actors and functions are differently influenced by the identified drivers from the literature. It showed that the actors who had initiated the reversed logistical system had mainly both internal and external drivers influencing the overall system, which were retailers or the third party providers. It was concluded that the actors that had in-house reversed logistic systems were not affected by the external drivers compared to actors who had either outsourced their system or who offered a customized system. The third party providers proved to be extra sensitive to external drivers as they were dependent on quality and amount of collected footwear. The main conclusion from this part of analysis are the more functions an actor holds the more sensitive this actor becomes to its external environment together with more dependent on reliable collaboration in terms of decreasing uncertainty.

It was also identified to be a lack of important drivers on the Swedish footwear industry in terms of increasing overall footwear circular approach. The recognition was proven to come mostly from the regulatory sector as they can provide pressure and influence on producer's design of footwear's longer utilization and possibilities for repair and further reprocessed. With such pressure it may benefit in turn both the shoemakers business and the development of reprocessing technique. As footwear with such design will give an easier repair service as well as higher possible efficiency and purification of footwear material separation. Also, it was identified that higher regulatory influence was needed to provide these actors with support. For instance, regulatory support to customers was identified as a potential enabler to increase the knowledge on how to take care of shoes in order to prolong the footwear's life-cycle.

6.2 Reflection of the research

The main purpose of this research was to provide a better understanding of how to potentially increase circular material flow of postconsumer footwear and to capture the complexity of the topic. Footwear is a complex product and can contain a variety of material with toxic substances which during production and disposal can cause harm to the environment as well as humans. If initiatives cannot be created from a practical perspective to challenge the problem, it is important that it is captured and discussed on a research level in order to highlight potential possibilities in the industry.

However, this thesis could not cover all potential activities, actors and initiatives within the whole footwear industry. Therefore, there have been some limitations to this study. The analytical framework was developed from two main concepts; reversed logistic theory and circular economy. To develop the analytical framework provided tools in terms of identifying empirical data and later to analyze it. Although, different findings and conclusions may have been concluded if other related theories were selected, such as supply chain management,

product recovery, customer behavior and etcetera. This also applies on the methods selected to gather data. The gathering of data was based on the mapping of actors which had either a functional or influent part to the potential circular material flow of postconsumer footwear. With such mapping process it might have excluded other actors with a possible important functional part to the footwear's circular material flow.

The interviewed shoemakers for this study were located in Lund. A reflection should be noticed that these actors may have influenced each other perspectives. Shoemakers and shoe-repairers tend to collaborate, especially from the same areas. Although much of the information given during the interviews with these actors was confirmed during an interviewee with an actor from the Swedish Shoemaker organizations. Therefore, shoemakers' statements are pursued as important and valuable for this research findings and further discussion and analysis. Another selected method to gather empirical data was survey. The survey did not give any requirements of gender, age or other character factors which could have given different illustration of the results. The survey consisted ten questions and did not allow respondents to express other comments. All the critique mention regarding the choice of method could have changed the research in many ways if other methods were used or expanded.

The collected data for this research was not enough to cover an analysis over the whole circular flow chart regarding the identified functions and actors. (See appendix 2). The empirical data from these findings was able to cover the functions and actors from all stages besides, testing and sorting, resale and distribution. However, nothing can indicate that the selected methods for this thesis even covered the remaining functions and actors. What if actors that did not have an implemented reversed logistical model, could maybe cover more potential actors and maybe more potential valuable functions? Either way as indicated, many different approaches could have been selected to contribute more to this research.

6.3 Further research

Based on the main findings and conclusions, further research may be of interest:

Analyze further on the role and impact of the third party service providers and their position in a system of a circular approach. An interesting conclusion was that the third party service providers' difficulties to challenge the external environment. The more functions one actor in the reversed logistical system holds, the higher perceived uncertainty they will face. Analyzing their role deeper and their potential to increase and overcome these barriers could increase their position in the system as well as increase the circularity of material flow.

Analyze further the causes for inaction among many actors in the industry. One of the main findings proved the inaction of the relationship between the actors. Such inaction can cause barriers to reach circularity of material flow within the footwear industry. Therefore it would be of interest to further research and analyze what potentials and initiatives exist to overcome this.

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Appendix Personal Communications

Interviews with Third Party Organizations

Tamara Zwart, *I:CO* - June 16, 2015

Maria Gaspar, *Textile Recycling* - June 16, 2015

Anonym, *Textile Recycling* - June 16, 2015

Lotta Carlsson, Textile Recycling - June 16, 2015

Klaus Rosinski, *Returtex* - June 25, 2015

Urban Grahn, *Human Bridge* - June 26, 2015

Chetan Gupta, *I:CO* - 16 October, 2015

Interviews with Retailers/Producers

Daniel Johansson, *Stadium* - June 26, 2015

Jonna Burman, *NilsonGroup* - June 23, 2015

Pernilla de Filippo, *Gekås* - June 24, 2015

Anonym, *Kavat* - June

Interviews with Shoemakers/Shoe-Repairman

Per-Olof Nyström, *Sko-Rönne* - August 13, 2015

Bengt Nilsson, *Olles Skomakeri och Son* - August 13, 2015

Tage Månsson, *Tage Skomakeri* - August 12, 2015

Henry Soomus, *Henry Skomakeri* - August 19, 2015

Expert Interviews

Benjamin Marias, *AIR* - June 26, 2015

Carin Sundin, *Stockholm Vatten* - June 17, 2015

Ann-Marie Johansson, *Swedish Chemistry Agency* - August 20, 2015

Petra Ekblom, *Swedish Chemistry Agency* - August 13, 2015

Sandra Lindvall, *Sveriges Skomakarmästarförbund*, October 19, 2015

Appendix 1

The process of tanning – Key steps

Accordingly to the European commission report, a tanning manufacturing can be divided into five main steps. This assignment will specifically be looking on the wet process of a tanning manufacturing, which includes the beamhouse, tanyard, and post-tanning operations.

The Beamhouse operation which involves seven main step:

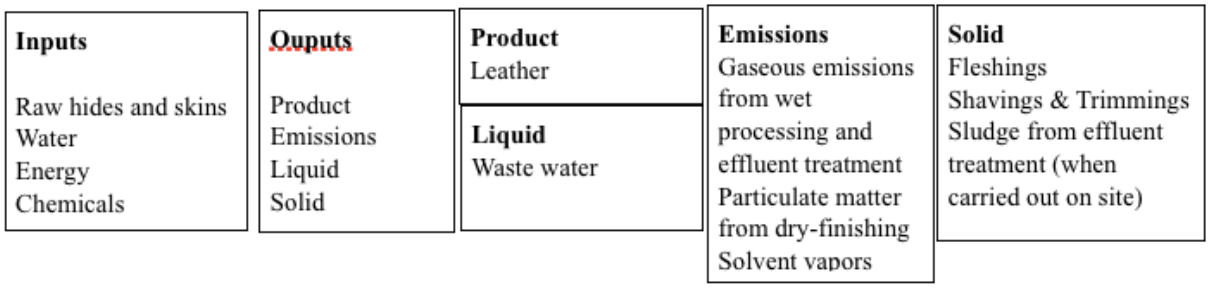
- *Soaking* includes removing heavy salt from previous procedure and cleaning the skin and hides from blood, dirt etc.
- Hair and other proteins is removed through *unhairing and liming* of hides and *painting and liming* of skin's which eliminate the unwanted substances with lime and sulphides.
- *Fleshing* of the hides and skins starts after different stages, either after soaking (green fleshing) or after liming and unhairing (lime fleshing). The waste contain fleshy matter.
- Hides and skins continues through a *splitting process* in order to receive the required thickness of the leather. It is done under a lime or tanned condition.
- *Deliming* is a process use of water, chemicals and energy in order to remove all the lime and alkine from the leather that have been used in earlier stages.
- The final process *bating* remove all the unwanted substances that have not been removed in the earlier steps such as hair and roots and are done through enzymes. (Black et al, 2013)

The Tanyard operation is divided into 5 steps;

- *Degreasing* is a process for the skin's in order to not counteract in the later steps. There are three different process which the first two involves high water use together with both organic solvent and non-ionic surfactant, and the third involves a solvent medium.
- *Pickling* is used in order to reduce the pH and prepare the leather before tanning process. It is done by solution of sulphuric acid and common salt.
- *Tanning* is used to stabilize the fibre in the leather to not putrefaction. Different kinds of tanning as chromium, mineral, vegetables, syntans, aldehydes and oil tannage.
- *Draining* process drain and fixation of the leather.
- Last step involves *shaving* the leather to the required thickness.(Black et al, 2013)

The last step of the wet process the post tanning operation involves six steps;

- *Neutralization* of hides to a suitable pH level and *bleaching* of skins to reduce to coloring or remove stains in order to continue the last step.
- The *retanning process* involves improvement of the leather in order to reach the requirements made.
- In order to reach a complete color over the whole leather, the hides and skins goes through a *dyeing process*. This is usually made through a water-based process of acid.
- The leather needs to go through a *fat liquoring* in order to regain the lost fat. This is made either using oils of animals, vegetables or synthetics. (Black et al, 2013)



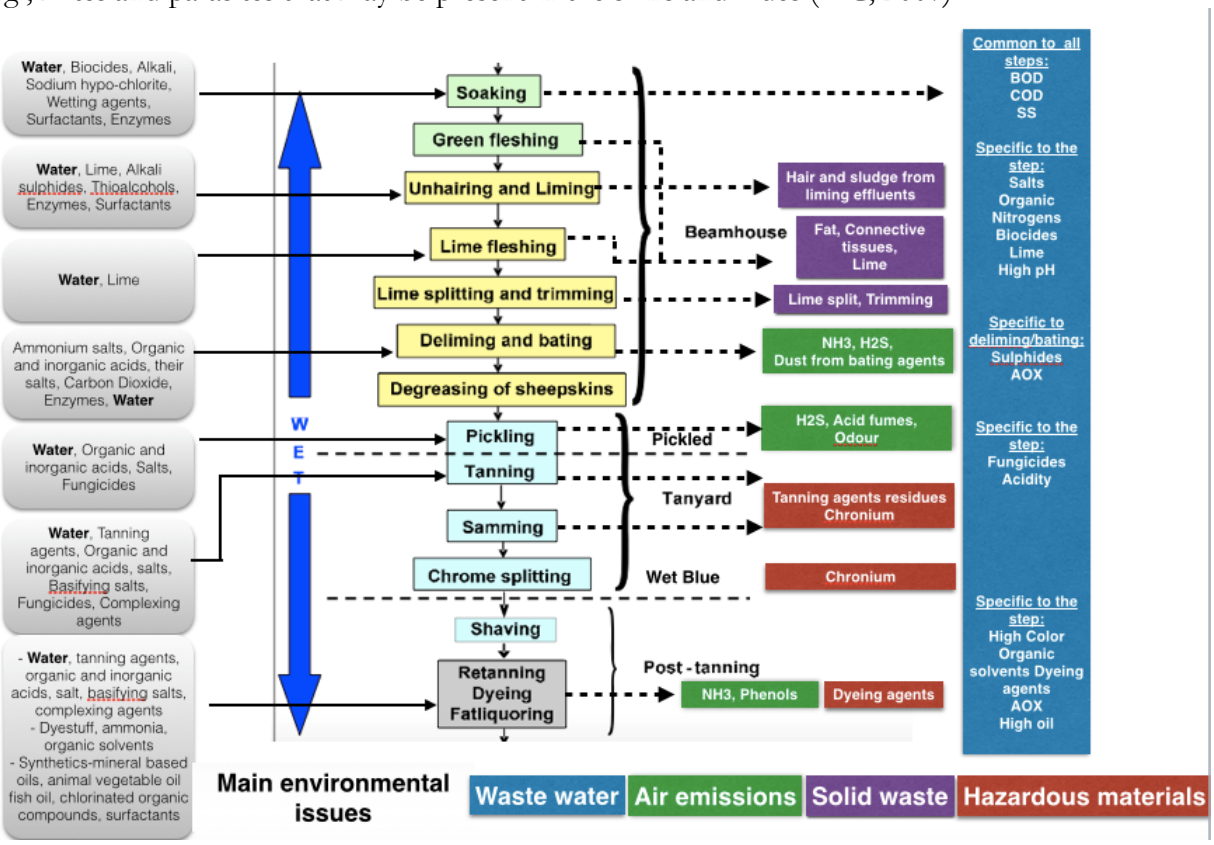
Identified environmental issues of tanning

Wastewater - Tanning industry processes are water intensive and as a consequence large amounts of waste water are produced. The second issue with regard to water is the pollution loads contained in wastewater. The wastewater organic load largely emanates from the beamhouse operations where around 75% of it is produced (measured as bio-chemical oxygen demand [BOD] (IFC, 2007). In terms of volume, liming is the most water consuming process.

Air emissions - Air emissions of different kind originate from different operations: sulfides (beamhouse [deliming], tanyard [pickling] and wastewater treatment if performed on site), ammonia or NH3 (beamhouse [deliming], post-tanning [dyeing]), organic solvents (leather finishing operations) and odors. (Black et al., 2013)

Solid waste - Solid waste resulting from the process include hair and sludge from the unhiding and liming process; fat, tissues and lime from the fleshing; lime split and timing from the trimming step. Wet blue trimming can also be generated and would contain chromium.

Hazardous materials - Tanning and leather finishing processes involve the use of a variety of hazardous chemicals that require strict guidance on handling, storage, transportation and disposal. Chromium and dyeing agents are identified as the most significant ones. However, if vegetable tanning is performed (as an alternative to Chrome tanning) effluents from vegetable tanning will have high levels of organic matter. Additionally, it is important to mention the risk involved in biological hazards, workers can be exposed to disease-agents such as bacteria, fungi, mites and parasites that may be present in the skins and hides (IFC, 2007).



Appendix 2

Table 0-1. Identified functions and actors in Swedish footwear Sector

Functions in Reversed Distribution Channel within Footwear Sector	**Use phase**	**Repair**	**Collect**	**Test & sorting**	**Resale (charity)**	**Reprocess**	**Distribution**
The potential actors in the reversed distribution channel	Customer						
			Retailer	Retailer			
		Shoe-maker					
				Producer			
			3PP: *Charity* *Commercial*	3PP: *Charity* *Commercial*	3PP: *Charity* *Commercial*		

Appendix 3

Table 0-1. Identified drivers, barriers and enablers of the reversed distribution's function

Functions in a Reversed Distribution Channel in Footwear Sector	Use-phase	Repair	Collect			Test & sorting	Repair/recovery	Resale	Reprocess	Distribution of new product
Actors	Customers	Shoemakers	Retailer/producer & Third Party Provider (3PP)			3PP	?	Retailer/producer & 3PP	Actors behind the recycling system (Nike, "Air-based technique")	?
Drivers	-Customers' participation to return used footwear will increase by giving them compensation.	-All kinds of customers.	-Gain more postconsumer products. -Making the customers to feel good by returning their items.			- Early testing before transportation may save costs. - Control over the system.	-	-	-Control. -Minimize costs.	-Use in the same product. -Quality of input.
			Retailer/producer		3PP					
			-In-house collection. Gives control, stronger commitment, better understanding.	-Outsourced collection. Focus on the core business and cost saving.	-Customized collection. Reaching new markets – more collection.					
	-Use shoe-care only for specific shoes.	-Construction of footwear complicated and different chemical use	-Steer the logistic system up. Requires resources; time and money.	-To find a place in the store to have the collection box.	Charity: -Charity's business threaten by new commercials	-And sorting to keep it in-house may require more expensive techniques and skills while to	-Time consuming. -Require skills and		-A possibility of chemicals in continues cycling	-To reach an up-cycling of the reprocessed materials.

Barriers		makes it harder to work with			coming into the market. <u>Customized collection</u>: -Requires much resources to steer the system up. <u>Collection containers</u>: -Thieves -Hard to control how much have been collected.	outsource it might lose the control over the system. -May require expensive equipment and skilled maintain.	professional understanding.			-Finding potential markets.
			-Costumers lack of participation -High transaction costs -Lack of customers participation -Customers rather turn the shoes to charity or sell on second hand markets							

Source: Fleischmann (1997) Carter and Ellram (1998)

The text in red: Drivers and barriers identified from the literature.
The text in black: Drivers and barriers identified from the Swedish footwear industry.