CHALMERS

LET'S RECONSIDER SHOES END-OF-LIFE

How to facilitate a prolonged life and proper material recycling, through system- and product-redesign

Master's thesis in Industrial Design Engineering

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Gothenburg, Sweden 2017

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Let's Reconsider Shoes End-Of-Life
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PREFACE

This master thesis project is carried out by two Industrial Design Engineer students from Chalmers University of Technology at the Swedish footwear company, Icebug. Which is an independent footwear company from Gothenburg that was founded in 2001 (Icebug AB, 2014). They are specialized in traction and produce walking-, running- and trail-running shoes with soles that have integrated studs and a unique rubber compound that provides outstanding traction on slippery ground, making them the frontrunners in terms of grip.

ACKNOWLEDGEMENTS

This project has had a great number of people involved and we would like to give our sincere thanks to everyone that have been involved. The many interviewees that have stood out with us during long interviews and bad skype connections and the survey respondents that took their time to answer our questions.

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We also want to give thanks to the entire Icebug office with their warm and friendly atmosphere that have made us feel welcomed around the office and for putting up with us huddling up in the different rooms, putting up our post-its and messing around with the 3D printer. We also would like to give special attention and thanks to the Icebug coffee that have made us extra productive, alert and has helped us through this challenging project.

ABSTRACT

In this study, it was found that footwear offers a great challenge to the industry regarding its environmental impact. The part of shoes lifecycle that is often overseen is the end-of-life phase, where there are not a lot of options available today and where the design of the shoes offers great difficulties. Most shoes today are not possible to disassemble, increasing the difficulties for successful material recycling. Where a large number of shoes end up on landfills or are incinerated instead, not making use of the material. Hence, not being a sustainable option.

Another impact that footwear impose on the environment today is their very short lifespan, where on the other hand using the shoes too long can induce injuries, making it to an ethical question if longevity and reuse can be promoted, which are the preferred first options before recycling. This problem is further enhanced by the difficulties to repair shoes, such as sneakers and running shoes.

Although there are some alternatives out there, they are not fully implemented and the demand for the recycled material from shoes need to be increased for it to be profitable for the recycle centres to further develop methods and recycling techniques. There are also difficulties to get the shoes from the user to the recycling centre, as post-consumer collection methods vary and users lack knowledge of what the proper way of disposing old shoes actually are.

Because of these facts a take-back system was designed, where the producing company can gain more responsibility of their shoes and see to it that they are given the most sustainable end-of-life possible, that the users know what to do and why they should hand in their shoes. External stakeholders for reuse and recycle were included to provide a holistic solution.

This system also included tools for educating the users to take care and repair their shoes, enabling a prolonged life, as well as a repair kit to provide accessibility to spare parts. A proposition of a redesign was also made in order to accommodate a changed user behaviour, to strengthen the system as a whole and to be an inspiration for future footwear development.

To succeed with creating a system that could solve these issues an extensive literature study was performed where the barriers for shoes longevity and end-of-life was identified. A range of different interviews were conducted and a survey was performed in order to gain users insights and behaviours. A disassembly test as well as a benchmarking regarding already existing solutions was also made. A range of different design guidelines for sustainable product development was investigated and applied in the redesign. This made it possible to test their applicability and be able to combine them with the findings in the literature study - to offer design guidelines aimed for footwear, focusing on longevity and EoL. The result from this project can be used in future studies regarding the great impact that footwear causes in their EoL and be of inspiration for how it can be tackled and the requirements that are needed in order to move towards a more sustainable use and disposing of shoes.

Keywords: End-of-life, Footwear, Take-back system, Disassembly design, System design, Sustainability, Environmental impact

LIST OF ABBREVIATIONS

EVA

Ethylene-Vinyl-Acetate, a copolymer, is a material commonly used in the midsole of the shoe.

SBR

Styren butadien rubber, foam for example used as softening reinforcement in shoes

PU

Polyurethane, a polymer, can be used as fake leather, flexible foam for padding, laminates and much more

TPU

Thermoplastic polyurethane, used for example in the outsole and midsole of shoes

W/R

Water resistant treatment

EoL

End-of-Life

DfD

Design for Disassembly

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METHODOLOGY

PART I

1. INTRODUCTION

This chapter describes the background to this master thesis together with the aim, objectives and delimitations for the project. The chapter ends with a description of how this report is dispositioned.

1.1 BACKGROUND

One of Icebug's visions for the future is to be able to offer their customers shoes that not only offers good grip but that also is a sustainable choice. As Icebug's passion is to encourage people to be more active outside and to enjoy the nature, they want to form a sustainable business model that goes hand-in-hand with their way of life (Icebug AB, 2016). They are working hard regarding chemical contents in the shoes, they are also active in terms of material choice and have good knowledge over the condition of the factories where their shoes are produced. What has been left out for now is the focus of the end-of-life of their products, which is something that is overseen by many in the footwear industry. This project therefore investigates what possibilities there are for Icebug to make a bigger effort in this area and to reach further in their sustainability work.

The significance of being able to offer environmentally friendly products is something that can seem more important for some industries than others, regarding the commitment and interest of their customers. The outdoor industry is considered to be one of these industries where they have to be at the frontiers of innovative sustainable solutions in order to do well on the market (Scandinavian Outdoor Group, 2015). According to studies done by Svensk Handel (Svensk Handel, 2016) 71% of consumers find that it is important or very important that the companies they purchase from actively work with sustainability, whereof 57% are willing to pay more for products that have environmental or ethical labels, indicating their authenticity. As outdoor products are supposed to be used in the nature it also becomes an obvious reason to why it has raised such interest and commitment among customers, as the decay of the environment will not favour their hobbies in a positive way (Scandinavian Outdoor Group, 2015). So, in order to stay interesting and relevant on an already competitive market, outdoor companies need to have sustainability as one of their core values.

One very important part of truly becoming more environmentally friendly is to step away from the linear use of products, the take-make-waste economy, and instead aim to close the loop of producing and using products - stopping the depletion of raw materials (Ellen Macarthur Foundation, n.d). Such a closed-loop economy is referred to as, circular economy and deals with all aspects of products life cycle. A circular economy demands a different perspective and mindset of companies where existing business models need to be changed and adapted in order to be successfully implemented (Svensk Handel, 2016). Designers have a huge possibility and responsibility to change the environmental impact of products and to make sure to design systems where the product design and material flow is taken into consideration.

Consumers of today own a wide range of different shoes and the interest and demand for specialised shoes is also something that have increased in recent years. Together with the quick turns of the market it also put pressure on the shoe manufacturers to be responsive to trends and changes in the market, resulting in shorter life cycles as well as a more limited time span for product development (Rahimifard & Staikos, 2007). In relation to when the life cycle of shoes is decreasing, the production quantity of shoes is increasing, giving a greater amount of post-consumer waste. Looking at the pure number of shoes produced worldwide, a staggering 23 billion pairs were produced in 2015, (World Footwear, 2016).

Looking to Sweden it can be seen in a report made by Svenska Miljö Emissions Data, SMED, where 14 picking samples were made of Swedish household waste, that approximately 1kg shoes per person were disposed of in 2014 (Hultén, et. al., 2016). That accounts for approximately 9 800 ton discarded shoes, about 3 pairs per household[1], in Sweden alone. According to Haworth et. al, (2006) the footwear industry's biggest environmental impact is in fact from the end-of-life phase of the shoes and is also seen as one of the biggest challenges that they face. Haworth et. al (2006) also claim that most of the shoes that are discarded worldwide end up on landfills, a non-environmental EoL solution.

1 As these numbers were based on an approximate calculation from SMED's findings they clarify that it may not be representative for the general discarding pattern of shoes, although it serves as a good estimation of how many shoes that were thrown away in Swedish household waste in 2014.

Footwear include a lot of different plastics and as plastics mostly are made from crude oil which is a non-renewable resource, it becomes even more essential to deal with the waste and try to minimise the use of raw materials (Goodship, 2007). However, before the shoes even reach their EoL the first and most important step is to reduce the environmental impact by prolonging the life of the shoes, making use of the product and its materials for a longer period of time (Ellen Macarthur Foundation, n.d). As the consumption of shoes is such a widespread problem it is therefore believed that a legislation on how the footwear industry deal with the EoL of their products will come into power in a near future and that pressure from the market also will push the companies to consider this problem in a wider scale (Haworth, et,al., 2006). Making it necessary for the footwear industry to start taking this problem seriously, which is also why this report deals with the most challenging sustainability issues for shoes, their longevity and EoL.

1.2 AIM AND OBJECTIVE

The aim of this project was to investigate how the lifespan and the end-of-life phase of Icebug shoes can be prolonged and improved. The objective was to bring Icebug closer to their sustainability goals by suggesting a take-back system that can help Icebug to alter their current business model to a more circular approach. It was investigated how a system can be designed to fit Icebug and their project category of shoes, to make it more environmentally friendly than today and to encourage a changed and more sustainable behaviour among users.

Furthermore, a conceptual shoe design was suggested that can improve the system further by enabling better possibilities for care, repair, reuse and recyclability. The objective with a concept shoe was to give inspiration to how the design of a shoe could be altered to be more sustainable, as well as to provide design guidelines that can be used in future development projects at Icebug.

Relevant questions that supported this study is stated below:

- How can the system be designed so that Icebug's shoes are reused or recycled in an efficient and correct manner?
- How can the system be designed so that it encourages user involvement and a changed behaviour?
- How can a redesign overcome the barriers that affects the longevity and EoL of shoes?

1.3 DELIMITATIONS

The deliverables for this project is to provide a suggested system design, including different collaboration possibilities that can take care of the sorting and recycling, as Icebug is way too small to incorporate these services in their business. Furthermore, the conceptual system design should include branding possibilities that can strengthen Icebug's sustainability image and to be able to be profitable as well as realizable. The system should also take users interest and behaviour into account in the design, in order to create an attractive system that will engage the user. The shoes limitations regarding their design and material will set the criterions for which collaborations that is possible. Although the possibilities that the redesign can bring, might give other collaboration opportunities.

The collaborations are merely a suggestion for Icebug and is something that they have to take a decision on, it is not something that will be implemented in this project time. The realizability of the collaborations will although be investigated to be able to suggest viable options. Furthermore, the project will also be confined to Icebug's Swedish market. The redesign will aim at the identified barriers for longevity and EoL in order to produce a concept that outperforms today's solution in terms of sustainability.

The system will be presented with illustrations of the system flow, from pre-purchase phase to EoL, including company and customer involvement. The conceptual proposal of the redesigned shoe will be presented with sketches, CAD renderings and a full-scale prototype. The compiled design guidelines that are deemed fit for footwear design will be presented as a poster.

1.4 DISPOSITION

This report is divided into five main parts, Theoretical framework, Methodology, Part I - Identifying opportunities, Part II- Suggestion for future system & redesign and Part III - discussion & conclusion.

The theoretical framework includes the background research for this project with relevant theories and methodologies that provides a fundamental knowledge for the rest of the report. The second chapter, methodology, describes the process and methods used for this project and how they were put into practice in order to reach the project aim. In Part I - identifying opportunities, the reader will find the results derived from the research and methods used.

Each of the chapters in Part I is followed by a summary & conclusion, which can be read to get a quicker overview of the results and the main findings from each chapter. Part I is also summarized in a final discussion, bringing up the results that will be the foundation for Part II - suggestion for future system & redesign. Part II includes, the different concept suggestions, as well as the evaluation of these, leading up to the presentation of the final concept. This chapter is summarized with a final discussion and conclusion of Part II. Where the main findings and what has been accomplished through this project is highlighted, together with suggestions for further development.

FRAME OF REFERENCE

- THE BASE OF THE PROJECT

2. INTRODUCTION TO FRAME OF REFERENCE

To be able to produce products that are environmentally friendly and that are taken away from the outdated take-make-waste principle, it is of great importance to truly understand all of the aspects that affect a product along its life-cycle. As this project focuses on the longevity of a product and the end-of-life it is important to understand the different aspects that touches upon these subjects from a more holistic point of view. This includes, not only the design but also external factors such as waste management methods and recycling processes that will affect the product when it has reached its end. Thus, making it necessary to know what methods that are the most beneficial ones from a sustainable point of view, in order to be prepared and be able to make the best decisions already in the design phase. In order to not forget parts of the system that have an impact on the product's life cycle, design guidelines aimed for sustainable development can be used to aid the product development.

This holistic perspective of a product is also what brings the need for a system design, to connect the dots and create a complete system that is able to give the producing company more control and the ability to affect how their products are dealt with at their EoL. This way the company extend their responsibility for the entire lifetime of their products. The preparation of the product to suit such a transition and consider how the material flow will work in the system is also of significance for it to be able to be a successful system implementation.

Some of these foundational factors and design guidelines that have an impact on the design approach in this project is presented in this chapter to give a good overview and understanding for the rest of the report.

2.1 EUROPEAN WASTE HIERARCHY

The European Waste Hierarchy is presented in this chapter to be able to understand which waste management approach that are the most beneficial from an environmental point of view when dealing with post-consumer waste. This is important to understand in order to design a system that can deal with the EoL of post-consumer products in a proper and correct manner.

The European Commission established a directive for the waste hierarchy in 2008, defining how waste should be taken care of in order to reduce the environmental impact on waste generated (Naturskyddsföreningen, 2015). In the directive, five different steps of waste management are defined, which are; Prevention, Preparing for reuse, Recycling, Recovery and landfill, where prevention is the most desirable and disposal the most undesirable from an environmental point of view, see figure 1.

1. Prevention,
refers to generate as little waste as possible. Producing merchandises in a resource efficient way and to consume as little as possible, is two approaches the can be taken in order to minimize waste (Naturskyddsföreningen, 2015).

2. Reuse,
a product that is fully functional and in good condition but is not of value for its owner anymore might be of value for someone else or something else, and should therefore be reused. A product can for example be donated to charity or sold as a second-hand product.

3. Recycling,
refers to collect waste and make use of the material from the waste. If it is not possible to reuse a product it should be recycled. Producer's responsibility refers to the responsibility of collecting and take care of EoL products.

4. Recovery,
means to extract energy from materials, and should be made if the waste material is not possible to recycle. The energy in the waste is transformed into electricity and heat through incineration.

5. Landfill,
means that the waste ends at a dump. This is by far the most undesirable solution and should be avoided at all cost.

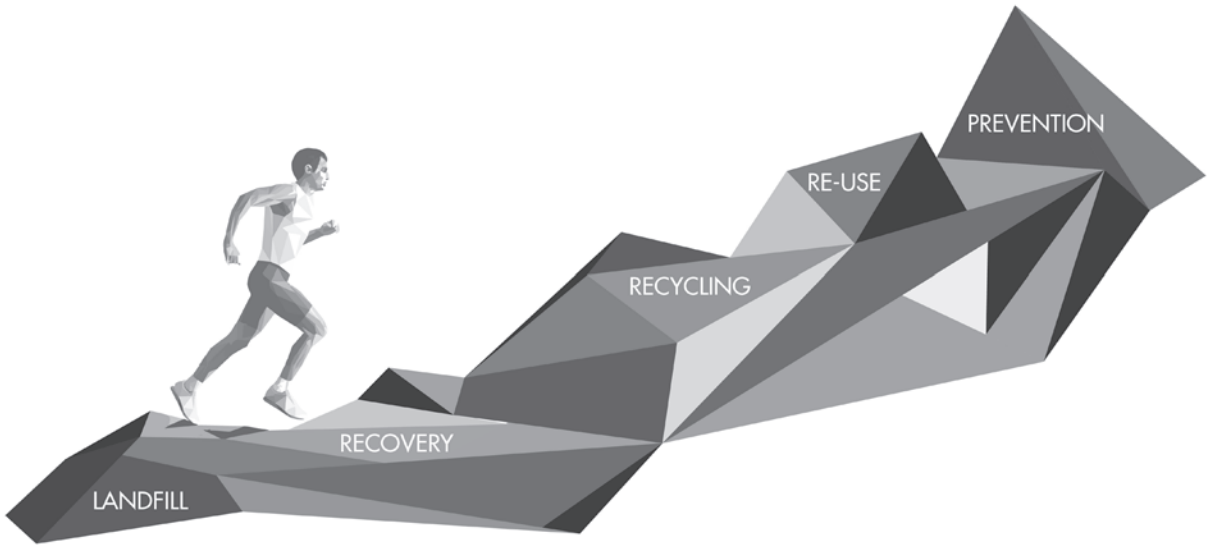


Figure 1. Illustration based on the European waste hierarchy.

2.2 UPCYCLING VS DOWNCYCLING

According to the European Waste Hierarchy, prevention and reuse are the first steps that should be made from an environmental perspective, but as recycling will eventually be the final solution and something the post-consumer shoes will have to go through, it is important to gain a better understanding for what the preferred options are. As defined under step 3 in the waste hierarchy, recycling aims to make use of the material from the waste and depending on the quality and how it will be used, the recycled material can either be seen as Upcycled or Downcycled. According to William McDonough and Michael Braungart (1998), downcycling is recycling that reduces the quality of a material over time. Material upcycling on the other hand is defined as recycling of a material to a higher degree of physical quality than that of the original material (White, St. Pierre, & Belletire, 2013).

Another definition of upcycling is when waste material is transformed into something that give a higher value and/or quality in their second life (Kyungeun, 2015). However, it is also stated that it is only possible to achieve upcycling of a material by adding different types of material to the recycled material (White, et al., 2013). However, in this case, the main aspect to consider in terms of upcycling is that the material recycling process should not require the use of more energy and not more material inputs than needed.

2.3 RECYCLING PROCESSES

Most of the applications for the recycled materials from footwear are considered as downcycling, but it is still seen as significantly more beneficial compared to disposal to landfill (James & Rahimifard, 2012). Table 1 illustrates the most common materials used in footwear today, which is a large amount of different materials and which requires different recycling approaches (Haworth, Heath, Staikos, & Rahimifard, 2006). If the materials are considered separately, there are existing recycling options that can be used today, where the materials can offer a second value instead of going to landfill or incineration.

If shoes can be successfully separated the different materials could go to their suiting recycling option, but the materials still offer challenges for proper material recycling. EVA can for example be mechanically recycled and can be used in underlays for laminate floors, filling in car seats, carpets and for sport pitches (James & Rahimifard, 2012). However, recycling of EVA is not a widespread activity. Thermosets, such as rubber, is not possible to recycle directly. However, it can be shredded instead of melted and reprocessed, as is often the case with thermoplastics (Thompson & Thompson, 2014). Surfacing products, matting, decking and underlay material is some example of applications for reclaimed rubber (James & Rahimifard, 2012). PU is a recyclable plastic, in its pure state, and is primarily either recycled mechanically or chemically (Thompson & Thompson, 2014).

When it is mechanically recycled it is kept in its polymer form and is reused for different purposes (American Chemistry Council, n.d). PU flexible foams can for example be rebonded and reused as carpet underlays for cushioning, car seats or it can be re-grinded into a fine powder and mixed with virgin materials to make new PU foams. According to Thompson and Thompson (2014) polyurethane, as well as other plastics, have a high energy content and is therefore an effective material to recover energy from, making it more profitable for recycling centres to incinerate.

Suede or leather can be recycled, it is for example possible to produce leather sheets from recovered leather fibres (James & Rahimifard, 2012). Furthermore, it is possible to use leather granules as fertilizers if it is treated so that the chromium, present in the leather granules, are removed. Since leather has acoustic and thermal insulation properties it can be suitable for use as insulation material.

Polyester, can be converted into fibres again through chemical recycling, alternatively be repolymerized into new plastic (Thompson & Thompson, 2014). Although this is not a widespread technology. Poly-

Table 1. The most common materials that are in a shoe (Haworth, et.al., 2006).

FOOTWEAR MATERIALS	PERCENTAGE
Leather	25 %
Polyurethane (PU)	17 %
Thermoplastic Rubber (TR)	16 %
Ethylene Vinyl Acetate (EVA)	14 %
Poly (VinylChloride) (PVC)	8 %
Rubber	7 %
Other (Adhesives, metals, etc.)	7 %
Textiles and Fabrics	6 %

urethane is often recycled through chemical means, just like for Nylon, and is an important part of recycling PU, as cross-linked PU cannot be melted or reformed (Harper & AccessEngineering, 2000). When it is chemically recycled, it is taken back to its chemical ingredients and can be used as a raw material again, breaking it down into gas and oils or polyols that is used as raw materials for new polyurethane (American Chemistry Council, n.d).

For TPU films that are used for adhesives they need to be combined with chemically compatible materials in order to be recyclable, an appropriate bond for TPU film can for example be with elastane textile (Thompson & Thompson, 2014). If combined with non-chemically-compatible material the TPU film can be disassembled by reheating it, to be taken apart. Nevertheless, this is not a practical or efficient process why incineration is often more beneficial for this material as well.

2.4 PREREQUISITES FOR MATERIAL RECYCLING

To be able to recycle materials there have to be a system available for the collection of the products going to material recycling. The facility dealing with the collected material must be able to process the material into a useful form that manufacturers can use for new products. Lastly, the new product made from the recycled material, or partly made from it, have to be sold (Harper & AccessEngineering, 2000). So, in conclusion the four main prerequisites for recycling are:

- A System for Collection
- Use of Materials that are Possible to Recycle
- A Facility that is able to Process the Material
- A Need for the Recycled Material for New Products.

2.5 CIRCULAR ECONOMY

The prerequisites for efficient material recycling, is also something that is included in the concept of Circular Economy. Where the aim is to move away from a linear 'take,make,waste' economic model and provide a more circular approach to products (Ellen MacArthur Foundation, 2015). A circular model is becoming more and more attractive and viable since it aims to keep products as well as valuable materials and components in a closed loop. This approach is taking the waste hierarchy into account with the aim to prevent waste of resources by promoting, minimize, reuse and recycling.

According to Ellen MacArthur foundation "a circular economy is restorative and regenerative by design". The concept distinguishes between the technical cycle where resources are recovered and restored, and the biological cycle where resources are regenerated, these two cycles are illustrated in figure 2. In order to maintain as much value as possible of the materials, in the technical cycle, the principal is to be as close to the two inner loops as possible (Jansson, 2015).

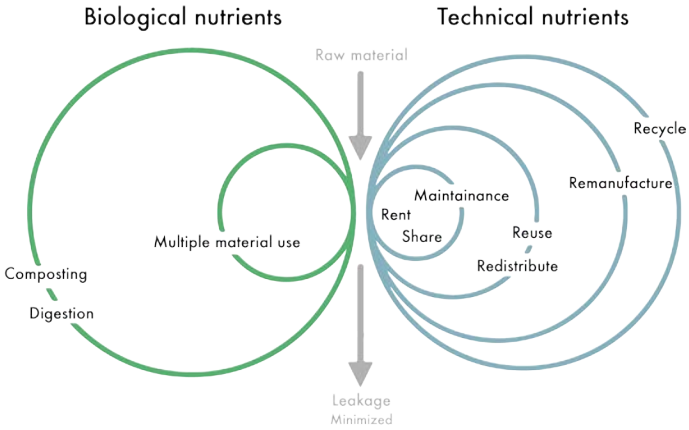


Figure 2. Illustration of the technical and biological cycle in a circular economy (Jansson, 2015)

According to Ellen MacArthur one of the building blocks that is essential for a circular economy is Circular Economy Design. Which includes to consider; material selection, standardised components, design-to-last products, design for easy end-of-life sorting and separation or reuse of products as well as considering possible application areas for by-products and waste from the manufacturing, which is called design-for-manufacturing (Ellen MacArthur Foundation, 2015). One model of circular economy, that is often proposed, is to remain the ownership of the products (Ellen MacArthur Foundation, 2015). This model can ensure the company's access to useful materials and components after its product's useful life and can be referred to as sharing economy, which will be explained further in the next chapter.

2.5.1 SHARING ECONOMY

Sharing Economy is a concept built on a collaborative economy where it depends on shared resources (Newlands, 2015). Through 'Sharing Economy', consumption is avoided to some extent where consumers instead share goods or services between each other. Fewer resources are then extracted to make new products which gives the concept of a Sharing Economy its Environmental argument.

Sharing Economy is according to Matzler, et al. (2015) divided into three areas; product service systems, where the ownership is kept by the company or private persons but shared between multiple consumers, or through redistribution markets, where for example online platforms are used to redistribute products or services. The third type of a 'Sharing Economy' is through Collaborative Lifestyles, where people share for example their skillsets or a part of their garden.

According to a study done by PwC (2015) Sharing Economy have grown substantially over the last years and considered to be a strong continuous trend, especially among younger consumers. Matzler, et al. (2015) also mentions how the concept of a Sharing Economy is growing at a fast pace and that it is very much thanks to the internet and the possibilities that social media is bringing, facilitating and making the concept easier to attain. The spread of Sharing Economies is described to be a potential threat to established industries as people buy less and share more (Matzler, Veider & Kathan, 2015). Their suggestions on how companies can meet the trend instead of fighting it is to:

- Keep the ownership of products instead of selling them
- Support customers to sell their second-hand goods
- Exploit unused resources
- Offer repair and maintenance services
- Find new customers through collaborative consumption
- Develop a new business model that builds on collaborative consumption

2.6. DESIGN FOR END OF LIFE & LONGEVITY

To consider the possible scenarios for a product's end-of-life in the early design process can have significant effect on the possibilities to incorporate the mindset of circular economy (White, et al., 2013). Designers have an important role of making sure that the product they design can be disposed of in a good way in its end-of-life, meaning that the design of a product can affect the waste management approach. It might also occur that even if the product is designed for recycling it might not be disposed of in the way that it was planned for. Designers therefore have to consider and be aware of how the infrastructure for recycling look like, the collection possibilities, sorting and recycling processes of the materials in order to take the right design decisions (White, et al., 2013).

Figure 3 is an interpretation that was made by the authors regarding how design for EoL and longevity can be approached. This interpretation was made with regards to existing design guidelines and theories related to EoL and longevity. Where three main areas were identified as the common denominators for the area, design for recycling, reuse and repair. Example of strategies that are included in the three main design areas, are design for disassembly (DFD), and design for modularity. The different areas are overlapping because a lot of the design strategies and methods within strategies for Longevity and EoL are interconnected and treat the similar design approaches.

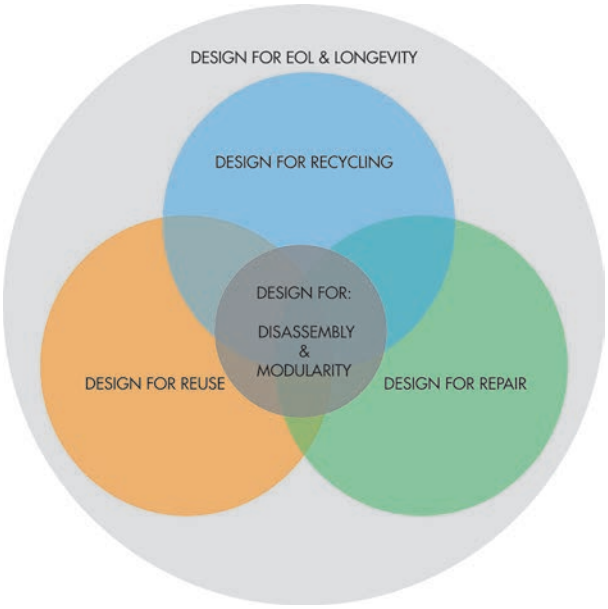


Figure 3. Illustration of the three main areas within Design for EoL & longevity and how they are interconnected with design for disassembly & modularity.

DFD enables easier repair of components due to the fact that it is possible to disassemble the product, which in turn can also make it easier to clean the product or to redesign/remake the product by replacing a component and thus changing its function or design (White, et al., 2013). Modular design is also something that is covered in DFD, as the modularity makes parts easier to disassemble, repair, replace and upgrade (Poppelaars, 2014). Making use of these strategies and guidelines is a way to design products that can fit into a more circular business model and to offer better alternatives for waste management.

2.6.1 ECODESIGN STRATEGIES AND GUIDELINES

As sustainability is a holistic term, including the entire lifecycle of a product, it can be hard for a designer to know what to include and consider in order to design a more sustainable product. There are already so many other needs that has to be considered in product development. Therefore, a number of guidelines and strategies have been developed by different actors to make it easier for a designer not to miss anything. Some of the guidelines and strategies that were deemed suitable for this project are presented in this chapter. The choices of which design guidelines that are presented in this chapter are based on how established they are in terms of being recognized methods, their focus on longevity and EoL, and how well they complement each other if combined. This is also the reason for why three different design guidelines are presented, to strengthen and create a wider perspective of what to consider in the product development.

THE ECODESIGN STRATEGY WHEEL

The Okala Ecodesign Strategy Wheel's design strategies are connected to the stages of a product's life-cycle, see figure 4. These strategies are aimed to help designers and system developers imagine new opportunities in order to reduce the environmental impact from a product, service or a system (White, et al., 2013). How successfully each ecodesign strategy can be applied to a particular product or a system is depending on the context, meaning that "they are not universally beneficial in all situations" (White, et al., 2013). Since this project will cover, prolonging life and the EoL of shoes, the strategies for System Longevity, Transitional systems and Optimized End of life will be explained in more detail, highlighted in blue, figure 4.

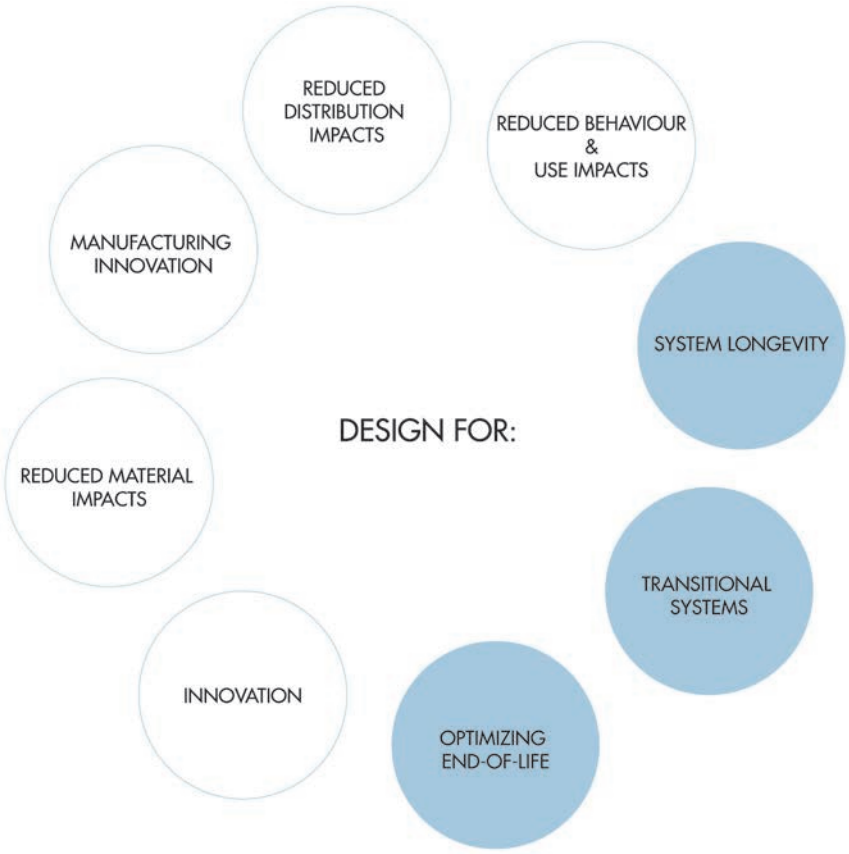


Figure 4. The Ecodesign strategy wheel based on the model by White, et. al (2013)

This category aims to conserve resources by creating products that lasts, eliminating the need to replace them (White, et. al., 2013). Design strategies for this category is presented below.

Design for durability
This strategy aims to consider the choice of material, finishes and details in relation to their physical durability.

Foster emotional connection to product
The possibility that people will keep and use products for a longer time could be enhanced if they have created an emotional connection to them.

Design for maintenance and easy repair
Design for maintenance and easy repair can be accomplished by making the parts of a product physically accessible and offer clear repair instruction.

Design for reuse and exchange of products
This strategy implies to foster reuse and exchange of products, which can be made through designed systems as for example online trading sites.

Create timeless aesthetic appeal
Following trends might not always be beneficial in order to design a product for longevity, a product that has a timeless design often last longer. Okala's advice is to choose graceful classic materials, proportions and lines.

This category has similarities with the previous, system longevity, but in addition it covers the possibilities to update components and reuse the product for a different application (White, et. al., 2013).

Design upgradable products
Design products that can easily be upgradable, making it possible to follow trends without the need to replace the whole product.

Design for second life with different function
The strategy implies to consider how the product can give a second function after its intentional usage area as for example a mustard jar can become a drinking glass.

Design for reuse of components
Create a product system that enables the reuse of standardized components in a product of the same model.

The category implies strategies that will enable recycling of products in order to improve the end-of-life phase (White, et. al., 2013).

Design for fast manual or automated disassembly
Recycling and reuse can be economically feasible if the product is designed for easy disassembly, an example given from Okala is to use click fits or snap fits for easy detachment of a product's components.

Design recycling business model
For Optimized End-of-Life it is necessary to design a business model that can ensure recycling follow-through.

Use recyclable non-toxic materials
The strategy aims to find solutions to keep recycling operations below acceptable toxin threshold by identifying materials with minimal toxicity and easy to recycle.

Provide ability to biodegrade
If the product is not designed for a long life, as for example paper-based packages, it is good to consider a design that can biodegrade, hence a product that is suitable for composting.

Integrate methods for used product collection
To ensure that products will come back or be recycled a take-back function of the system has to be offered.

Design for safe disposal
Make sure that product is safe to disassemble. Make sure what suspected materials the product can contain and design the process for disassembly after that.

DESIGN STRATEGIES FOR SHOES

Better Shoes Foundation (2016) encourage footwear designers to implement eco-design in the design process of shoes. They suggest 7 design strategies to consider in footwear development. These are:

Better material selection:
Some of the commonly used materials in footwears are not especially sustainable, according to Better Shoes Foundation (2016) they state that there is better alternative for many of them, were some material suggestions is given on their webpage.

Alternative manufacturing methods:
To choose a process that can minimize the amount of energy needed or by for example using a glue less construction that can avoid health and security issues.

Multipurpose use:
Implies to design a shoe that can be used for multiple occasions

Minimal design:
Try to eliminate unnecessary components while still keeping the basic functions of a shoe.

Minimal waste:
Aims to avoid waste material during the construction process.

Easy-care / Repairable:
Increase the lifespan of a shoe by a design that enable to freshen up worn shoes and for example resoling them.

Custom / Customizable design:
Implies to avoid unsold and unused goods by letting the users contribute to the design & development process, which can create a lasting relationship between the user and the shoe.

Design for disassembly:
To promote repairability, recyclability and durability as well as to minimize waste it is crucial to consider how a shoe can be broken down into separate components.

DESIGN FOR DISASSEMBLY

Presented in this chapter is a more detailed guideline how to implement DfD, which are given from Alex Diener (2010), an industrial designer which is the creative director at Pensar. He has compiled DfD guidelines from several different practitioners in the field of DfD, resulting in an elaborate list of what to consider in the different stages of product development. In this chapter, an excerpt from that list with the most relevant guidelines for this project will be presented, with main focus on the design phases; *research materials, processes and creating concepts.*

Minimize fastener type:
Minimize fastener types can reduces material costs, management and labour time, partly because it is easier to assemble a product that for example only requires 3 screw types instead of a product that requires 34 different screw types.

Minimize material types:
Fewer parts and material types in products can significantly facilitate the sorting and recycling.

Avoid permanent fixing (adhesives, co-moulding) of different materials:
Implies the problem of recycling dissimilar materials together. In regards of shoes, it is necessary to investigate ways to stitch or lace the material together instead of using glue.

Avoid toxic or harmful materials and chemicals:
In DfD it is very crucial to consider the larger implications of the chosen material.

Avoid paint:
Paint and coatings prevents plastics from being recycled as well as it is costly and wear poorly. For plastics, an example is to use in-mould plastic colour instead of paint or metallic coatings.

Identify material types:
Consider the simplicity for recyclers to sort the different items from a product into correct material stream, the different parts/components of a product should therefore be marked with international recycling symbols.

The User(s) Experience:
Get familiarized with the user(s) experience of a product that can be disassembled. This can be made by visualizing or simulating the steps that are required to repair or disassemble the products. What is important to remember here is that every product has many users, such as the manufacturing and assembly workers, the consumer(s), the service tech, remanufacturing workers, and recyclers.

Provide Guidance and Accessibility:
Provide the users with instructions that are accessible at all time, because it is very likely that the manual is gone by the time a product need to be disassembled or repaired. One possibility is to "build in" the instructions in the product, by making a design where all components are visible and where the disassembly features are described by the products appearance itself.

Design for easy repair + Provide access to parts:
The product design should support the possibility to replace parts. This implies that the design has to enable easy replacement of parts as well as these parts must be accessible for purchase through a website or a reseller.

DESIGN STRATEGIES FOR SUSTAINABLE BEHAVIOUR

If a user is offered a product and a system that is designed to enable easy maintenance, reuse and recycling, the user's attitude towards care, repair, reuse and recycle of a product is of high importance in order to make the system work and to be beneficial. Design strategies that can affect the user behaviour before purchase, during and after use is therefore important to consider in order to encourage people to make use of the benefits that the product and the system offers.

Lidman & Renström (2011) has created a model where design strategies for sustainable behaviour has been divided into five different categorize, Enlighten, Spur, Steer, Force and Match, see figure 5. These are further divided into two big clusters, where the four first mentioned represents the categories which the users are affected by the design whilst Match is where the product design adapts to the user. The design strategies in the category Enlighten implies to influence the user's knowledge, values and norms in order to motivate people to perform sustainable behaviours. This can be done by for example giving the user information, feedback or means for reflection. Spur on the other hand is to encourage a behaviour by additional motivation, as for example with a game or by

giving something in return. Steer and force are two categories where the designers have the most control. The strategies included in Steer aims to design so that the sustainable behaviour becomes the evident choice and force is as the name suggests, to force the user to make the sustainable choice by for example limited functionality or by restraining the undesired behaviour (Lidman & Renström, 2011).

Another method that can be used to affect the sustainable behaviour of the users is Nudging. Nudging is intended to facilitate for individuals to make the right decision when they are facing situations where the information is complex (Mont, et. al., 2014). The goal with nudging is to make the more desirable option more available. This can be made through offering the most crucial information more prominent, by turning the desirable option into the standard option, by simplify complex information, or by changing the physical environment. However, nudging is not about affecting the attitude or values, it is rather a tool that can promote behaviours which are beneficial for the individual and for the society as a whole. In the report by Mont, et.al, (2014), they suggest that nudging is most profitable for decisions that involves limited conscious deliberation or where the level of participation is high but the decisions are complex or new.

2.7 SUMMARY: FRAME OF REFERENCE

In this part of the report theories connected to waste management approaches, recycling, circular economy and design guidelines as well as design strategies for sustainable behaviour have been explored. The opportunities for prevention, reuse and recycling connected to post-consumer shoes has to be further investigated. The theories that have been presented in this chapter will be used as a foundation to steer the project in the right direction regarding which options that are the best from an environmental point of view.

Moreover, a combination of the three sets of design guidelines will be used as a tool to explore the possibilities for how a shoe can be redesigned, to give better opportunities for preventing waste of resources and for enabling a more circular system within the footwear industry. The design strategies for sustainable behaviour will work as ideation tools for what elements the system should be included in order to encourage and empower the user in an effective way.

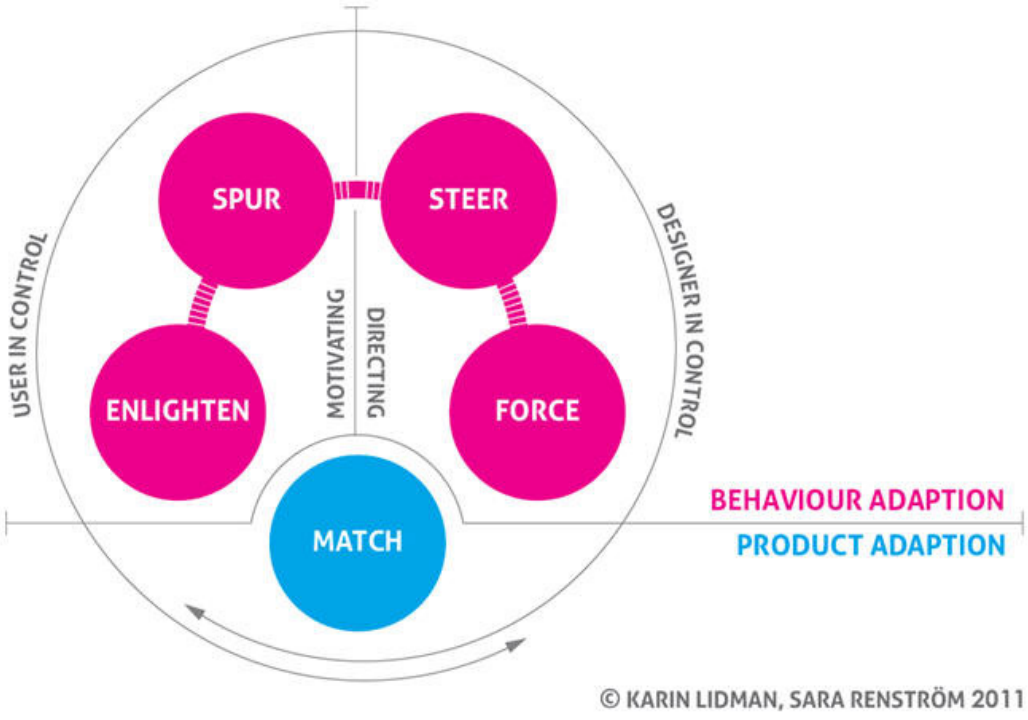


Figure 5. Strategies for design towards a sustainable behaviour by Lidman & Renström (2011).

METHODOLOGY

- FROM IDENTIFIED CHALLENGES TO SOLUTIONS

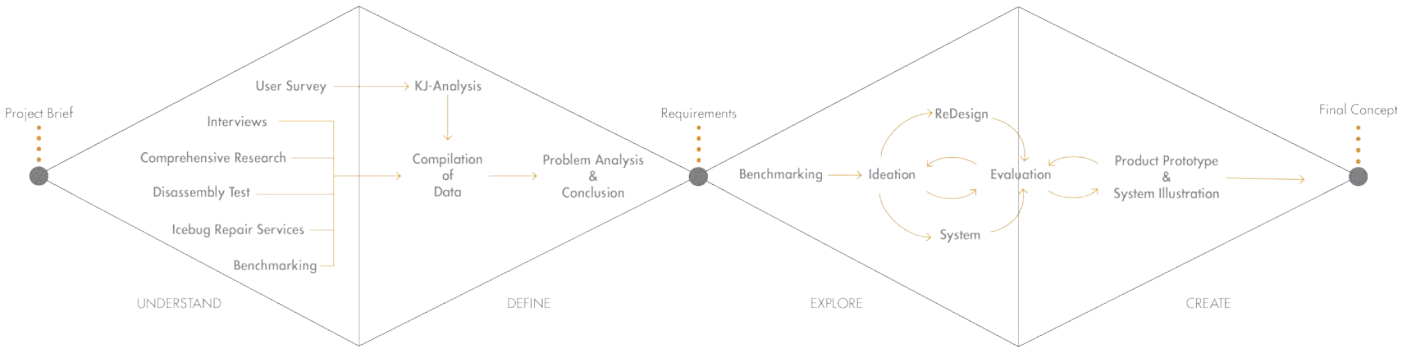


Figure 6. Flowchart of main activities based on the double diamond method, a divergent and convergent work method.

3. DESIGN PROCESS

The design process that was used in this project is inspired by the convergent and divergent, Double Diamond model that was developed by the Design Council in 2005, which visualizes what it is that happens in a creative process. This project's approach of the model is visualized in figure 6.

According to Design Council's model the process start with a divergent thinking where the aim is to discover, widen the focus and to create a broad understanding, before narrowing it down (Design Council, 2015). In the following chapters the methods used in the four different phases of the double diamond model will be explained in more detail.

3.1 UNDERSTAND

In the 'understand phase' a literature study, disassembly test, an investigation of what Icebug offers today, a user study, interviews and a benchmarking were performed in order to explore and create a broad apprehension of the possibilities and barriers.

3.1.1 LITERATURE STUDY

To gain relevant information regarding opportunities for care, repair, reuse and recycling of shoes a comprehensive literature study was conducted. The total study mainly covered; materials in shoes, how to prolong the life of shoes, lifespan for shoes, EoL situations for shoes, collection of post-consumer items, local second-hand and second-hand abroad, ethical issues with second-hand abroad, difficulties in shoe recycling, existing material recycling for shoes, consumer behaviour and green branding. The literature material was gathered from books and articles from Chalmers library search and google scholar. Material was also gained from different companies and organizations homepages. Even though the materials are not a focus area for the project, it was necessary to gain some basic knowledge about the materials in the shoe in order to get a holistic understanding of what is possible, in terms of improving EoL for shoes.

The trail running shoe Zeal2 RB9X® was chosen to work as a reference product for this project. This shoe model was chosen in concurrence with Icebug. Zeal2 is one of the more popular shoes in their assortment and have been on the market for a while. The focus regarding the study of the reference shoe will be laid on the material used in the shoes from the perspective of the possibilities to recycle, disassemble, repair and reuse. The material content was given from Icebug in the form of a BOM- list, bill of materials.

3.1.2 DISASSEMBLY TEST

A disassembly test was performed to investigate and create a better understanding of where the different materials in the reference shoe were situated and how difficult or easy it was to disassemble a shoe. It was also made in order to figure out if there was anything in the design of the shoe that made the process more difficult.

The tools that was used to separate the materials in the reference shoe was a heat pistol, a knife, a screwdriver and pliers, which can be seen in figure 7 together with the shoe.

3.1.3 ICEBUG CARE & REPAIR SERVICES

To acquire a view over what Icebug offer their customers today and scan what possibilities they give their customers in regards to care and repair, Icebug employees were asked regarding company routines, if they offer accessibility to spare parts and what information they advertise for and that reach the customer. Their homepage was also evaluated regarding how well the information regarding care is given. A test on replacing a stud was also made to get an insight how easy or hard it is, and to evaluate if the instructions given to the customers from Icebug is enough to understand how to do it, since this is a spare part that can be sent out to the customer.

Figure 8, shows the tools that was used during the test, a running shoe, studs, pliers and Liquisole. First step was to thoroughly clean the holes where the new studs were to be placed. After preparing with tools and cleaning of holes, the next step was to fill the hole with glue. A demonstration of this can be seen in figure 9. The stud was then pressed and twisted into the hole with help from the pliers, see figure 10.

3.1.4 BENCHMARKING

Benchmarking was used to gain both knowledge and inspiration of how a system for improving EoL for shoes could look like. Studies of relevant companies, both within the footwear and the outdoor industry, that had successful models in terms of take-back systems as well as care and repair services, were made. These companies included, Nike, Adidas, Lundhags, Puma, Nudie, Houdini, Haglöfs and Patagonia, well known brands within the footwear and outdoor industry that all have made effort to create a more circular business model. The benchmarking was performed by scrutinizing the companies' homepages and other commercial channels. Furthermore, email contact was held with Eliina Brinkberg, CSR manager at Nudie Jeans and a shoemaker at Lundhags was interviewed over the telephone to get a better insight in their companies. Moreover, successful branding channels and methods that the mentioned companies use to promote and to change user behavior were investigated to create an understanding and inspiration for how the solution for this project could or should be branded in order to be as effective as possible.

Figure 7. Tools used for disassembling a Icebug Zeal 2 RB9X.

Figure 8. Tools needed for the replacing of a stud.

Figure 9. Adding glue in the sole cavity where the stud should be placed.

Figure 10. Placing the stud in the cavity in the sole.

3.1.5 INTERVIEWS

A range of interviews were performed throughout the project to confirm information, get deeper knowledge and to explore possibilities within the project scope. In order to gather qualitative information from the interviews they were performed with a semi-structured approach which is a flexible method of performing interviews, were open-ended questions are asked to get longer and more extensive answers (Wilson, 2014; 2013). This was an appropriate interview technique for this project, as it made the respondents more open and free to elaborate on their answers, gaining more data. This technique was used both for the personal meetings, skype interviews, telephone interviews and email contacts where questions were asked and answered in written form. The email interviews were more structured, due to its written form, and it was not possible to ask follow-up questions unless sending a second email.

The interviews that was performed are presented in this chapter and has been divided into different categories. Each category should represent the main aim of why these interviews were performed and of importance for the study.

ADVICE & INSPIRATION

The interviews that are presented here was performed in order to gain advice and inspiration for the project within areas related to the project scope. The different interviewees had their expertise in areas such as sustainable development in outdoor and sports industry, circular economy, take-back and repair services and redesign.

Joel Svedlund
A skype interview was performed with Joel Svedlund at Peak Innovation, where he is in charge of a sustainable development project with a focus on the sport and outdoor industry. He is also a member of the sustainability council at the European Outdoor Group, EOG. Because of his great experience and expertise in the area of sustainable development regarding sport and outdoor products, he was contacted to give advice and support for the project's further development. He could also provide good contacts to other interesting actors.

Chalmers University of Technology, Isabel Ordonez Pizarro
Isabel Ordonez Pizarro is a PhD student with a focus on closing the material loop in society and is a member of Gothenburg Environmental Science Centre. She was interviewed because of her knowledge regarding material flows and circular economy. She could offer support and give suggestions to what to consider in the further development of the project.

Nudie Jeans, Eliina Brinkberg
Nudie Jeans is a jeans company that have a clear sustainability focus. Because of the fact that they have a take-back system and repair service in place, perform redesign of post-consumer jeans and sell second hand jeans they were of interest for this project. Eliina Brinkberg, CSR manager at Nudie Jeans was then contacted through email as a part of the benchmarking study, to get a better insight in how their system work, to hear how the response have been from their customers and what advice she could give.

Lundhags Shoemaker, Urban
Lundhags is a Swedish hiking shoe company that have a long experience of making shoes. They have a sustainable focus and also produce shoes that can be repaired and maintained in a simple way through the design of the shoes. A shoemaker working at Lundhags, Urban, was therefore contacted and interviewed over the telephone regarding what it is that makes the shoes easy to repair. He was also interviewed regarding their repair service that they offer their customers, how it is working and what limitations it has as well as how their customers are responding to it.

Studio Re:design, Birgitta Nilsson
Studio Re:design was an initiative from Västra Götaland County as a reaction to the unsustainable consumption of textiles. Their aim was to create new products from textile waste collected from the Västra Götaland region. They have now changed their name to Re:textile. Birgitta Nilsson, that was the contact person for the project, was interviewed to gain more information about the project and what possibilities there could be for Icebug. The aim was also to see whether or not they had any experience with redesign of footwear.

POSSIBILITIES FOR CARE & REPAIR

To get a deeper understanding of the barriers and possibilities for repair and maintenance of Icebug shoes, interviews was held with shoemakers and a footwear retailer. The aim of the interviews was to investigate what is being done regarding repair, what can be done, what is difficult/helpful in terms of shoe design and what can be done to prolong the life of shoes.

The shoemaker's that was contacted was Larssons Skomakeri and Servicehörnan Peter Lillberg AB, and the footwear retailer, Löp & Sko. These shoemakers were contacted due to their expertise in how to repair and restore worn out shoes. Löp & Sko, which is a shoe retailer, was approached because they offer repair of shoes for their customers and has knowledge in how to prolong the life of running shoes by correct usage and maintenance. One walking shoe and one trail running shoe from Icebug was brought to the interviews so that the interviewees could get a clear view of what types of shoes that the questions were aimed at.

POSSIBILITIES FOR REUSE AND RECYCLING OF SHOES

A range of interviews was held where the aim was to get a deeper knowledge behind the problems of recycling of shoes, as well as to find solutions and opportunities that would improve today's recycling options. Most of the interviews presented here are connected to reuse and recycle operations and were contacted since they were seen as possible collaboration partners for Icebug.

Chalmers University of Technology, Antal Boldizar
Antal Boldizar who is professor in polymeric materials and composites at Chalmer University of Technology, was interviewed regarding the material content of Icebug shoes. His expertise in the area of plastics was a great way to get a deeper understanding of the possibilities and barriers of material recycling as well as disassembly possibilities of shoes. Adhesives as well as alternative materials was also discussed.

Plusfoam Compound Technologies, Bridgette Roberts
PLUSfoam is a material supplier, who also offer a material reclaim service for when the products that are made out of PLUSfoam material reach their end-of-life. They were seen as an interesting company for this project and were therefore contacted by email and later on through a skype interview in order to gain a better view and understanding of the company, what they do and if they were of interest and suitable for this project.

I:CO, Paul Dietzsch Doertenbach
I:CO is a collecting company for post-consumer textile products, including shoes, and have a collaboration with the recycling company, SOEX. They were in similarity with PLUSfoam seen as an interesting company for this project and were contacted to gain a better understanding of what they can offer to companies and how a collaboration actually can look like, as there were not a lot of information that could be attained through other channels. They were contacted through email and later on Paul Dietzsch Doertenbach was interviewed through skype.

SOEX, Benjamin Marias
SOEX, which is a big recycling company in Germany where they also have started a pilot project for recycling of shoes, was contacted through email and later on Benjamin Marias, one of the initiative takers for the pilot project was interviewed over skype. The target was to gain a deeper understanding of their offerings and how a possible collaboration could look like. The aim was also to investigate what difficulties there are in shoe recycling connected to product design.

Returtex
Returtex was a Swedish recycle centre that were focused on textiles and shoes at the time of the telephone interview, unfortunately they are no longer in business. They had a collaboration with the charity organisation, Human Bridge, and the international recycling company, Boer Group. The aim of the interview was to collect data that was not found through other channels regarding how they process the shoes.

Red Cross, Eva Maria Rudbäck
Eva Maria Rudbäck is the logistic manager at Red Cross and have great experience of what it takes from a company when collecting post-consumer items, being in collaboration with recycle centers, selling second hand items and what it is that need to be considered. Red Cross has a collaboration with the recycling company, SOEX. Rudbäck was contacted through email and a Skype interview was also performed where the main target was to get a insight in how their system is designed, what difficulties they experience and how their collaborations look like with producing companies.

Myrorna, Emma Enebog
Emma Enebog is the sustainability manager at Myrorna, she was contacted through telephone. The aim with the interview was to investigate if they could be a possible collaboration partner in terms of reuse and recycling of shoes.

Boer Group, Elisa Bes
Boer Group is a international recycling company with focus on textiles and shoes. Because of unclarities regarding how they process shoes Elisa Bes was contacted through email to gain a better understanding and knowledge of their process.

Stena Recycling, Taina Flink
Taina Flink, Stena Recycling's specialist for 'Design for recycling' was contacted partly to gain knowledge regarding Stena Recycling's possibilities to process shoes and also to gain her advice on design for recycling.

3.1.6 USER SURVEY

The participation and inclusion of users when designing a system for improving the EoL for post-consumer shoes was of great importance in order to make the project successful. Surveys was therefore developed to obtain the needs, request and opinions from customers regarding, care, repair, reuse and recycle of shoes. The surveys were made in a google form, to enable online editing and semi-automatic compilation of data. A pilot-test was performed with employees at Icebug before it was used. This was made in order to get feedback on the questions stated and to ensure that the questions were understandable and relevant.

To reach Icebug users, who was the main target group for this project, one survey was posted on Icebug's official Facebook site, whilst another survey was posted on the authors' Facebook pages to get a more general insight of the user behaviour. Conducting two surveys with different target groups also made it possible to make a comparison between the attitudes among Icebug users and the public in general. The choice to post the surveys on a social platform was made due to the chance for fast responses as well as to reach as many respondents as possible. The number of respondents was, 131 on the Icebug survey and 73 on the public. The surveys were constructed with both open-ended and fixed response questions, meaning that the respondents marked alternatives on some questions and wrote down their answer on questions that needed more qualitative information (appendix 1).

General survey
71% of the 73 respondents were women and the age spanned from 21 - 68 years, most of the respondents were between 25-29. A possible explanation would be that it was distributed on own Facebook pages, meaning that the answers cannot be generalized for all ages and gender but still give a good indication of user behaviour.

Icebug
74% of the 139 respondents were women and 26% were men aged between 17-65 years old, most of them between the age of 27-44. As this was only directed to Icebug customers and owners of a pair of Icebug shoes it gave a more diverse age than the general survey, the rate of gender was surprisingly similar in both surveys.

3.2 DEFINE

In the narrowing down phase of the double diamond, where convergent thinking is used, the possibilities and barriers that were identified in the previous phase are compiled and made sense of, the goal of this stage is to set the frames for the project (Design Council, 2015). This was the phase where all of the information gathered in the 'understand phase' was compiled and processed. Specific requirements could then be drawn out from the findings and define what the final solution had to fulfil. This consisted of a KJ-analysis of the survey and a compilation of data.

3.2.1 KJ-ANALYSIS

The large amount of qualitative data that were gathered from the questionnaires were structured using the KJ-method. The aim with a KJ-analysis is to compile and transform qualitative data to a complete picture which enables to communicate the results in an effective way (Johannesson, et. al., 2004). In this project, the written answers from the questionnaires was analysed, and related statements was clustered into categories which made it possible to identify and formulate hands-on problems. The results from the KJ-analysis was compiled in diagrams and tables to give an easy and understandable overview of the relevant outcome from the different questions. For open

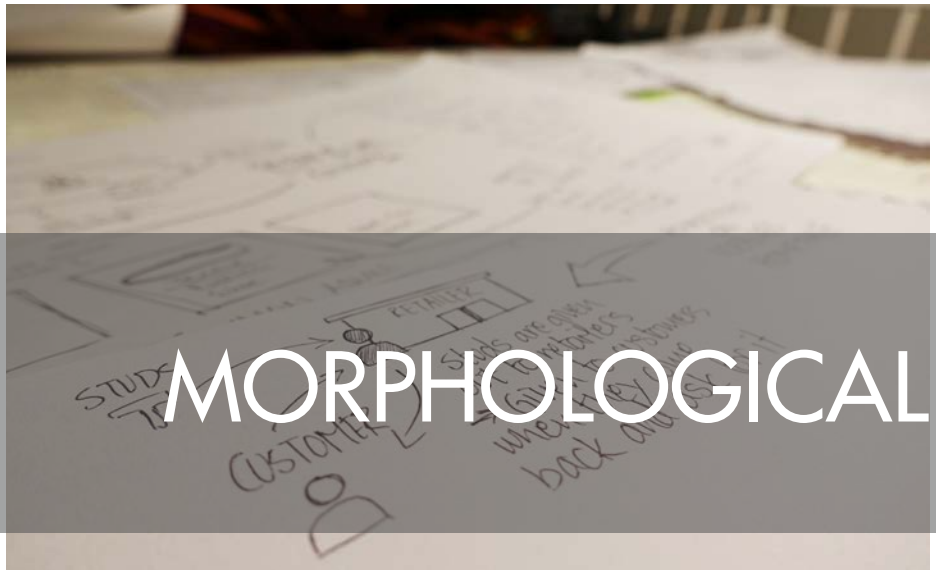
questions, each mentioned factor got 1 point, meaning that if one person mentioned for example 3 different reasons for buying a new pair of shoes, one point was given to each of the three factors. Making it into an alternative way of performing a KJ-analysis that could be summarized in a diagram.

3.2.2 COMPILATION OF DATA

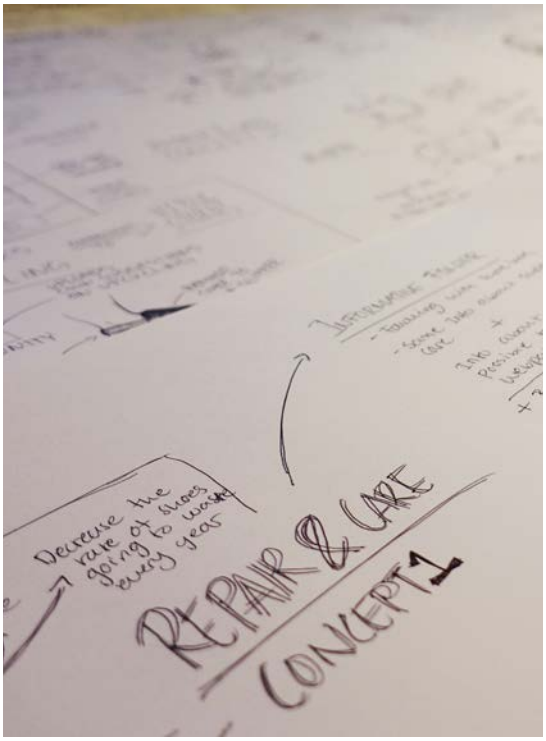
The information gained from the 'understand phase' was analysed and structured in documents. As the gathered data was quite extensive, containing different focus areas, it was of necessity to compile the data in a such a way that a holistic understanding of the whole system could be made. Therefore, a short summary was made, containing the identified problems as well as possibilities. This made it possible to see the connections between the different parts and make use of the relevant findings gained from this 'understand phase'.

3.2.3 REQUIREMENTS

The aim with a list of requirement is to determine what the system or product should perform (Bohgard, et. al., 2010). All the relevant results gathered from the understand phase was compiled and formulated in a requirement list. The aim with the requirement list was to create a framework and guide for the development process. Needs were clustered into two different categories, one for the redesign of a shoe and one for the system as a whole. The system category was further divided into subcategories which consisted of; general, information, induce a changed user behaviour, branding and requirements directly connected to Icebug. This was done in order to provide an easy overview of the compiled list of requirements.



MORPHOLOGICAL MATRIX



3.3 EXPLORE

Following the Double Diamond work process the scope is then widened again through a convergent work method where the defined frames for the project and possible solutions are explored. This is the phase where ideation takes place. Ideas are tested through mock-ups and with a continuous iteration to help to further develop and refine ideas (Design Council, 2015). For this project, an explorative benchmarking was performed, in order to gain inspiration of different possibilities. This was also the start of the ideation, supported by sketches and mock-ups, to drive the work forward. The concepts were evaluated and there was a continuous iteration between these stages to be able to further refine and develop the concepts.

3.3.1 IDEATION

This project dealt with two main areas of development, a system and a redesign of a shoe. Therefore, the ideation for the two main areas had different approaches and methods that will be explained in this chapter.

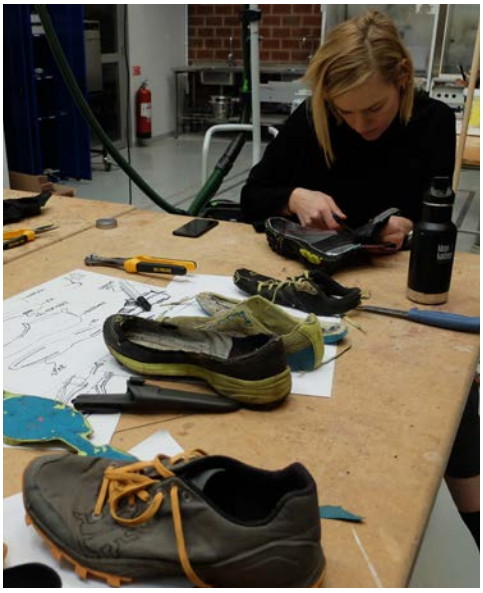
DEVELOPMENT OF A SYSTEM

For the concept development for the system it was chosen to use a morphological matrix for the ideation. This method was chosen because of its systematic approach and way of dividing the problems into sub-categories and then to finally compile different solutions together in a number of concepts. The method's aim is to help the designer to not miss any solutions or combination of solutions (Johannesson, et. al., 2004). The systematic approach of the morphological matrix was deemed appropriate to use due to the wide problem area that was attended to.

According to Johannesson, et. al. (2004) this method requires an understanding of the critical variables and that they have been identified and correctly formulated. For this project, the data that was compiled in the understand phase set the basis for the sub-categories, the main elements of interest that would make the system work. These were set to Second-hand, Collection, Recycle, Prolong life - repair, Make it easier and Care information. These were the identified main categories to be able to produce a complete system for the project focus, improve end-of-life and longevity. The care and repair categories was divided into sub-ideation-categories of; why repair and care? - focused on information to customer, how to get repair parts, information how to repair - how it should be given and finally the category of upcycling tips.

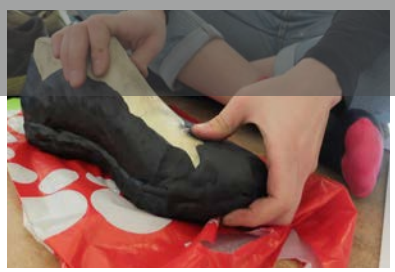
One category at the time was then chosen and ideated around, in order to keep a focus and not get overwhelmed. The data that was gathered in the understand phase was used as a basis to understand the possibilities for different solutions. Questions that were asked during the ideation was, what opportunities exist?, how can it be used?, how can it be taken advantage of?, are there possibilities to adapt or alter?, what can be added?. These questions were asked on the basis when external opportunities were added as solutions, but on some of the categories that were not locked to an existing system, such as a recycling centre, there were more freedom to ideate. In these cases, it was more explorative ideation that was used, were questions were making the problem wide or narrower in order to get inspired and create more ideas. The aim for the entire ideation phase was to come up with as many ideas as possible.

There was a second ideation session which was focused on ways to incorporate branding as a means to affect customer behaviour. Ideas was also here generated one category at a time to bring focus and create quantity. Solutions from the different categories were then combined to form system concepts in two different main categories, branding - second-hand & recycling and branding - care & repair. These concepts went through an evaluation and further development. Then a second round of combining different solutions was performed for each of the two categories, separately. The third round combined the best solutions from the two categories into a final and complete system design. This 3-level morphological matrix enabled an increased comprehension of all the including parts and made it possible to create a holistic system, not forgetting any of the important aspects.





EXPLORATIVE IDEATION


REDESIGN OF A SHOE

For the redesign of a shoe a more hands on and explorative concept development process was used to generate ideas. Inspiration for the redesign was based on the difficulties and possibilities identified in the understand phase. Inspiration was also retrieved from the benchmarking of existing products on the market. Concepts were generated by the support of the design guidelines explained in chapter 2.6, by implementing them in the process the guidelines could be tested for how well they are suited for design of shoes and how they can be used by Icebug in the future. Ideas were sketched and was combined with hands-on exploration of cutting shoes into pieces to create fast mock-ups. This helped the further development of ideas and to gain a clear visual aid of the concepts. It also gave inspiration for more ideas and how different pieces could work together.

After the evaluation of the first concepts a main idea was chosen and further developed. In this phase of the ideation clay was used on a last from Icebug to give a clearer understanding of the design and to make it possible for quick changes and to try out different ideas. The mock-up was used as a tool for ideation and made it possible for a simultaneous ideation and mock-up testing.

3.3.2 CONCEPT EVALUATION

SYSTEM

The ideation phase generated a lot of ideas in the categories of, branding, second-hand & recycling and some of the ideas were already eliminated after the first round of the morphological matrix. This was due to the fact that they were missing several of the criteria stated in the list of requirements. Seven concepts were however considered as possible solutions and was therefore taken to a second and more thoroughly evaluation. These concepts were discussed and compared against each other with respect to the compiled data from the understand phase. Each concept was marked with plus and minus including a description to each mark. The marks and descriptions was based on how well they fulfilled the required criteria's and to what extent they covered the desired needs. The plus and minus marks was then counted for each concept, giving final score for each concept. The concept that had the highest score was considered as the most promising one.

To eliminate concepts, they were considered from their further development possibilities, to be able to reduce their negative aspects and improve them. This approach gave all the concepts a fair chance in the evaluation as well as it reduced the risk for eliminating any promising ideas to early. A crucial aspect for the choice of concept was also made with respect to the implementation criteria's, such as the possibilities for implementing the different solution in a near future with regards to Icebug's current business model and the size of the company.

The evaluation of the concepts in the category care, repair & branding was performed quite similar, using the approach with plus, minus and descriptions. However, the different ideas for how to inform and encourage about care, how to give instructions about repair, where to get repair parts and how to get them, and how to give upcycling tips, was evaluated separately. The reason for this was that each of these concepts was possible to be combined with each other, to create a complete solution. This way the most promising solutions from each category had the chance to create the best solution as a whole. Crucial in this evaluation was that the final concept should be applicable on the chosen concept for the category branding, second hand & recycling to be able to deliver a uniform system, including all the necessary parts.

REDESIGN

The evaluation for the redesigned shoe was made continuously during the ideation phase. Due to the fact that the concept generation was mainly performed through creating mock-ups with clay, sticky tape and old shoes it was possible to test and evaluate the different ideas continuously. The design guidelines, presented in chapter 2.6, and the list of requirements was used as base for the discussion and evaluation around the concepts.

3.3.3 FURTHER DEVELOPMENT

SYSTEM

The further development was made continuously during the evaluation process, where it was understood that some parts were missing. Possible user scenarios were also used to go through the concepts, for how users would act and use the system, to be able to find further development possibilities. The selected system was therefore enhanced by adding two complementary sub-solutions. Which in turn could fill out the gaps,

making it into a fully capable system that could deal with the different user scenarios.

REDESIGN OF A SHOE

The chosen shoe design was further developed in Fusion 360. Throughout the modelling of the shoe different further development possibilities were found, as the 3D-modelling helped to get a clearer view of how it actually would look like. Two different models were then presented to the product development team at Icebug, whereupon small incremental changes were made to the shoe.

3.4 CREATE

Following the double diamond model, the divergent phase is followed by a second convergent phase where the focus narrows down on one solution. This is the delivery phase where according to Design Council (2015) the concept is finalized, produced and launched. Because of the fact that this project's main focus has been on the first two phases, understand and define, in order to fully comprehend the complex system, the last stage did not include production and launch. It did on the other hand produce a solution that can be implemented in a near future, building on the knowledge gathered in the first two phases, creating a realistic concept proposal. The last stage for this project was therefore to finalize one concept, produce a prototype, visual aid and perform a final evaluation and further development possibilities.

3.4.1 PROTOTYPES AND VISUAL AIDS

SYSTEM

A visual presentation of the system was mapped out with the help of icons, using Adobe Illustrator, in order to create a visual comprehensive view of the complete system.

Visual mapping of homepage details was made as well as examples of how the layouts for the informative brochures, including care, repair, reuse and recycle possibilities, could look like. A solution for an informative shoe-bag was also sewn together by using sheets and some cardboard. These prototypes were done in order to be able to communicate the concept in an understandable way and to provide Icebug with a more detailed view of the concept.

REDESIGN OF A SHOE

The final concept of the shoe was created in Fusion 360 and rendered in Vred. The sole of the shoe was also 3D printed in full scale, using flexible filament to be able to gain a deeper understanding of how the shoe might look like and how it would function, as well as being an aid in the presentation. This gave the possibility to try it on the foot and to feel how the design worked.

The design guidelines that was tested by the development of the shoe was also put together as a poster in InDesign, to be able to provide Icebug with clear and compiled guidelines that they can use in future projects.

PART I:
IDENTIFYING OPPORTUNITIES

- THE BASE FOR THE PROJECT

4. SYSTEM DESCRIPTION

The illustration in figure 11 shows an overview of the different elements that are included in this study in terms of system development, what it is that has been investigated and which focus they belong to. The re-design of a shoe is something that can affect all parts of the system.

The grey, blue and orange circles illustrates the specific parts that need to be included in the system, where they belong and how they are connected to each other. How well the blue circles are executed in the system depends on user behaviour, what they are encouraged to do and how willing they are to use the system. The green boxes show which design development focus that is used for each system area, in order to bring a better solution than today. The grey boxes in the illustration contain questions linked to specific system areas that need to be answered in order to create a valid and functional system, which will be dealt with in this part of the report.

4.1 STAKEHOLDERS

This project is carried out in collaboration with Icebug, being the main stakeholder. But there are also other very important stakeholders that need to be taken into consideration in order to provide a wide understanding of the project and what it is that affects it. This chapter presents the different stakeholders and what effect and influence they have on the project.

Icebug
From Icebug's point of view it is important that the final solution can give benefit to the company, bring them closer to their sustainable target and enhance their green branding. Furthermore, the final concept need to be realistic for their company size as well as be able to be implemented in a near future.

Manufacturers, Producers & Suppliers
The manufacturers, producers and suppliers are stakeholders that can affect how a take-back system and especially how a re-design might look like, regarding possibilities for flexibility in terms of material choice and alternative manufacturing techniques. It might inflict barriers or possibilities that have to be taken into consideration for the project. Thus, meaning that

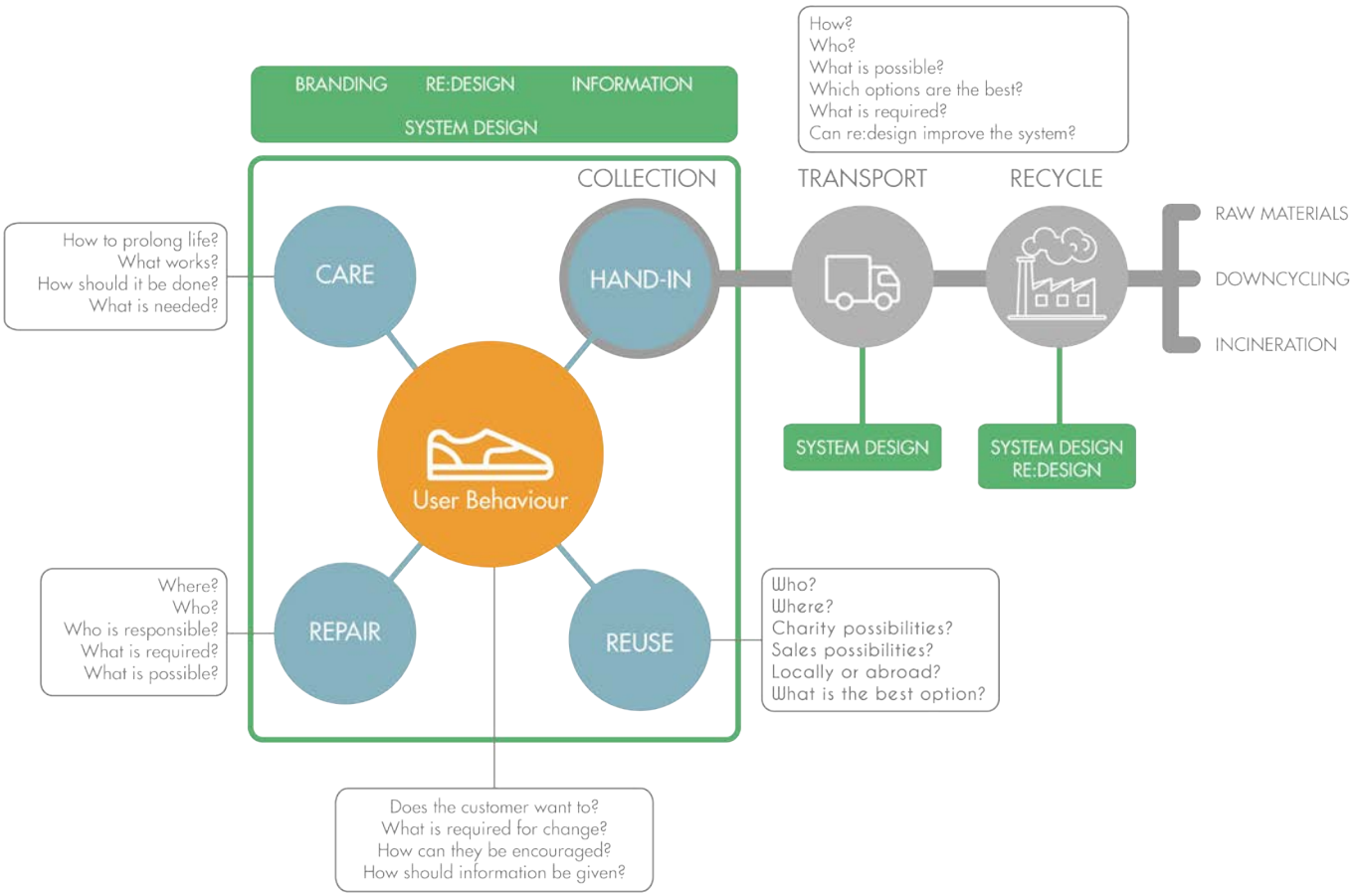


Figure 11. Illustration of the different focus areas in the system.

the system might come to effect what manufacturers, producers and suppliers that are used, in order to facilitate the best sustainable solution possible.

End user
The end user is a crucial stakeholder for this project. The consumer interest for sustainable products have increased over the years and it is a growing trend on the market, making it important for a company such as Icebug to keep up with the user demands and provide desirable products (ISPO Textrends, 2016). The end user also put pressure on companies by being critical to how sustainable products actually are, demanding transparency from companies. Such bad reputation from consumers can otherwise give serious implications for a company (Ottman, 2011). End users are also willing to pay more for products that are sustainable (Svensk Handel, 2016). The end user has to be in focus when developing the system, as otherwise it might not be used, removing its sole purpose.

NGO's,
NGO's, non-governmental organizations, such as Green Peace are of interest as they are controlling companies, if they can hold up to what they promise. If they do not find that the company is honest and transparent enough, they can give big consequences to their businesses. They are also a valued ally as they are doing research and coming up with important findings that might need to be taken into consideration.

Collaboration Partners
Icebug is a member of the Scandinavian Outdoor Group which is a non-profit, non-political Swedish association that consist of nearly 60 outdoor brands from Scandinavia (Scandinavian Outdoor Group, n.d). It lays in their interest to include companies that strive for a sustainable development and can offer premium products. Thus, putting pressure on Icebug to target for a sustainable development

Government, legislations & Policies
An important target that have been made by the European Commission is that by year 2020, the re-use and recycling of waste material from households should increase to a minimum of 50% (European Commission, 2016). The preparing for re-use, recycling and using waste as material for new products, have to increase by 70% by 2020 according to the Commission Decision 2011/753/EU.
In Sweden, the government assigned Naturvårdsverket, the Swedish Environmental Protection Agency, to provide a suggestion for a future goal when it comes to recycling. In connection to the European Commission target for 2020, Naturvårdsverket set the goal to reuse 40% of the textiles that are put on the market and that 25% should go to material recycling to new products (Naturvårdsverket, 2016). According to Naturvårdsverket it is of necessity for designers to start using mono-fibers, easily removed metal parts and that the clothing industry start to adapt to recycling in order to reach this goal (Berlin, et al., 2015). Which in terms also affect the shoe industry. Naturvårdsverket also press on the importance to change consumer behaviour.

The Swedish government also lowered the tax from 25% to 12% for repair services for bikes, shoes, clothes and leather products to encourage people to take care and repair instead of buying new products (Regeringskansliet, 2016). They also claim to be pushing for other ways to make it easier to implement circular economy. They also mention that the European Union is pushing the government to start producing products that makes it easier to recycle. It has also been made more difficult to use greenwashing, false marketing, where Konsumentverket, the Swedish consumer Agency, have been given the power to immediately stop companies that use false claims about being sustainable (Regeringskansliet, 2016). This is a strive to bring more transparency to the market.

Recycle Centres
Depending on what kind of recycling methods that are available it will set the frames for how the system can look like and what is necessary to change, regarding shoe design, in order to facilitate efficient recycling. The recycle centres are also dependent on shoe design in order to develop their own recycling methods, making it a two-way collaboration, becoming dependent on each other. The smarter the original design of shoes the easier it becomes for recycling companies to gain value from such post-consumer products.

Charity organisations, second-hand stores
Charity organizations and second-hand stores that sell or donate second-hand shoes are a possible collaboration partner for a system that should encourage reuse and facilitate recycling. If taking advantage of such existing reuse and recycle systems it can put demands on the condition of the shoes that are handed in and require different means of collecting, distributing and recycling post-consumer products.

Collection companies
There are a number of different companies offering collection of post-consumer items as a service. These can become a possible collaboration partner in order to succeed with a system for the end-of-life phase of shoes. Therefore, it is of importance to understand their restrictions and demands that they have on their partners and what is required. It is also a good source of inspiration of what might be required if performing collection services.

Retailers
From retailers' point of view, they need to sell products that they believe in and feel like they can sell. The product brand becomes an important factor of making it easier to sell, as a strong brand can almost sell itself. As consumers are getting an increased interest and knowledge of sustainable products it also becomes of interest for retailers. Retailers are also a very important link to the consumer as they are in direct contact with each other, making it to a valuable stakeholder. Retailers can also be of interest to include as a collaboration partner for the system, as they have this direct contact.

4.2 DIFFICULTIES REGARDING SHOE DESIGN

In this chapter, some of the more specific difficulties identified for the design of a shoe will be presented and lays the foundation for what redesign possibilities there are. It is also used to create a deeper understanding for what opportunities that exist for the system design. Focus in this chapter is therefore laid on identifying the parts of a shoe that have a significant effect on the lifespan and what it is in the product design that complicates recycling and disassembly. The benchmarking on shoes that have been made with a DfD approach is also presented in this chapter, as an inspiration for what is possible and what it is that has already been done.

4.2.1 THE LIFESPAN OF A SHOE

To understand what parts of a shoe that wear out the fastest and that need to be replaced in order to prolong the life of a shoe, it is important to look into the lifespan of a shoe and its components. The lifespan of a shoe is something that have different answers depending on who you ask. In an interview with Löp & Sko they gave the recommendation to exchange a running shoe after 800-1000 kilometres. In a brochure provided by American College of Sports Medicine they mean that the general opinion is to exchange shoes after 500-600 kilometres (Vincent & Vincent, 2014). Although, they argue that it is hard to tell when it is time for a shoe to retire as it is highly dependent on which shoe it is, as shoes wear differently depending on the materials as well as how they have been used. In an article made by Runner's World they describe that the lifespan of shoe also depends on the kind of environment that the shoes are used on, grass, concrete, mud etc, where softer surfaces gives a longer lifespan (Brunick & Burfoot, 1996).

The job for a running shoe is to prevent the runner from getting injuries by providing cushioning, stability and motion control (Asplund & Brown, 2005). Shock absorption is something that degenerates with usage as well as with age, as the cushioning midsole made from EVA ages even when it is not used. According to Asplund & Brown (2005) the midsole loose some of the shock-absorption properties after 1 to 2 years, even if not worn and used. In a conversation with Henrik Tuomas, Icebug's quality manager in the product development team, it was concurred that EVA is a material which ages quickly and loses its elasticity and that this is the reason why some shoe companies put the date of when the shoe was made inside the shoe. In the article "The Runner's footprint" from Runnersworld, Derek Campbell, a material engineer from Brooks Sports, states that "if the midsole are the technical wonder of the shoe, they are also its main environmental culprit" (Williams, 2008). This is because the midsole of a shoe has a very short lifetime. The biodegradability of EVA foam is also very poor, a midsole made of EVA can last up to 1000 years on landfill (Lippa et al., 2016). In a test performed by Brunet, et al. (1985) on how the shock absorption on running shoes is affected by the amount of kilometres run, they made the conclusion that the midsole is in fact the limiting factor in shoe performance. In terms of preventing injuries they stated that it has to be improved or replaced in order to be able to offer proper shock absorbing properties for a longer period of time and kilometres.

Asplund & Brown (2005) means that the most important areas on a shoe to keep an eye on when it comes to deteriorating and aging is, the heel counter, the midsole and the outer sole in regards to associated injuries. The outer sole has a longer lifespan than for the midsole and signs to look for if the shoe needs to be

replaced is if the heel counter has been worn down, probably through incorrect usage, or if the midsole has a lot of wrinkles, is tilting or is noticeably compressed (Asplund & Brown, 2005). When shoes are worn out in an uneven way it also gives a change in the mechanics of running, which can lead to injuries (Vincent & Vincent, 2014).

Regarding how long people actually keep their shoes in reality, the result from the questionnaire directed to Icebug users shows a clear pattern that people keep them longer than the 1-2 years lifespan of the midsole cushioning, see figure 12. The majority of the respondents that own a pair of Icebug have had their oldest Icebug shoes up to 4 or 5 years, which includes both running shoes and walking shoes. It was also asked how often they use their Icebug shoes, most answered that they use them several times a week during the winter season or several times a week during all seasons of the year. Giving an indication that Icebug shoes are well used and used for a relatively long period of time.

4.2.2 DIFFICULTIES REGARDING USE OF MATERIAL

To attain the full picture of what it is in the design of a shoe that brings difficulties in regards to its EoL, it is important to create an understanding for the multiple materials that a shoe consists of and how they are attached to one and another. It is also beneficial and necessary to understand the do's and don'ts of material combinations in order to make the right designer decision.

Figure 13 shows the materials used in Icebug's trail running shoe, Zeal 2 and their placement in the shoe. As can be seen in the figure, there are a numerous of different materials integrated in the shoe, which are joined together with adhesives and stitches. According to Rahimifard and Staikos (2006) these aspects of a shoe, the large amount of different materials and the use of adhesives, complicates the disassembly of a shoe and makes the repair, maintenance and recycling of shoes a big challenge. In the interview with Antal Boldizar he also expressed the challenges with recycling when using numerous of different materials that are glued together. The use of adhesives is very common in the manufacturing of footwear, and especially for attachment of the upper to the sole (Intertek, 2010). Through the use of adhesives, heat and pressure the different polymer layers in the shoes are fused together, causing a strong bond between the parts. Boldizar expressed that it is hard to find a glue that creates a strong bond between parts, which is required in shoes, and at the same time enables easy separation of parts. This has also been verified by further literature research, where a strong enough glue that can be easy to dissolve - to enable users to manually separate their own shoes, has not been found.

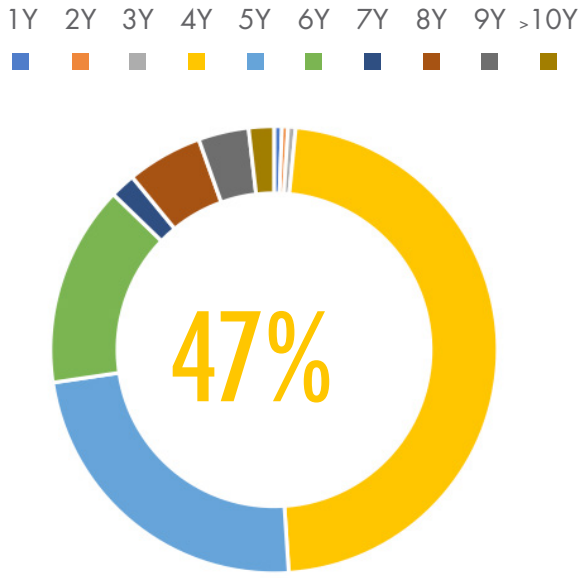


Figure 12. Survey answers to; How long have you had your oldest Icebug shoes? (139 respondents).

Figure 13. The material content of the reference shoe, Zeal 2 RB9X.

According to Boldizar another big issue that can complicate the recycling process is when rubber is combined with plastics, or thermoplastics combined with thermosets, due to the materials different behavior when heating and melting. To mix rubber with plastics is, according to Boldizar, seen as something worse than mixing metals with plastics, since metall easily can be separated from other materials with for example magnets. Benjamin Marias, who is involved in the SOEX pilot project of recycling shoes, which can be read more about in chapter 8.1, also expressed that metals are not such a big problem especially if they are magnetic. Although the exception is really compact resistant and hard metals, such as the ones used in the toe cap of working shoes. Their Pilot project do not accept these kind of shoes as their process cannot deal with such hard parts. Smaller zipper parts can be processed but hard plastic and aluminum is difficult for their machines to process. Marias also brought up the difficulties to identify different materials as for example fake leather, pinpointing the importance of marking the different materials for easier identification. According to Antal Boldizar, professor in polymeric materials and composites at Chalmers, the requisite for efficient recycling is to be able to separate and sort the materials in the right bin. Furthermore, the recycling should give a profitable output, it should give a sufficient amount of material, and the recycled material should be part of a permanent material flow.

A big barrier for shoe recycling in Sweden is, according to Taina Flink from Stena Recycling, that it is hard to find a demand for the recycled materials from shoes. Due to this fact, shoes normally go to incineration in Sweden. However, she stated that a bigger demand for more specific plastic materials exists in Europe, especially in Germany and The Netherlands. According to Flink, a crucial part in order to close the loop is to include recycled material in the product, which in turn will create a demand for these materials and makes it profitable to collect these material for recycling.

A industry where recycled material is gaining more demand, is the textile and apparel industry. More and more apparel companies are using recycled content in their garments, increasing the demand for recycled fiber, and are working towards a more circular business model. The continuous low price on virgin materials compared to recycled is although according to Naturvårdsverket (2016) still a barrier for a higher usage of recycled material in products and therefore affects the further development of recycling techniques. Naturvårdsverket also informs that material recycling is preferred even though it might take place abroad and require transport, it is still the better option (2016).

Rahimifard and Staikos (2006) discuss design and material improvements as the two major methods that can be applied in the footwear industry in order to reduce waste. Design improvements should be considered early in the product's life cycle, meaning already in the design phase. Design improvements that reduces the waste for the products EoL could for example be a shoe designed with as little amount of material as possible. Another way that can significantly reduce waste from the shoes EoL is to make conscious material choices by choosing materials that can be more easily recycled. In a textile report done by Mistra Future Fashion[2] (Elander & Ljungkvist, 2016), they listed 43 critical factors that need to be attended to be able to improve the closed loop recycling of textiles. A selection of the obstacles and difficulties presented from the report, that was consider as relevant for this project, are presented below.

- Use of mixed fibers
- Use of non-textile (metals, plastic, etc.) materials in textile products
- Lack of textiles available for recycling due to insufficient collection & sorting
- Plastic prints on textile
- Use of different lining and outer materials in textile production
- Spandex, lycra, elastane mixed in textile products
- Use of threads in different materials than the fabric
- High market price for recycled textile compared to virgin
- Lack in information regarding material and chemical content in products

2 Mistra Future Fashion is a Swedish cross disciplinary foundation for strategic environmental research focused on circular economy - to bring a positive future for the fashion industry.

4.2.3 DISASSEMBLY TEST

A disassembly test was performed on the reference product in order to build on the knowledge how the different parts of a shoe are joined together and the difficulties it gives in terms of manual disassembly. This process is also used as an inspiration to what it is that can be improved in the design of a shoe, for easier separations of materials. In the course of the disassembly test it was discovered that almost all parts were joined together with adhesives in combination with seams. The disassembly of the reference products, Zeal 2, took around 2-3 hours to complete. The separated parts of the shoe can be seen in figure 14.

This manual process required time and a lot of effort. Some parts were also unsuccessfully separated from each other, for example, parts of the EVA midsole were stuck to the outsole and the upper fabric. This was due to the fused effect from the adhesive, which made it harder to separate the materials from each other. To fully remove the EVA it would have required at least, another hour of work. Furthermore, foam such as SBR and PU joined with fabric was not possible to detach from each other. To be able to separate the outer sole and the midsole from each other a heat pistol was required, the vapor generated when heating plastic and rubber resulted in a strong odour that caused headache and dizziness. This test proved that the reference shoe as it is today is not well adapted for manual disassembly, which also affects the possibility for easy repair, upgrading of components and recycling.

4.2.4 BENCHMARKING DFD SHOES

One way to make a shoe easier to take care of, repair and recycle, is to design it for easy disassembly, as described in the various design guidelines in chapter 2.6. Some of the designs that have been investigated has used this DfD approach. However, many of them are not established on the market, but serves as innovative examples of what can be done in terms of shoe design. Some of the interesting ideas that was found can be seen in figure 15, and are described shortly in this chapter.

Similar for almost all of the solutions that can be seen in figure 15, are that they use some kind of mechanical lock to connect the different materials together. This way they are able to offer a completely glue less solution that can be easy to disassembled by the user themselves. POP, that is designed by the Ethical foot-

Figure 14. Results from disassembly of Zeal 2.

Figure 15. Benchmarking of different shoes designed with DfD principles in mind.

wear brand Terra Plana (Alammary, 2011). They use a sole that pops into a frame which is possible to remove and replace in similarity with the approaches used by Nike for their Consider shoe where a frame is used to enclose the midsole and then stitches are used to secure the uppers. This way traction is given from the rubber and cushioning from the Eva, without having to join these two parts with adhesives. The LYF and Nike's Zvezdochka shoe are other examples of where an outer cage is used to safely secure and lock the midsole into place without using adhesives. In the Zvezdochka no stitches are used, an inner sock is used instead. This replaceable inner sock is also used in Arcteryx Bora shoe, making it easier to wash or replace. The simpler 'Sugar and Spice' from Patagonia, uses the same loose insock principle with a caging rubber outsole, securing the sock in place.

A different take on a DfD shoe is the simplistic Loper shoe from the fashion brand Proe which has a upper and a sole that is tied together with a thin nylon rope instead of using glue (Gibson, 2016). Another take on it is the 'Repair it Yourself' shoe where the textile is secured to the sole by placing the midsole from the inside of the uppers through holes in the fabric and then snap the rubber outsole on from the outside. Two other mechanical lock solutions are the Urshuz and the Mahabis where snaps and buttons are used.

4.3 SUMMARY & DISCUSSION SHOE DESIGN

There are as presented quite a lot of barriers that the design of a shoe poses for a good end-of-life process. The main implications that can be taken away from this chapter is that shoes generally have a short lifetime and contain a lot of adhesives. Regarding the component that have the shortest lifespan in a shoe, the midsole has been identified as the limiting component, where it loses its cushioning after 1-2 years. The midsole, EVA, also deters even if it is not used. As indicated from the survey, Icebug users tend to use their shoes for longer than the lifespan of the midsole. The short lifespan of the midsole gives an impact not only on the environment but also affects the health of the user, since an old midsole can induce injuries for the user. The midsole is identified as the limiting factor for shoe performance by researchers and together with the heavy use of adhesives throughout the shoe it makes it hard to disassemble, to be able to replace and upgrade components. Correct usage of shoes is also something that is identified as an important factor for the lifespan of a shoe. Making it important to educate customers in what correct usage of shoes actually is so that they can make the right decisions.
Regarding material recycling a range of different improvement possibilities have been found where the strive for mono-materials, material identification and use of recycled materials is a few of the important aspects that can elevate and aid the material recycling. Another important insight is that even though material is shipped to other countries for material recycling it is still better than incinerating it for energy locally. Even though there are a lot of negative aspects of a shoe the benchmarking shows a lot of inspirational shoe designs where these obstacles have been tackled.

5. OPPORTUNITIES FOR CARE

To properly mend and take care of shoes are a way of prolonging the life of them, making them last longer and it might also be a way to increase the chance for someone else wanting to use them second -hand. This chapter will therefore present the findings of how shoes generally should be taken cared of as well as the behaviour and knowledge that the respondents to the surveys have. These findings make it possible to understand what it is that have to be communicated to users.

5.1 HOW TO TAKE PROPER CARE OF SHOES

This chapter deals with the general recommendations for how to take proper care of shoes, which will be used to understand what information it is that should be given to users and what it is that can enable better maintenance possibilities for users. Asplund & Brown (2005) recommends that in order to keep the shoes for a longer period of time it is important to know how to properly use and care for your shoes. The Swedish shoe retailer and foot specialist, Löp&Sko (2017) also recommended that shoes should be taken care of in order to maintain the stability, cushioning and fit.

Asplund & Brown (2005) stress on the importance of putting the shoes on and off in a proper way, to untie them instead of kicking them off. This reduce the risk of destroying the heel counter which is important for the stability of the shoe. Asplund & Brown (2005) also press on the fact that it is important to use the shoes for the chosen intent, using running shoes for other activities, such as walking or other sports will wear them out faster.
Löp&Sko (2017) highly recommend to keep the shoes clean, as the upper mesh fabric can get clogged with sand and dirt which affects the breathability of the fabric. Dirt particles also tear on both the fabric and the seams, making them break faster. It is also important to keep the shoes clean as otherwise the mesh in the uppers can stiffen and get more porous which makes it break faster and to get a worse fit. Therefore, they recommend to clean the shoes on regular basis. The shoes should be cleaned with lukewarm water as if cleaned with too hot water it can have a bad effect on the glue and laminate. Shoes should therefore not be washed in a washing machine as this deforms the shape of the shoe (Asplund & Brown, 2005). Löp&Sko (2017) is also recommending to not put the shoes in the washing machine as it tears on them and reduces their lifespan. If the shoes are heavily soiled then a dish-brush can be used instead, to brush of the shoes with some water. A smaller amount of mild laundry detergent can also be used once in a while in order to keep the shoes fresh and odourless. Löp&Sko (2017) also gives tips on using the rough surface of a soft sponge to get the side of the midsole cleaned. The innersoles are best if they are cleaned and dried separately.

Shoes should not be exposed to excessive temperatures when drying them as it can degrade some of their components (Asplund & Brown, 2005). They should instead be let to dry by themselves in room temperature with some newspapers stuffed inside of them to absorb the water, the newspapers can be exchanged every other hour (Sko&Löp, 2017). The shoes should also not be stored in high temperatures or in direct sunlight as the entire sole can dry out, shrink and lose its shock absorbing properties, decreasing the lifespan of the shoes (Brunick & Burfoot, 1996). The shoes should also not be stored where it is humid as they can start to mold (Sko&Löp, 2017). A well vented fabric bag can be used to store the shoes in when going between activities and then to immediately put them out when getting home for drying (Brunick & Burfoot, 1996).

Regarding care of shoes that have a uppers made with a GORE-TEX membrane it is the same cleaning procedure as described above, (Löp&Sko, 2017). For GORE-TEX shoes that have an upper of leather it is recommended to not use waterproof oils or grease as it affects the breathability of the GORE-TEX membrane (GORE-TEX,2017). They also recommend to follow the advice of the manufacturer of the shoes for the treatment of the upper as it is the outer material that decides the treatment.

5.2 CUSTOMER BEHAVIOUR REGARDING SHOE CARE

Some of the questions asked in the two surveys, one for Icebug users and one general, was aimed to investigate customers behaviour regarding shoe care. Do you take care of your shoes? How do you care for your running/walking shoes, clean, impregnate, spray, wax, etc.? Do you consider yourself having the right knowledge regarding shoe care?. These questions were

posed in order to understand how much knowledge people have about taking care of their shoes and if it is in fact something they do. Whereof 22% of the 73 respondents in the general survey claimed that they take care of their running shoes while the double, 44% answered that they take care of their walking shoes, see figure 16. Showing that there is a clear difference in terms of which shoes that is believed to need shoe care. In the survey directed towards Icebug users, 49% of the 139 respondents answered that they take care of their Icebug shoes, see figure 17. 79% of the respondents in the general survey felt that they do not have the right amount of knowledge of how to take properly care of their running shoes and a slightly lower number for walking shoes, 56%, see figure 18. 53% of the respondents of the Icebug survey answered that do not feel like they have the right amount of knowledge of how to take care of their shoes, see figure 19. Giving evidence that too less information regarding how to take care of their shoes are given from Icebug to their customers as well as brands in general.

"I do not have the right knowledge now, but if I would like to know I could always google. I am basically to lazy and uninterested to find out."

- Respondent to general survey

"The shoes would probably hold longer if I knew what it is that makes them last longer"

- Respondent to Icebug survey

Comments that was given to the question regarding knowledge of shoe care, was sorted into different answering categories using the KJ-method, stating the reasons why there is a lack of knowledge within the area. This resulted in four categories for the general

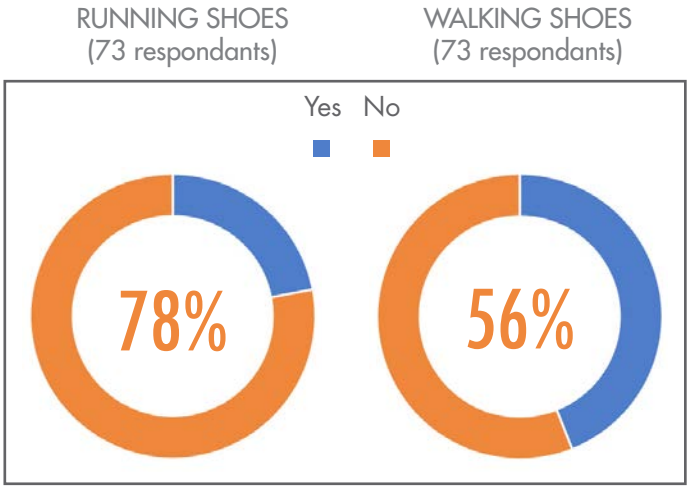


Figure 16. General survey results, Do you take care of your shoes, clean, impregnate, spray, wax etc?

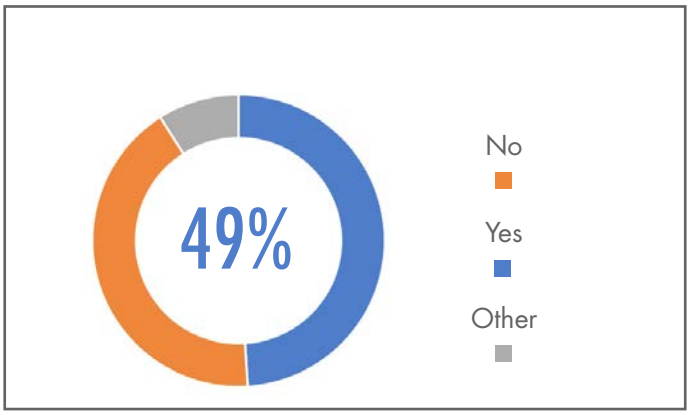


Figure 17. Icebug survey results, Do you take care of your shoes, clean, impregnate, spray, wax etc.?

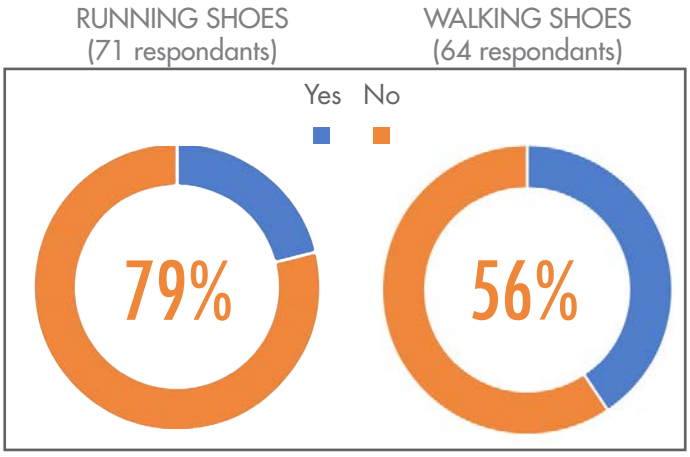


Figure 18. General survey results, Do you feel that you have the right knowledge regarding maintenance of your running and walking shoes?

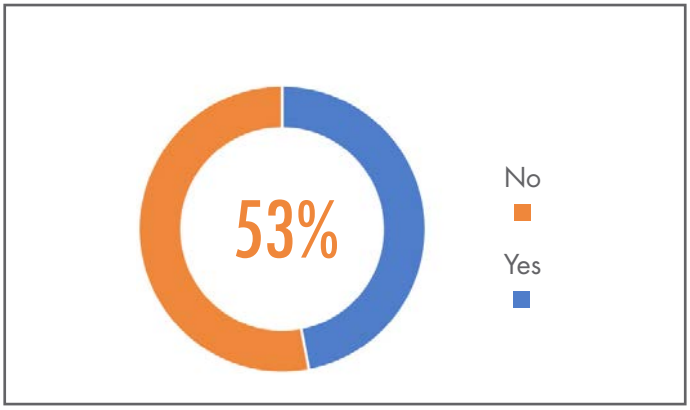


Figure 19. Icebug survey results, Do you feel that you have the right knowledge regarding maintenance of your shoes?

survey and five categories for the Icebug survey. The categories can be seen in table 2.

In the general survey 35 responded regarding how they take care of their walking shoes and 27 for their running shoes. By the ones answering that they put the shoes in their washing machines they seemed aware that it was something that is not preferred in terms of shoe care. For walking shoes the most common methods used was to use some kind of shoe grease, wax, polish or impregnation spray. Water and brush were the most common method for running shoes.

> *"When the shoes are old and I no longer care so much for them (2-3 years) I usually put them in the washing machine. Which is a pity to do, both to the shoes and the washing machine, but they turn out like new afterwards. Especially when the running shoes have passed their due date the washing machine feels like a good option. Then you kinda get a pair of new shoes again that you can have when painting, working or walking in terrain with."*
>
> - General survey

For the Icebug survey, the most frequently methods that were mentioned were to use water and a hose, alternatively to scrub the shoes off when really dirty which coheres with the general advice of how to mend for your shoes, except for using the hose and to soak them completely in water. To impregnate the shoes were also one of the top methods that were mentioned. In comparison to the general survey it was far less percentage of the respondents that said that they use vax, shoe grease or polish, which has a clear connection to the fact that most of Icebug's shoes are not made out of leather. The different methods were often described to be used together in a combination. Faulty cleaning methods that harm the shoes were also mentioned for the Icebug users, such as putting the shoes in the washing machine and drying them on a heater. Icebug do have general care advice on their homepage that have the purpose of guiding their users in how to properly care for their shoes. This tab is found at the bottom left corner of the homepage, making it relatively difficult to find if not actively searching for it.

Table 2. Categories from the two surveys, regarding their comments to their knowledge about shoe care.

GENERAL SURVEY	ICEBUG SURVEY
Lacking knowledge but is too lazy, not interested or does not feel that it is worth the fuss	Is to lazy or sloppy to care about the shoes in a proper way
Lacking knowledge and is interested to learn	Would like to know and learn more about shoe care
Feel confident and do not need more information	Feel confident about how to properly care for the shoes
Feel confident but has not properly understood or have the right information	Do not feel like it is needed
	Have not thought about the subject before

Some of the respondents commented that they haven't needed to clean their Icebug shoes yet while others commented that they always brush or clean them after using them. One respondent also comments "I do nothing special, there is no leather in them". Connecting this with the answers that was gained from the general survey it can be seen that a lot of people tend to think that shoes that are not made of leather do not need to be taken care of.

5.3 SUMMARY & DISCUSSION: SHOE CARE

To summarize this chapter, there is an environmental value to take care and mend for shoes in order to keep them going for a longer time. There are specific advice regarding shoe care and usage that when followed can increase the lifespan. From the answers on the surveys it can be concluded that there is a lack of knowledge regarding shoe care and hence, improvement possibilities for Icebug to provide their customers with information and educate them on the matter in a different way. It can also be concluded that people tend to care more for their walking shoes than for their running shoes, and the same for leather shoes compared to textile shoes. Thus, not having an understanding to why shoe care applies for all shoes. People also tend to think that there is no point in taking care of their shoes and also finding it to take a lot of effort and work, bringing a need for encouragement and education. The survey also shows that there is an interest to get to know more and the questions seemed to spark some interest to get to know why it is good to take care of the shoes, wanting to learn more.

6. OPPORTUNITIES FOR REPAIR

To understand what opportunities there are in terms of improving the repair possibilities for Icebug's customers this chapter's main focus is about what other companies offer in terms of repair services, what Icebug offer their customers today, what shoemakers can repair and what they find difficult, what customers can repair by themselves, which parts of a shoe it is that generally need reparation and consumers attitude towards repair of shoes.

6.1 BENCHMARKING

This chapter will present some of the companies that have successfully been able to implement a repair element in their business and been able to affect the behaviour of their users. This is presented to give an insight in how other companies have done it and work as an inspiration for this project.

Two examples of Swedish companies that have succeeded with included a repair element in their businesses are Nudie Jeans and Houdini, both being active in the apparel industry and have a very clear environmental approach. Houdini offer a repair service in all of their stores and if the customer doesn't live near a Houdini store, they encourage people to contact the local tailor. They can then send spare parts to the tailor, if needed, in order to make sure that the clothes are repaired. Houdini is very clear in terms of their marketing, that they want to extend the lifetime of their products.

Nudie Jeans have a similar approach, although the repair service is deeper rooted in their brand and who they are as a company. At Nudie Jeans, their brand stores are in fact called repair shops, and they offer free repair on all Nudie Jeans, see figure 20 (Nudie Jeans, 2015). People who live near a repair shop have the opportunity to leave their jeans directly to the shop and people who don't live near these repair shops are offered a free repair kit that can easily be ordered from their website.

Nudie sees the repair service as an important factor in terms of reducing the environmental impact in the user phase. It is also expressed as something that has been very appreciated among their customers according to their CSR manager, Eliina Brinkberg. She also expressed that the interest from their customers to use this repair service is increasing. Where they repaired 44 000 pairs globally in 2016, approximately 10 000 more than the previous year. Brinkberg also expressed that such a system demands quite some effort and personal resources to be able to function. Although she made it clear that it still gives a huge benefit from the fact that they gain customer loyalty, as many of them rather buy jeans from Nudie than from other brands. Brinkberg also pointed out that the system is something that makes up the foundation of their company philosophy where they want to give their customers an opportunity to consume slower, more sustainable and with a more long-term perspective. Concerning the repair-kit, Brinkeberg told that they send out approximately 50 kits per week, having quite a high level of interest among their customers. According to Brinkberg they do not offer their customers living further away to send their broken jeans in by post, as

Figure 20. Information to customers in Nudie Jeans' stores (Nudie Jeans, n.d, A)

they already have such a huge amount of jeans coming in from the local customers. Another reason is that they do not have the right system in place to be able to receive and send the jeans back to the customer. The jeans are repaired by their store employees and customers entering their stores receive information from the interior of the store, regarding their services and why they should use it.

A big name in the outdoor industry in terms of their sustainability work is, Patagonia. They are encouraging users to consume less, use their garments for a longer period of time and to give them away for reuse when they no longer want them (Patagonia, 2016). They claim that the best possible scenario for the environment is if the garment is kept longer, why they are encouraging users to repair their garments instead of throwing them away. They go after their mantra "Repair is a radical act!" and "If it's broke, fix it!" (Patagonia, 2016). Patagonia claim that if a garment is used for nine months longer, the total CO2, water, and waste footprint can be reduced to about 30% (Patagonia, 2016).

Patagonia has promoted users of all brands to start repairing their garments by offering easy to follow and step-by-step guides on common repairs on their website (Patagonia, 2016). They also have a collaboration with the DIY webpage iFixit, which offer guidelines on how to repair stuff by yourself (Patagonia, 2016). This is to promote their users to fix their repairs themselves at first hand and they are also sure to inform the user that own repairs will not void their product warranty. They also have an own repair team, so if the customer cannot, or will not repair the garment themselves they can send it in to Patagonia for repair, which might take a small fee for the service, see figure 21.

Their retailers are also educated in repairing smaller fixes in store. They also sell a repair kit which the customer can purchase to make repairs in field or at home easier and more available, see figure 22. They also went on tour around the world in a repair van, where the aim was to offer free repair of users gear and to learn people how they can do quick fixes out in the field, to inspire and create a changed behaviour (Patagonia, 2016).

Figure 22. Patagonia's repair kit that can be bought on their homepage (Patagonia, n.d, A)

Another Swedish example of a company that offer repair services is the shoe brand, Lundhags. Their core values as a company is to make highly durable shoes that can offer their customers a long-life time (Lundhags, n.d). In the interview with a shoemaker at Lundhags, Urban, he expressed that the shoes are designed

Figure 21. Patagonia's repair service (Patagonia, 2016)

with a quite simple construction, which is what makes sure that parts can be easily repaired or exchanged. They can replace the sole and this is the reason for why the outer sole and the midsole are not casted in one piece, in order to be able to separate them. If a problem arises with a Lundhags shoe, they first recommend to contact the shop were purchased, since many problems can be resolved directly at the shop. If the shoes are older than what applies in the consumer sales act, the customer can send the shoes themselves to Lundhags factory in Järpen, where their shoemakers can repair the shoes, figure 23.

6.2 ICEBUG REPAIR POSSIBILITIES TODAY

To be able to know what repair services and possible improvements that can be suggested to Icebug, it is necessary to know what they offer today, which will be presented in this chapter.

When a customer has a claim, they can contact either the store where they bought their Icebug shoes or they contact Icebug directly to make a claim. In the case of a stud loss, Icebug offer to send out studs to the customer free of charge. This is not something that is publicly advertised for and is given upon request from the customer. According to a conversation with Jerome Manceau, director of products at Icebug, spare parts such as zipper, studs and metal hooks can be sent to the user after a refund claim and can either be repaired by the user themselves or with help from a shoemaker. Icebug do not offer repair in their Icebug store, according to Manceau, this is mainly because the store is too small to be able to offer such services. Neither do they have spare parts in the store, the spare parts are stored at Icebug's office in Jonsered and sent out on request. Repairing a stud is according to Manceau quite easy for customers to do on their own, not needing to go to a shoemaker. This was also confirmed in the test of replacing a pair of studs on an Icebug shoe. When a customer gets new studs from Icebug they get a short instruction on a piece of paper that describes what to think about before and during the activity. Figure 24 shows how this instruction sheet looks like.

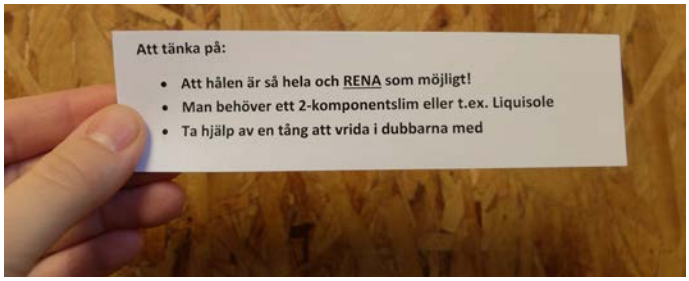


Figure 24. Existing instructions for replacing studs on a pair of Icebug shoes.

The three bullet points with information informs:

What to think about:

- That the holes are in good condition and as CLEAN as possible!!!
- You need a 2-components glue . or for example Liquisole
- Make use of a pliers to wringe the studs into the holes

Figure 23. A shoemaker at Lundhags (Lundhags, n.d).

How well the instructions are understood by a user was tested in order to see if the information given was sufficient. The parts of the description that were found to need some elaboration was the importance of why it is important to have as clean holes as possible in a shoe. The reason for why it has to be as clean as possible is so that the stud can successfully be attached to the rubber, which can be good to convey to the user so that they gain an understanding to why they should do it. Something that also can be good to inform is that the studs used for the running shoes are covered with rubber, which can be seen in figure 24, whilst the studs for walking shoes are without rubber, see figure 25. Since running shoes often are exposed for higher stress, the studs need to fit very well to the rubber sole means Jerome Manceau. The rubber cover on the studs helps the studs to fasten better and to get a straighter position, avoiding a slanted stud. Thus, the rubber on the running studs should not be detached from the studs, which was in fact accidently done in the test. This was done because the rubber covering the studs looked different than the studs on the shoe, where the rubber had worn off. Making it to something that can be important to inform the user about. Something else that can be included is that the step from filling the hole with glue and putting the stud in place had to be performed quite quickly before the glue dries.

6.3 SHOEMAKERS REPARATION POSSIBILITIES

To understand what services shoemakers can actually offer in terms of repairs on Icebug shoes and to investigate what options that users actually have, this chapter will present the possibilities that were found regarding repair possibilities around Gothenburg, Sweden. The findings also aid the understanding for what changes that might be necessary to do on the design of a shoe, to make it easier to repair.

According to a shoemaker at Larssons Skomakeri in Gothenburg repairing running shoes or sneakers is often harder than for example a handmade leather shoe. This is mainly because the sole and the upper part of the shoe is glued together and therefore hard to separate. The shoemaker states that handmade shoes are more profitable to repair than shoes that is manufactured in for example China. It is both the assembling of the shoe and the materials that decides if it is possible and worth to repair. In terms of materials, synthetic leather and plastics are more sensitive and harder to repair. Furthermore, shoes made mainly of plastics are also the ones that has the shortest life time.

When people do hand in their running shoes for repair it is often the heel or the sole, in some cases a seam. But the repair of the type of shoes that Icebug have, can according to the shoemaker at Larssons Skomakeri be complicated. This is because the sole often consists of different materials that is glued together and are not possible to separate from each other, and therefore hard to replace with new parts. However, with some rubber soles it is possible to grind parts of the sole down with a grinding machine and then replace it with a new part. This is, according to the shoemaker, the most they can do with these kind of "China made shoes". However, seams on shoes are easier to repair than the sole and is most often a quite simple repair.

In an interview with a shoemaker from Skomakare Servicehörnan in Gothenburg he explained that they cannot repair sneakers or running shoes except from seams and sometimes a part of a sole, but that special

Figure 24. Studs for running shoes, covered in rubber

Figure 25. Studs for walking shoes

machines is needed in order to do more advanced repairs of sneakers, which they did not have. However, the shoemaker pinpointed that the possibility to repair a shoe or a part of a shoe differs a lot from shoe to shoe.

At Löp & Sko, retailers of shoes from different brands and specialists on running shoes, they offer a guarantee to their customers, including smaller repairs of shoes. They also accept shoes that have not been bought in their shop but then they take a small fee for the repair. According to a salesman at Löp&Sko, the most common part to repair on a running shoe is the heel counter as well as wear and tear in the inner lining. When repairing such a part they simply put on a new material or fabric that will protect the shoe from further wear. If the fabric on the upper part of the shoe is damage they are able to patch it from the inside to make it as clean as possible. Often, they recommend customers, who are aware that they use to have such problems, to hand the shoes in as soon as they discover that the fabric is starting to get damaged. However, to repair the sole is not something that Löp & Sko can do, it requires specific knowledge and machines to be able to do that.

6.4 COMMON DIY REPAIRS

If a user need to repair their shoes they can either turn to the store where they bought their shoes, go directly to the shoe brand or to a shoemaker, or they can do it themselves - DIY. If the user is not sure how to repair something a common way to go is to look it up online, where a great amount of DIY homepages and blogs exist. The most common recurring DIY tips for repairing shoes are presented in this chapter to gain an insight to the most frequent problems users have with their shoes as well as what they feel confident enough to repair by themselves. It also aids the understanding for what information that would be good to give to Icebug's customers if a DIY guideline would be offered.

Outer Sole

The outer sole is something that home fixers attempt to fix by themselves but Brunick & Burfoot (1996) are of the meaning that the exchange of the outer sole is not a sufficient way of prolonging the lifespan of shoes as the midsole, as previously presented, still can be worn out and is what gives shock absorption. A common wear of the outsole is on the outer edge of the heel as this is the first impact for most gaits, even for people with normal gait (Asplund & Brown, 2005). Asplund & Brown (2005) are of the meaning that this uneven wear causes an imbalance and is something that can induce injuries. In figure 29, a common DIY repair of the lateral edge of the heel can be seen where a rubber outsole has been glued with contact adhesive directly on top of the midsole. The person performing the repair in this case explains that the rest of the shoe was in a good condition (Seong, 2015).

Figure 26. DIY repair of the rubber heel (Seong, 2015)

If the outer rubber sole has detached, glue can be used to attach it once again. A fairly simple repair to perform. The most reoccurring glues that are mentioned in DIY-shoe repair guides are the adhesives, Shoe GOO, Gorilla Glue and LiquiSole. Something that need to be considered is that the use of glue can give impacts on the user performing the repair.

The solvent used in Shoe GOO for example is Toluene, which according to the European Chemicals Agency, ECHA can be fatal if it is inhaled or swallowed (ECHA, n.d). REACH has also identified Toluene to be the cause of permanent damage to marine life and fresh water and that it may be the cause of infertility and fetal damage. Shoe GOO is not readily available in Swedish hardware shops but can be found on Swedish webshops. LiquiSole is on the other hand sold in Swedish shops. It is polyurethane polymer that is described to be excellent to use when repairing holes in shoes and to attach loose soles (Casco, 2014). It also has a number of hazardous effects, but compared to Shoe GOO it is consider a better option (Sika Sverige AB, 2016). The Gorilla Glue is a Polyurethane adhesive just like LiquiSole and have similar hazards (The Gorilla Glue Company, 2015).

Upper Fabric

Another common repair that is needed is when the upper mesh fabric has broken, creating a hole. This is something that the salesperson at Löp&Sko also

pointed out to be something that frequently occur. Common occurring DIY tips is to fix the hole by stitching it shut from the inside, with the help from a piece of elastic fabric.

Heel Counter

The inside fabric of the heel is also something that the salesperson at Löp&Sko expressed as a common breakage and is something that is seen on many DIY shoe repair tutorials. In a tutorial from Instructables (Instructables, n.d) they explain how to repair athletic shoes when the heel fabric has been broken, as can be seen in figure 27. As some of the heel padding was gone it is explained that new stuffing in form of cloths have been glued into place. A piece of sturdy jeans fabric is then glued and later stitched to make sure it stays in place.

Figure 27. Repairing worn and broken textile in the heel (Instructables, n.d).

6.5 WHAT USERS HAVE REPAIRED ON THEIR SHOES

To gain a deeper insight in what parts of a shoe that users have the most problem with as well as if they are in fact doing their own repairs, it was asked in the surveys if the users themselves had repaired anything on their shoes. In the general survey 86 % of the 73 respondents answered that they had not repaired anything on their running shoes versus 70% for walking shoes. Hence, it was more common among these respondents to repair a pair of walking shoes then running shoes. On the survey directed to Icebug users, 91% of the respondents answered "no" on this question, showing that the majority had not repaired anything on their Icebug shoes.

The respondent who had answered that they had repaired something on their shoes was also asked to describe what and how. In this case it can be seen what component that was broken. In the general survey, 15 respondents answered this follow-up question and in the Icebug survey, 12. These answers was summarized in 6 categories of different DIY-repairs, which are shown in table 3. Some of the respondents also commented even though they had not done any repairs, such as this quote "I lost 3 studs but never tried to replace them with new!". This answer gives an indication that customers have had broken shoes but have not, for some reason, repaired them.

Table 3. Categories from the KJ-analysis on the comments regarding DIY repairs.

GENERAL SURVEY 15 RESPONDANTS	ICEBUG SURVEY 12 RESPONDANTS
loose sole repair with glue, liquisole or similar	Repair with glue
loose sole repair with string	Changed studs
Used tape on heel counter	Made whole in soles so that the water will drain faster
Changed laces	Changed laces
Solved broken laces with a knot	Repair Zipper
Stitched worn seam with needle and wire	Stitched worn seam with needle and wire

It was also asked if they had let a shoemaker repair something on their shoes to understand how users today use their services. The results here differed a bit more in terms of running shoes versus walking shoes, where 18% of the general survey respondents answered that they had let a shoemaker repair their walking shoes in comparison to 3% for their running shoes in the general survey. 5% of the Icebug respondents answered that they have handed in their Icebug shoes for repair to a shoemaker. The comments that were summarized into different categories are presented in table 4.

Table 4. KJ-analysis categories for the answers regarding repairs done by a shoemaker.

GENERAL SURVEY	ICEBUG SURVEY
Changed to a new heel	Heel cap
Changed to a new sole	Loose upper from sole repaired with glue
Repaired loose sole with glue	Repaired zippers
Patch in heel cap	Repaired seams on upper
Repaired zipper	
Repaired seam on upper	

The results both from the public survey and the survey for Icebug users shows that to repair shoes is not especially common. However, the case might be that people has not own a pair of shoes that has needed a repair, why the question could have been stated differently, for example, have you ever had a pair of shoes that needed a repair but you did not repair them? and why?

6.6 WHEN ARE SHOES REGARDED AS CONSUMED?

To understand if there are possibilities to influence the number of people who could consider to repair their shoes instead of throwing them away, making it important to find out why they find their shoes to be consumed, in the first place.

To be able to investigate this matter it was asked in the survey what aspect that makes their shoes feel consumed. These respondents' answers to this question were categorized using the method of a KJ-analysis. Table 5 shows the different categories derived from the analysis. Worn or compressed outsole and midsole was included in several comments in both surveys, as well as a broken upper and shoes with any kinds of holes in them. There was a lot of undefined answers, such as "when they are broken", "when they are too torn or worn". Which were categorized as 'Broken. holes, torn etc.' or in 'totally consumed'.

The fourth most mentioned category in the Icebug survey after 'Outsole', 'broken' and 'totally consumed' was the state of the studs. Some considered loss of studs to make the entire shoes feel consumed, making it to a necessity to inform them that the studs can in fact be repaired.

"The studs fell off and the zipper also broke"

"For Icebug shoes it is when they have lost too many studs. In general with other shoes it is when the sole is torn or if the inside, where the big toe is, is torn."

"For Icebug's they feel consumed when the studs get worn down"

Table 5. Categorized reasons for why shoes are considered to be consumed, reached their EoL.

WHY SHOES ARE CONSIDERED TO BE CONSUMED
Totally consumed - not possible to use anymore (frequently mentioned - Icebug survey)
Outsole and midsole, loose, hole, compressed or worn (frequently mentioned - Both surveys)
Bad grip
Broken, holes, torn, etc. (frequently mentioned - Icebug survey)
Broken heel counter
Broken zipper
Not possible to repair / clean anymore
Not trendy anymore
Uncomfortable
Bad smell, do not feel fresh
Physical signs - ex. hurts in knees/feet when I use them
Affects running/walking dynamics
Lost their shape
Discolored/ugly
Feels old

6.7 SUMMARY & DISCUSSION: REPAIR

From the survey, it can be concluded that some of the most common problem that people experience with their shoes can in fact be repaired by the user themselves, such as stud loss, broken fabric and loose sole. Broken seams, zipper and heel counter might require some extra tools and knowledge but are on the other hand something that a shoemaker find easy to repair. The survey also showed that there is a low percentage that have repaired their own shoes, which can mean that either they have not had any problems with their shoes or they have chosen not to do anything about it. This can be an indication that either they find it to be a big effort to repair their shoes, they do not have the right knowledge, they do not care, they do not have the spare parts to perform the repair or the shoes simply do not need to be fixed.

Through the current system, that Icebug have in place today regarding spare parts, customers are not informed that they can get studs for own reparation unless they themselves take the first step in requesting them. This lowers the chance that people will replace their studs and in combination with the fact that

many find that their shoes are 'used up' when they have lost studs, it makes it even more important to inform that there are spare parts available and that the repair is easy to perform by the customer themselves. From the amount of DIY instructions that are available online it gives some proof that people can imagine to repair their own shoes, only that they need some guidance, inspiration and spare parts to do so. The high interest in Nudie Jeans repair services and repair kit also give an indication that people are open to repair things themselves, however it might be dependent on the product. If giving advice to repair shoes, it also means that the user might have to purchase and use glue, which depending on the glue can be more or less damaging for the user as well as the environment.

As understood from the interviews with shoemakers, the kind of shoes that Icebug offer in their assortment and along with the general type of running- and walking shoes of today, they are difficult or not possible at all to make more advanced repairs on. Making it difficult to refer to a Shoemaker for repairs or to offer such a service. Easier repairs such as a hole in the uppers fabric or in the heel counter are possible to do. Repairing the outer sole is also possible to do, but do not necessarily prolong the shoes life anyway, as the midsole 'dies' first. This gives a difficult scenario, prolong the life of the shoe, which is good from an environmental point of view, or stop using the shoe, as it otherwise might induce injuries for the user. This off course makes it more difficult to refer customers to a shoemaker when for example the sole has been worn down and to always promote prolonging the life of the shoes. If the soles of the shoes are altered by the shoemaker it can also change the running dynamic for the user, making it different than intended by the producer.

The main difficulty in the shoe design is identified as the adhesives used in the shoes, as it makes the disassembly of the shoe hard or impossible without having to destroy the entire shoe to be able to repair it. This limit the shoemakers' chances of replacing and upgrading parts of the shoe. This was also something that was experienced in the disassembly test, see chapter 4.2. Synthetic leather and plastics were also expressed as something that is more difficult to repair. The example from Lundhags gives the advice to keep the shoe design simple in order for it to be easier to repair and to choose the manufacturing techniques carefully.

7. OPPORTUNITIES FOR REUSE

Reuse is something that can positively affect the environmental impact related to post-consumer products, since it aims to keep the original product in the technical cycle, even after the product is considered as consumed by its first user. This chapter presents the main findings related to opportunities and barriers for reuse of shoes. These results are derived from interviews and research connected to charity organizations and second-hand stores, benchmarking of brands working with second hand, and user studies.

7.1 SECOND HAND

Second hand is an established activity for reuse of post-consumer products, and is when the product has had a previous owner but attains a new life with a new, second user. According to Naturskyddsföreningen (2008), buying second hand clothes has large environmental benefits both in terms of energy savings as well as the use of chemicals and water. Up to 97 % energy is saved through reuse of clothes compared to if the same garment would have been newly-produced (Naturskyddsföreningen, 2008). Selling products second hand can be done privately through different channels available on the web, as for example on Tradera, Ebay or Blocket, or it can be handed in directly to second hand stores. An example of two established second-hand stores in Sweden are, Myrorna and Red cross, which are charity organizations. Myrorna and Red Cross was both seen as possible collaboration partners to include in the system and their organizations are therefore explained in more detail in this chapter.

Myrorna's mission is to work for a more humane and sustainable society and any surplus that is made goes to the Salvation Army's social work (Myrorna, 2016, A). At Myrorna, most of the collected items goes to second-hand in Sweden but some also goes to global sales abroad (Myrorna, 2016, C). Approximately 10% of what Myrorna collect goes to incineration in Swedish heating plants, mostly because the items have not been in a good enough condition to be sold. Myrorna also ship items not suitable for second-hand to recycling centres abroad, where they claim that 20% are recycled, around 3-5% is incinerated and the rest is reused (Myrorna, 2016, C). The post-consumer items that are recycled are down-cycled to rags or to stuffing materials. However, in an interview with Emma

Enebog, sustainability manager at Myrorna, she mentioned that shoes that are not possible to sell in their second-hand stores goes directly to incineration, meaning that they are not recycled. This is, according to Eneborg, due to the lack of possibilities for recycling of shoes.

Red Cross is a help organization that is active around the world, including Sweden (Röda Korset, n.d). Red cross has 300 second hand stores in Sweden, where it is possible to donate, clothes, shoes and other post-consumer items. The profit that Red Cross gets from their second-hand stores goes to charity, both local and international. In an interview with Eva Maria Rudbäck, Logistic manager at Red Cross in Sweden, she stated that their goal is to sell as much as possible locally or internally in Sweden. According to Rudbäck, the reason behind this goal is that it is hard to sell second hand items abroad without getting scammed by unserious organizations and that it has environmental benefits in terms of shorter transports.

Near half of the textiles and shoes that are being donated are not in conditions to be sold in their second-hand stores says Rudbäck. These items are instead send to their textile and shoe recycling partner, SOEX in Germany. According to Rudbäck, Red Cross stands for the shipping charges to SOEX, and SOEX pays a sum to Red Cross that relates to the amount in kg that has been sent. In the case of shoes, Red Cross differs from Myrorna, instead of going directly to incineration SOEX have recently started a pilot project for shoe recycling which enables material recycling of shoes, which is further presented in chapter 8.1. The post-consumer products that are delivered to SOEX are manually sorted and the items that are in good enough condition are then sold in over 90 different countries worldwide or locally in second-hand stores in Germany (Soex Group, n.d). According to Paul Dietzsch Doertenbach, the sales and market chief at I:Collect - a collecting company in collaboration with SOEX - companies collaborating with SOEX can choose which reuse channel they want to use, meaning locally or abroad. Moreover, Rudbäck mentioned that Red Cross also offers collaborations with for example textile and footwear companies. An example for how such a collaboration could look like, according to Rudbäck, is that the companies donate sample collections or left over from earlier collections to Red Cross, which then are sold in some of their second-hand stores.

7.2 ETHICAL ISSUES WITH SECOND HAND SALES ABROAD

Some charity organizations redistribute post-consumer products abroad either for charity reasons or to be sold on second hand markets abroad. The donation of clothes to developing countries comes with benefits, both in terms of increasing reuse of clothes and shoes, and to provide cheap or free goods for people in need. According to a study by Baden and Barber (2005), second hand trade abroad has shown to support a large number of people who work in trading, distribution, repairing, restyling and washing in developing countries. However, the same study also discusses the issues regarding the environmental impact and the economic consequences that comes with this type of second hand trades (Baden & Barber, 2005). One example being the industrial textile and clothing production in West Africa that saw a significant decline in the 1980's and the 1990's, causing unemployment because of imported second hand goods. A similar perspective but regarding shoes is discussed in the article by Rahimifard and Staikos (2006). As an example, they discuss the situation in Uganda "In the case of Uganda, the import of a large volume of second-hand shoes in recent years has significantly reduced the size of the local footwear industry". Moreover, they state that the demand for second-hand shoes might drop in developing countries because the cost for producing new shoes is decreasing. The price difference between second-hand shoes and new shoes in less developed countries are therefore expected to shrink. The need for local reuse and recycling of post-consumer shoes in the developed world is therefore expected to increase.

Furthermore, Baden and Barber (2005) highlight the difficulties to properly take care of the waste that exported post-consumer shoes produces in the developing countries they are sent to. The possibilities to deal with additional waste are in many cases small, diverting the products to landfills. Where the second-hand items otherwise would have gone through better recycling facilities in the country where they were originally shipped from.

Other research also verify that exported second hand items that are not being sold on the market ends up in local landfills, where they contribute to pollution (Avfall Sverige, 2013). The result of this is that some Swedish organizations has decided to discard

all clothes that are not being sold within the country instead of selling them abroad. Furthermore, in another attempt to solve this problem, KICI, a charity organization, planned to establish a recycling plant for textiles in Kenya. Another problem that is brought up is that many people believe and expect that donated clothes and textiles goes to people in need without intermediaries (Avfall Sverige, 2013). However, all of the organizations that collect textiles and clothes are not reliable since, in some cases, the money that is gained through these business supports private interests rather than charity.

In a report by Watson & Palm (2016) they state that exporting textiles from Nordic countries shows significant global environmental benefits in comparison to if they had been incinerated locally. Impacts caused by transportation and processing of the used textiles are almost insignificant in comparison to the benefits it gives. They claim that the environmental benefits that comes with exporting the textiles to developing countries are far higher than would have been achieved if the textiles had remained in Nordic countries. The argument is that, the end-of-life fate for used textiles in Nordic countries are today most likely to be incineration. They discuss the environmental problems that second-hand items can lead to when they have to be disposed in developing countries, but claims that this is no difference to if new textiles would be exported to the same country (Watson & Palm, 2016). It is stated that stopping exports or imports of second hand items to developing countries is not the solution, the problem should instead be tackled by assisting with waste management improvements in these countries.

7.3 BRANDS INCORPORATING SECOND HAND IN THEIR BUSINESS

The opportunity to buy or sell second hand are not only offered by designated second hand shops or charity organizations it is also being incorporated in brands business models in an attempt to prolong their products lifespan. From the benchmarking of brands, that are known to work with sustainability, it was found that some of these brands have their own second-hand shops. One example is the Swedish outdoor brand Houdini who has a reuse program where old Houdini clothes can be handed in to their second-hand-sale. The clothes are then priced depending on the original price and the condition (Houdini, n.d). The second-hand products can then be bought in Houdini's brand stores. When the product is sold, the person that handed in the garment earn 50% of what it was sold for in cash and also get 20% off a new purchase. This way, Houdini extends the life of their products and gives more customers a chance to afford and use their clothes. The outdoor brand Haglösf uses a similar approach, with their second-hand concept called Haglöfs Swapstories, having an own second-hand shop in their brand store in Stockholm. The customers handing in their products to Haglöfs get 20% off a new item as a thank you, and they also get to choose between two different charity projects that the profit from their sold item should go to (Elander, et al., 2014).

Another brand having their own second-hand shop in store is the Swedish denim brand Nudie Jeans. Customers can donate their unwanted jeans to any of Nudies repair shops and in return they get 20% off when buying a new pair (Nudie Jeans, 2015). The jeans that has been donated is washed and repaired and then returned to their shops as second-hand articles. If some jeans are not possible to repair, they use these as patches to repair other jeans or they make rugs out of torn jeans pieces. By having this service, Nudie is able to take advantages of old jeans and the material from them, and at the same time they reduce the risk that the jeans will end up in the bin. According to Eliina Brinkberg, CSR manager at Nudie Jeans, there are a lot of customers handing in their old jeans to gain the 20% off a new pair but not in the same extent as people want to get their jeans repaired. She believes that when jeans have been worn in and are a part of somebody's wardrobe they are not inclined to part ways with them and that this is the reason why customers rather will have their jeans repaired.

Except from these brands, offering their own second-hand shops, some companies have taken the chance to make use of existing second hand business by instead encourage their customers to sell their used items on these second-hand markets. This way they take on responsibility to increase the level of reuse of their products, but avoid the logistics needed for redistributing items for a second life such as, collecting, storing, sorting, pricing and selling.

Brands such as Patagonia and IKEA have taken on this approach and have created collaborations with online second-hand shops, Patagonia with Ebay and IKEA with the Swedish site, Blocket. The companies do not put down any effort and do not have any-

thing to do with the actual sales of the second-hand products, what they do is to advertise it and offer a platform for people, making it easier to sell and buy. IKEA have a designated buy and sell site on their own homepage in collaboration with Blocket, and the service is free to use if the person selling is a IKEA family member (IKEA, 2016). When uploading an item, it is shown on both IKEAs and Blockets homepages, offering double exposure. Blocket handle all contact with the customer if any problems would arise, meaning little or no work at all for IKEA. In Patagonias collaboration with Ebay they do not have a designated page on their homepage but they have a designated Patagonia Common Thread Initiative storefront site on Ebay (Patagonia, 2011).

7.4 CUSTOMERS WILL TO BUY SECOND HAND SHOES

One of the main targets with second hand activities is to minimize the consumption of new products as well as to prolong the life of the products. The environmental benefits with second hand is therefore highly dependent on customer consumption behaviour and their attitude towards buying second hand items.

In order to understand the customer's attitude towards buying second hand shoes questions related to this was stated in the two surveys. The general survey showed that 57% of 73 respondents could not imagine to buy second hand shoes, similar to the results in the Icebug survey which was 54% out of 139 respondents. The main reasons that were given in the general survey was because of sanitary reasons, such as sweat, germs, dirt and smell, see figure 28. In the Icebug survey the most common barrier for buying second hand shoes was because the shoes are shaped by the previous owner, and the second most common reason was due to sanitary reasons, see figure 29. The short lifespan of shoes was also mentioned to be a reason in both surveys. In the general survey the short lifespan was related to reasons such as fear of attaining injuries, bad cushioning and having a shoe that is simply worn down. For the Icebug survey a worn-down shoe or missing studs was mentioned as a reason to not buy second hand shoe this category. Some respondents also expressed that they would rather buy 'normal everyday shoes' than running shoes second hand. The problem of having a smaller market and not finding the correct model or shoe size were also something that were mentioned as a negative aspect.

"Wouldn't buy running shoes – because they wear to fast and then the foot can be injured. I can also imagine that it is difficult to find the shoe and size you need second hand. Could buy normal 'everyday' shoes."

- General survey

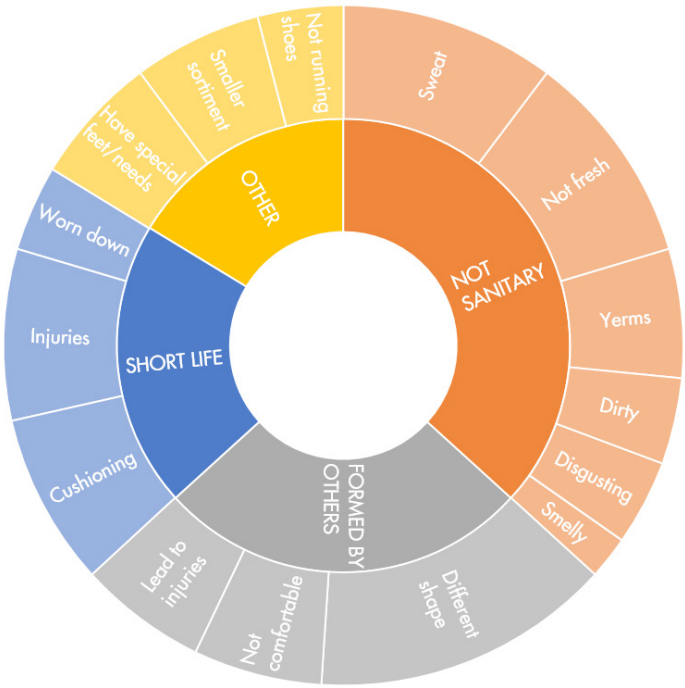


Figure 28. Reasons to not buy second-hand shoes, KJ-analysis result from the general survey.

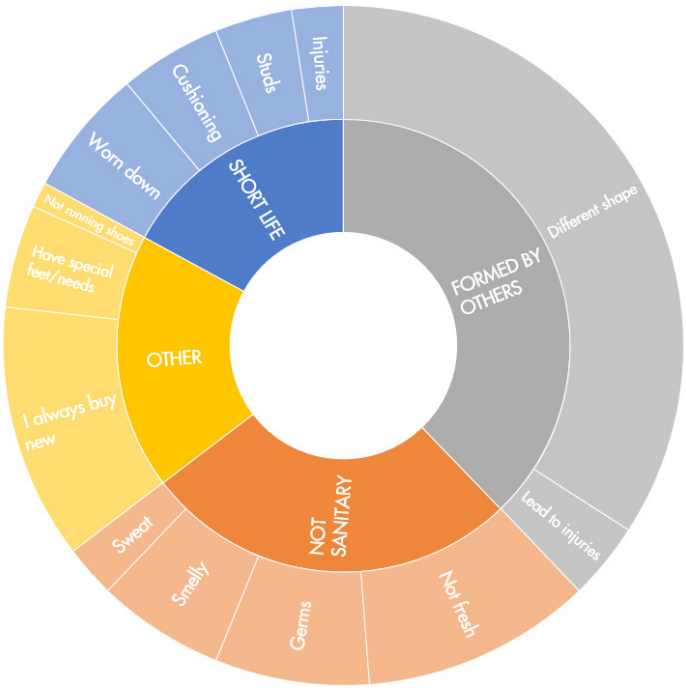


Figure 29. Reasons to not buy second shoes, KJ-analysis result from the Icebug survey.

The respondent who had answered that they are willing to buy second hand shoes were asked what requirements the shoes need to fulfil. The most frequently stated requirement, both in the public survey and in the Icebug survey, was that they should be clean and good in condition. The results showed that the requirements put on a pair of second hand shoes goes well in hand with the reasons for not buying second hand shoes.

The same respondents were also asked what their biggest incentives for buying a pair of second hand shoe was. The vast majority of the respondents answering this question in the general survey gave the same arguments, which resulted in only three categories of incentives, Cheaper, good for the environment and unique assortment, see figure 30. The most frequently mentioned argument was that it is often possible to buy shoes for a lower price tightly followed with the argument "good for the environment". Some also mentioned the benefits with finding unique shoes or older shoe models that are not produced anymore. Similar results were given from the Icebug survey, where cheaper and good for the environment was the two most common arguments, see figure 31. However, more respondents included the argument related to price which can be related to the relative high price of a pair of Icebug shoes.

"Cheaper and that it becomes reuse, less environmental impact to reuse something that someone else do not want"

- General survey

"Cheap, since you have to pay quite a lot for a new pair. I am a low-income earner"

- Icebug survey

7.5 SUMMARY & DISCUSSION: REUSE

From the findings presented in this chapter it can be concluded that, providing a system that can offer and encourage people to donate or sell post-consumer shoes second hand is a promising activity for Icebug in order to take responsibility for their post-consumer products. Myrorna and Red cross are two well-known charity organizations in Sweden that collects post-consumer items and sell them second hand They also takes responsibility for the products EoL, though in different degrees, Myrorna send unsold items abroad or to incineration, whilst Red Cross give them to local charity or send them to SOEX recycling centre in Germany. They are spread all over Sweden and Red cross is also active in other countries, which makes their second-hand stores very accessible for Icebug's customers in Sweden. Due to these aspects, both organizations are seen as possible collaboration partners for Icebug to prolong the life and improve EoL for their shoes.

Moreover, second hand is an established concept and it seems to be a trend among brands to have their own second-hand shops. These initiatives clearly indicate that these companies are willing to take action, it is also a strong branding opportunity in terms of environmental responsibility. With an own second-hand shop, the brands can offer cheaper and more sustainable items to their customers, as well as being able to

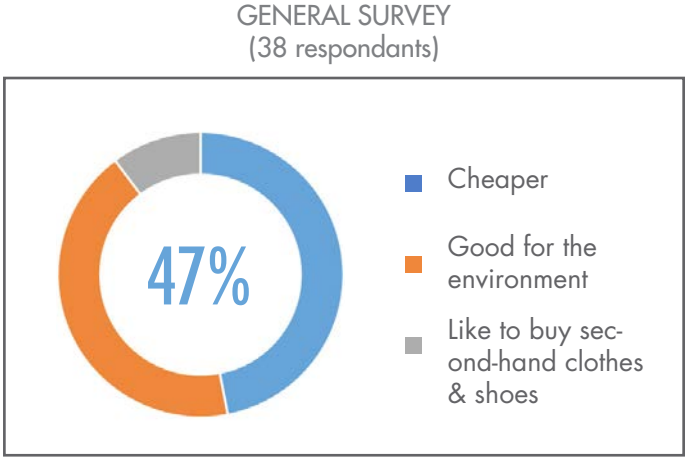


Figure 30. Biggest incentive for buying second hand shoes, KJ-analysis result from the general survey

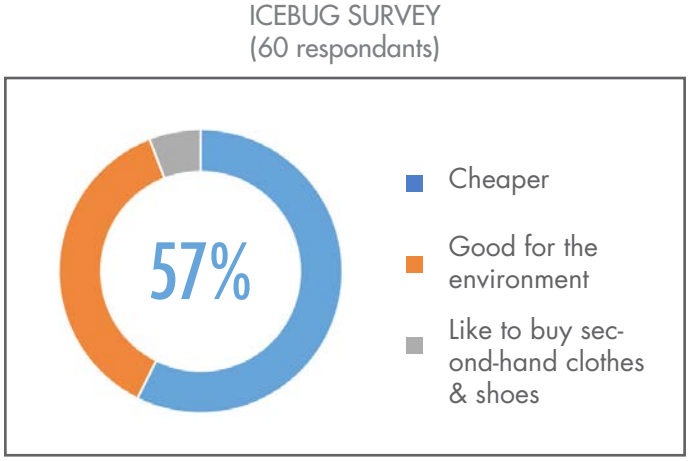


Figure 31. Biggest incentive for buying second hand shoes, KJ-analysis result from the Icebug survey.

fully account for what will happen with the customers donated items and the profit gained from the second-hand sales.

The opportunities for increasing reuse of shoes is not only about offering the customer's places to purchase second hand shoes it is also connected to customer attitude and will towards buying already used shoes. The survey results presented in this chapter indicated that a lot of people has a negative attitude towards buying shoes second hand. This was mainly due to sanitary reasons and because people do not want to buy shoes that are shaped by someone else, where many expressed a fear for injuries. This implies that in order to increase the reuse of shoes and second-hand purchases it would need a shoe that could be washed properly, in order to offer a shoe that feels fresh and without germs and sweat, and a shoe where components that are worn down and shaped by others can be replaced. Being able to replace components would also make the shoe more comfortable for the second user and avoid the fear of injuries. However, the incentives for buying shoes second hand was strongly connected to the economic and environmental advantage. This result could partly be used for marketing purpose in terms of encouraging people to buy second hand, and in such cases, combine the two arguments.

Furthermore, this chapter also brings up the positive and negative aspects with second hand items that are send to developing countries. The negative aspects are that import of post-consumer products to developing countries might undermine the local production, and shoes as well as clothes have a bigger chance to end up at landfills due to lack of resources in recycling facilities. The positive aspects are that it can supply people in need, give people work and prolong the lifespan of products. Moreover, it was also stated that to send second hand goods abroad gives environmental benefits compared to being incinerated locally and the environmental impacts from transports was seen as insignificant in relation to these benefits.

8. OPPORTUNITIES FOR RECYCLING

In order to gain an overview of what shoe recycling possibilities there are today, different recycling companies and possible solutions for material recycling of shoes were investigated and the main findings from this investigation is presented in this chapter.

8.1 MATERIAL RECYCLING FOR SHOES

A number of different recycling centres situated in both Sweden and in other parts of Europe, was investigated for this project. Some examples of the recycling centres are TEXAID[3] which are located in Germany and Switzerland, ReturTex[4] , a Swedish recycling centre located in Avesta and Boer Group[5] , in the Netherlands. These recycling centres are specialized in textile recycling, accepting primarily clothes and other textiles but also shoes. None of these recycling centres offers a solution for material recycling of shoes, instead all shoes that are too worn down, broken or not received in pairs, are incinerated. In an interview with Returtex it was explained that the reason for why they do not recycle shoes and instead incinerate them is because there is currently no demand in Sweden for the recycled material. This is also something that Taina Flink from Stena Recycling brought up, where a higher demand is described to exist in Germany and The Netherlands. ReturTex also explained that they do not have the proper machines that could enable shoe recycling. 10 % of everything that they receive in total is allowed to go to incineration. However, the shoes that are in good enough condition are sent to second-hand shops or donated to countries in need. It is quite common that these type of recycle centres have collaborations with help organizations that manage the collection of the post-consumer materials as well as the distribution of the items that have been deemed fit to be reused.

There are although a few material recycling possibilities that exist for shoes and according to Rahimifard and Staikos (2006) the recycling process for shoes can be divided into two major methods, which are destructive and non-destructive recycling.

3 http://www.texaid.ch
4 http://returtex.se
5 http://boergroep.nl/en/textilesrecycling/

Shredding process is a destructive method for recycling, and can be used for recycling of shoes. The materials generated from the shredding process can be used in secondary applications as for example sound insulation. However, in order to obtain a high grade and give wider application possibilities of the recycled materials from shoes, non-destructive recycling methods has to be used (Rahimifard & Staikos, 2006). In general, such methods include sorting, inspection, disassembly followed by shredding of the separated materials. Although, in both examples the material is being downcycled.

Nike is one example of a company that uses non-destructive recycle methods for shoes. Nike has for the last 20 years worked with the programs Nike's Reuse-a-shoe and Nike grind. Nike Reuse-a-shoe program is a shoe recycling initiative from Nike where they collect old athletic shoes to be able to use their material in for example sport courts (Nike, 2017). This with the aim to minimize the number of shoes that ends up in landfill. Any athletic shoe can be dropped off in some of their Nike stores in the US or be posted to any of their recycling facilities. Nike has recycling facilities in Tennessee and Belgium, and recycling partners in Asia.

Nike Grind is the raw material derived from the recycled athletic shoes and from the manufacturing scrap from the production of Nike products (Nike, 2016). The process for producing Nike grind differs depending on which facilities that gets the recycled shoes. For example, at their centre in Memphis they use a "slice-and-grind" technique. The shoes are separated into three pieces with help from a slicer, the rubber outsole, foam midsole and fibre upper, see figure 32.

Figure 32. A Nike shoe that have been sliced in preparation for it to be grinded (Nike, 2016).

Nike grind rubber, foam and fibres which can be seen in figure 33, are produced from the athletic shoes and has different application possibilities. Nike grind rubber, which is used in interlocking gym flooring tiles, track surfaces and playground surfacing is made from the shoe's outsole (Nike, 2016). The recycled midsole from the shoe becomes the Nike grind foam and is used for tennis courts and fields and also as cushion for outdoor basketball courts. From the shoe's upper fabric, they produce Nike grind fibres. These fibres are then used in for example athletic surface padding.
Another company that also have tackled the material recycling of shoes is the recycling company, SOEX. They identified a big problem that is overlooked by many, which is that the worldwide consumption of shoes is estimated to 20 billion pairs per year, where 95% is currently being sent to landfill or incineration. This sparked an idea to "Implement a circular economy approach in the footwear industry". The Nike grind and reuse-a-shoe program was the main inspiration for the SOEX shoe recycling initiative that started in 2011 in France (SOEX Footwear Recycling, 2016, A). This is currently the only recycling company in Europe that can properly recycle shoes, enabling material separation and utilization of the recycled material (SOEX Footwear Recycling, 2016, B). SOEX Footwear Recycling is located in Germany and is part of the SOEX Group (Soex Group, n.d).

The first step for the shoes before they end up being recycled is that the post-consumer items are collected through one of the collection companies that are part of the SOEX Group or delivered to SOEX by companies or organizations themselves, which Red Cross are doing. The items go through manual sorting and if the shoes are in good condition SOEX sort them into the reuse pile otherwise they might go to the pilot recycling program.

Figure 33. Nike grind rubber, foam and fibers (Nike, 2016).

In 2014 the first machinery, for recycling of shoes was set up at a lab scale that could mechanically separate the materials in a shoe, what followed was a machine at a pilot scale that can process 1 ton of shoes per day. In an interview with Benjamin Marias, the initiator of the pilot project, he mentioned that 1 ton of shoes per day is a very small volume compared to how many post-consumer shoes that are discarded. In 2016 a complete footwear recycling pilot line was installed, although still limited to 1 ton per day, at SOEX recycling facilities in Germany, which they claim is the first recycling plant in the world that can successfully recycle all types of shoes (SOEX Footwear Recycling, 2016, B). According to Marias, it is possible to use 20-25% of the recycled rubber, in the production of a new sole. This is made by shredding the sole into powder or granules with a size of 0.5-1mm, which is then possible to reinject into a new sole which can be seen in figure 34. Furthermore, Marias explained that they are currently doing tests on creating new midsoles from mixed foam such as EVA, but no results from these tests were available at the time of the interview. Benjamin Marias also informed that they keep all revenue that they gain from selling the recycled material or by selling the shoes second hand and reinvest the money into their pilot project. No money is therefore returned to the company collecting the shoes. Marias also explained that they are in need of investments and are open for partnering up with brands in order to develop the project further.

Figure 34. Sole produced from recyclates from old shoes (SOEX Footwear Recycling, 2016, C).

In figure 35 the recycling process that SOEX use are visualized in more detail where the shoes are shredded as a whole. The shredded material is then delaminated and non-ferrous metals and textile fluff is extracted. The shredded material then goes through an air-separator where rubber, leather and foam is separated. After that, the separated material goes through a granulator where the materials are made into smaller granules or fibers. The rubber can then be reused in rubber mats or in new rubber soles for shoes, the leather can be bonded together for new applications, such as shoe soles, or as insulation boards and the foam can become foam padding in for example a car seat. The material output from the recycle process is, rubber, leather, foam, metal and textile fines.

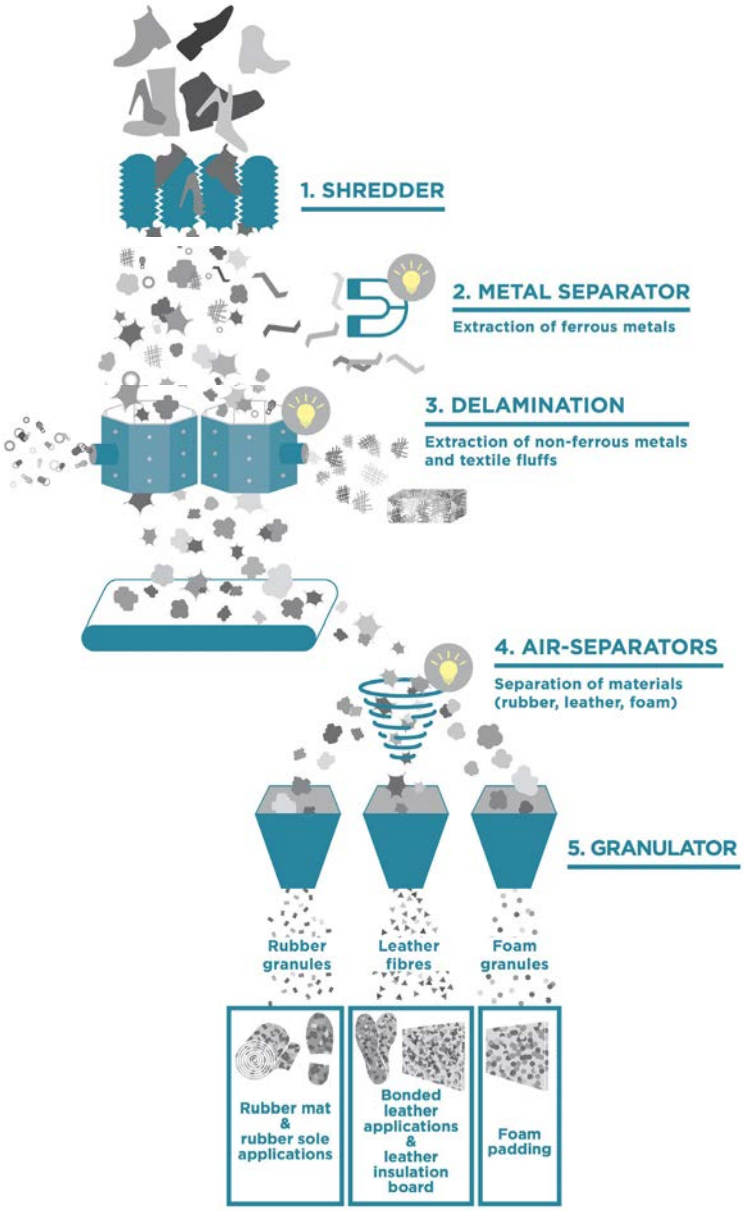


Figure 35. SOEX footwear recycling pilot line (SOEX Footwear Recycling, 2016,B).

A third material recycling possibility that was found, is the California based company PLUSfoam. Instead of starting at the end-of-life phase for shoes they wanted to tackle the huge amount of waste that is made in the production of shoes, where post-manufacturing waste is incinerated or put into uncontrolled landfills. such as in figure 36 (PLUSfoam, 2017, A).

What they ended up creating was their material which they call PLUSfoam, which is an alternative to common materials used in shoes, such as EVA, PU and PE foam (PLUSfoam, 2017, B). This material is 100% recyclable and produced with 0% manufacturing waste. PLUSfoam is also B corp certified[6] , which means that they meet high standards in regards to social and environmental aspects (PLUSfoam, 2017, A). They act as a material supplier but they also handle the consumer reclaim of the material at the end-of-life of the products for their partnering companies. Some of the shoe companies that use this material is TOMS, Vans, Patagonia, O'neill, New Balance and Roxy. So, what started with a focus on the post-manufacturing waste ended in an entire closed-loop system where they attend to all parts of their material's life cycle, their view on the system can be seen in figure 37.

In the manufacturing of their PLUSfoam material they feed the production waste back into the machine, which can be seen in figure 38. Thereby achieving 0% waste in the production stage and diverting it from landfill. The PLUSfoam logo is often moulded into the material to inform the customer about its origin and where it should go at its end-of-life. They also have hangtags for the finished product that informs that it is 100% recyclable and that the customer can send it back to PLUSfoam at its end-of-life stage (PLUSfoam, n.d).

When the user is done with their product they are advised to PLUSfoam's homepage where the customer prints out a shipping label and ships it to the closest PLUSfoam recycle centre, located in USA, Brazil, Canada, Germany, China, Japan and Korea (PLUSfoam, 2017, B). The customer can, if the brand decided to, get a voucher for a new purchase as an incentive. In an interview with Bridgette Roberts from PLUSfoam she informed that when they receive a shoe from the end-consumer they separate the textile in the uppers from the shoe sole to be able to recycle it as pure as possible, some textile fibres might be left and mixed

Figure 36. Uncontrolled landfill where post-manufacturing waste can be seen (PLUSfoam, n.d

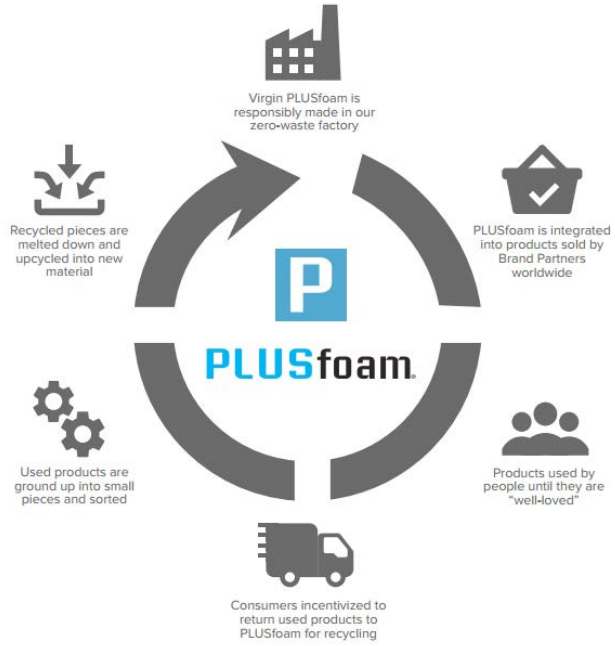


Figure 37. Infographic of PLUSfoam's circular business model (PLUSfoam, n.d)

Figure 38. Reusing the post-manufacturing waste, directly into new production (PLUSfoam, 2017, B).

6 https://www.bcorporation.net/

with the new material. According to Roberts the textile that is separated is recycled in the best possible way. Then the circle starts all over again, by using the recycled material in a new product.

In the interview with Bridgette Roberts she confirmed that their material can be used in more advanced shoes, such as running shoes and that it is also possible to create specific compounds together with a brand to create the material properties that they are searching for. According to PLUSfoam their material gets grippier when wet and is also non-microbial (PLUSfoam, 2017, C). It is also REACH[7] certified for restricted chemical substances. It is also claimed to maintain its flexibility in extreme temperatures (PLUSfoam, 2017, B). According to Roberts they are able to do the production, whereof a tool would have to be produced, otherwise they can send the granulates, sheets or pellets of the material to brands own factories. The minimum amount of production allowed is around 12 000 shoes to make the material cost effective. Their standard EVA substitute is about 20% more expensive than the market price but their premium substitute is equivalent with the market price for premium EVA. According to Roberts all of their material today is based on virgin material but when they have collected a big enough volume of post-consumer products they will be able to create products that are made from 100% recycled material.

8.2 SUMMARY & DISCUSSION: RECYCLING

The investigation in existing recycling possibilities for shoes showed that material recycling of footwear is not a widespread activity among existing recycling centres where some recycling centres do not even accept shoes and others only accept shoes if they are clean and in a good enough condition to go to reuse, hence not performing any recycling services of the shoes at all.

There is currently no material recycling of shoes in Sweden, only incineration, as there is no demand for the recycled material. The only relevant possibilities that were found for material recycling are SOEX Pilot Recycling project and PLUSfoam. SOEX use shredding and grinding for their shoe recycling, which is destructive and give secondary applications such as insulation material, floors, textile fibres and dust for fillings and padding etc. PLUSfoam also shred their reclaimed material but because of its 100% recyclability they can put it into production of new products again, upcycling instead of downcycling. SOEX can make new rubber soles with 20-25% of recycled rubber content. No disassembly, other than separating the uppers from the sole, are performed today by either company, due to the large amount of adhesives used. Separation of the materials could otherwise give a higher grade of the material and wider application possibilities. PLUSfoam are taking the entire lifecycle of their material into account, except for offering a reuse option. SOEX are focused on the end-of-life phase but offer solutions for both reuse and recycling.

9. OPPORTUNITIES FOR COLLECTION

A system that offers a solution for reuse and recycling also need to provide channels to collect the post-consumer items, which is one of the cornerstones for making a take-back system possible. In this chapter, different ways of collecting post-consumer items will be presented with references to existing recycle and second-hand companies and how they are being used by different brands. The benefits generated from take back systems and ethical issues with giving discount to customers when handing in post-consumer items, is also presented in this chapter. Furthermore, results from the user survey will also be presented in regards to consumers will to hand in their shoes, what type of collection channels the customers prefer and what they actually do with their consumed shoes today.

9.1 COLLECTION CHANNELS

In order to gain an insight to what collection possibilities that exist today, different collection channels have been investigated regarding how they are used and what benefits they can bring to the brand using them.

9.1.1 DIRECT IN-STORE COLLECTION

For companies to ensure that their products are handed back to them, one way is to offer customers to return the items they have bought directly to their brand

7 "REACH is a regulation of the European Union, adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals." (https://echa.europa.eu/regulations/reach)

stores. Companies such as Houdini, Nike, Nudie and Haglöfs offer direct in-store collection, where customers come to their brand stores to hand in old and used products for a second life or for recycling. This kind of drop-off is a physical walk-by to the brand store and some of the companies do not have so many retail shops, such as Haglöfs who only have one in Stockholm. Which is in similarity with Icebug, which only have one brand store located in Gothenburg. Through this kind of drop-off system, the store personnel need to receive, sort and sell the items or send it away for recycling.

Most second-hand shops run by help organizations such as Red Cross & Myrorna accept donations directly to their shops from both companies and private persons. Red Cross for example only accept physical drop-offs.

9.1.2 THIRD PARTY COLLECTION-BOXES IN STORES

Many of the larger and more fast fashion companies use extensive take-back systems where they partner up with a third-party collection organization or company (Muthu & Gardetti, 2016). An example of one of these professional collection companies is I:CO, which collects and ship post-consumer items to SOEX. Some of the Swedish companies that are known to collaborate with I:CO are Hemtex, KappAhl and H&M. The collection is made directly in store, where a I:CO box is put out, where customers can hand in their worn-out textiles and are then rewarded with a voucher. The collected items are brought to the company's storage facility where I:CO picks it all up and transport it to SOEX for reuse and recycle. The companies are responsible to transport the collected items to their storage facility, and according to Paul Dietzsch Doertenbach, sales and market chief at I:CO, this is usually made by reverse logistics. Doertenbach brought up H&M as an example, who have their own logistics, the person delivering a new collection from the storage facility to their stores at the same time pics-up the collected post-consumer items and transport them to the storage facility where they later are picked up by I:CO. However, Doertenbach mentioned that smaller companies not often have their own logistics, hence not able to make use of reverse logistics for this purpose. The companies have to pay for the logistic cost to their recycling facility, whilst I:CO are paying their partners for the collected goods. He also mentioned that they set up requirements on a minimum amount collected before sending the items to SOEX, and the brand that wants to collaborate with I:CO therefore has to accept all kinds of textiles and shoes.

Indiska, another big Swedish clothing brand have taken another approach on collecting clothes through the assistance of a third-party collection company, or in this case a charity organization. They have started a collaboration with the Swedish help organization Myrorna. This is according to Indiska an effort to make it easier and more available to hand in used textiles and to help decline the textile waste, and to increase reuse and recycle (Indiska, n.d). Stadium also uses a charity organization as a collection partner for their collecting initiative called re:activate (Stadium, 2015). They have teamed up with Human Bridge which provide Stadium with collection boxes and pick-ups. The boxes are available for customers drop-offs at all times but at different parts of the year Stadium organize campaigns where they aim for a specific merchandise, such as shoes or jackets, and where a voucher is given out for a new purchase. The different collaborations and take-back systems are branded in different ways and often used in combination with a slogan, such as "We Fight for Change" for Indiska's sustainability work, where the collection is one part of their initiatives (Indiska, n.d).

9.1.3 RETURN BY POSTAGE

Some companies, such as PLUSfoam and Patagonia have opened up the possibility to hand in post-consumer products by post. Users can access the company homepage where a shipping label can be printed and then sent to a designated location.

In PLUSfoam's customer reclaim service the customer enter PLUSfoam's homepage, where they then choose the brand and product that they want to return and after filling out all necessary information and paying the shipment, a return shipping label can be printed. The closest recycling centre to the customer is chosen for the destination of the package, (PLUSfoam, 2017, B). They have eight reclaim centres in total, where the one in Germany is the closest one for anyone living in Europe. When they have received the product, an award will be emailed, if the brand has decided upon giving it, such as for example 20% off a new purchase.

Patagonia uses a similar method of collection, where

their customers can post their used items, that no longer are possible to be repaired or reused, to Patagonia's Service Canter in Reno, USA (Patagonia, n.d, B). This reclaim for recycling do not seem to offer any possibilities to print out a shipping label on their homepage but regarding sending in items for repairs, it is possible to print out a shipping label through their homepage, costing $5 (Patagonia, n.d, C).

9.1.4 PICK-UP POSSIBILITIES

Some companies or organizations focused on post-consumer products offer services where the items are collected directly from the consumer. This kind of collection method, have not been found among companies that produce and sell their own products.

Myrorna is one example that offer pick up solutions to collect post-consumer items for their second-hand shops, where they use a truck to pick up larger donations from both private persons and companies (Myrorna, 2016, A). Sellpy, a Swedish company, is an example of a company that have built their business upon the concept of 'pick-up', see figure 39. Their business idea works so that the person wanting to get rid of some belongings but is too lazy to organise a sale by themselves instead order a "Sellpy Bag" from their homepage, free of charge (Sellpy, n.d, A). The customer then packs the bag with clean items and make a request for a delivery from Sellpy. They offer their pick-up service in Gothenburg, Stockholm, Malmö, Uppsala and Skåne. If the customer does not live in any of these areas Sellpy offer a free shipment with Schenker. Sellpy then handles the sale of the items for the customers, meaning that they sort, decide the price, organize the ad, which is put out on Sellpy's homepage and Tradera, organize all contact with the buyer as well as shipment. The customer gain some of the money that their items are sold for and the rest is kept by Sellpy, keeping more than 50% (Sellpy, n.d, A). If the items do not get sold they go to recycling or to the help organizations, Emmaus and Stockholms Stadsmission.

9.1.5 CONTAINER COLLECTIONS

Container drop offs is a common collection method used by charity-organizations such as Emmaus, Human Bridge and Myrorna as well for municipalities. Where containers are placed in public spaces or at recycle centres. In a report made for Naturvårdsverket (Danielsson, et.al., 2015) they express that some of the textile containers that are put out are from less serious actors, where their intent and origin is questioned. In an interview with Eva Maria Rudbäck, Logistic Manager at Red Cross, she also mentioned this problem. In the report from Naturvårdsverket (Danielsson, et.al., 2015) they also expressed that there are few municipalities that go in with collaborations with collecting companies or organizations but that the help organization, Myrorna is the most common collaboration partner that they do have. Myrorna have approximately 1200 donation boxes in total in Sweden, they are usually located at food shops, shopping centres or in residential areas (Myrorna, 2016, B). They also have collaborations with municipalities so that they can place their textile containers at recycling centres. Their hand-in containers and boxes as well as second-hand shops are more frequently placed in the southern parts of Sweden. An example of how these containers look like can be seen in figure 40.

Figure 39. Sellpy's pick-up service (Sellpy, n.d, B).

Figure 40. Human Bridge and Emmaus containers for collection of textiles and shoes (Vaggeryds kommun, 2016).

9.2 GENERATING REVENUE FROM A TAKE-BACK SYSTEM

To incorporate a take-back system, including collection of post-consumer products, in a company's business model it often requires investments. Why it is important to be able to show that activities included in such services can bring crucial benefits to the brand, in terms of revenue and a good reputation among customers.

In a report from the Ellen MacArthur Foundation (2013) it brings up that repair services, returns, and leasing services creates a higher level of customer-brand interaction, thus creating a higher value and customer loyalty. Except for pleased customers that return for new purchases it also can give the company valuable insights in usage patterns that can help the further development and improvements of products, leading to even better customer satisfaction (Ellen MacArthur Foundation, 2015). As described by Wijkman & Skånberg (2015): "Revenue is earned by maximizing the value of the stock (the wealth) rather than maximizing the flow, by "selling more stuff". Meaning that by increasing the lifespan of products, designing them to last longer, make it easier to disassemble and repair, the revenue possibilities also last longer.

Matzler, et al. (2015) discuss whether or not the kind of platform that IKEA and Patagonia offer through their collaboration with the online second-hand platforms, Blocket and Ebay gives a financial benefit, which was described in chapter 7.1. As they encourage their customers to buy and sell their products on a second-hand market instead of buying new products from them. IKEAs and Patagonias initiative have although proven to be positive. The platform strengthens IKEAs sustainable image as well as generating new sales, as people create space for new furniture when selling their old ones. Matzler, et al. (2015) also discuss Patagonia's Common Threads partnership with Ebay, where one huge benefit is described to be that it gives Patagonia a higher product visibility, both online and in real life, giving positive branding effects for the company. Customers that have sold their used Patagonia items, in similarity with IKEA, get both the money and possibly a need for new Patagonia products. Thus, generating both revenue and strengthening the brand.

With the third-party collection collaborations, where I:CO is a recurring actor that partner up with bigger fast fashion companies, the companies have to pay for the logistics but I:CO pays their partners for the collected goods. Paul Dietzsch Doertenbach from I:CO mean that, if the collaboration with logistics is set up in a good way, such as reversed logistics, the companies will generate revenue from it. He also mentioned that the companies often donate the profit to charity or fund R&D. Muthu & Gardetti (2016) point out in their article about green fashion, that the companies collaborating with I:CO also generate revenue from handing out discount vouchers, possible leading to a bigger purchase than the voucher gives.

From the post-consumer items that Nudie is selling, such as the denim rags there are a huge profit to be made due to the reused material, old jeans, that they make their rugs out of and that are sold at a relative high market price (Muthu & Gardetti, 2016). Nudie makes a business from these collected and redesigned products where other companies, such as Haglöfs with their second-hand sales, chooses to have all the money they make out of the collected and sold items to go to charity projects (Haglöfs, n.d). In similarity with Patagonia this is something that strengthens their image of being sustainable, generating a branding opportunity instead of direct revenue from the sales. In fact, by taking back products and by small means either repair, redesign or offer a second-hand platform where the material/products can go through a second life-cycle it can offer the company revenue with minimum effort (FinanCE Working Group, 2016). Costs to implement such businesses are generally much lower than it would be to manufacture and sell a new product from virgin resources. Thus, the company can take back already produced products that have been used for one life-cycle, prolong their life and make revenue from one item through a longer period of time, through repair services/kits, second-hand sales, redesigns and material recycling.

9.3 ETHICAL ISSUES WITH GIVING DISCOUNTS WHEN RETURNING ITEMS

The intent of using vouchers in a take-back system is to give customers an incitement, other than the greater good of handing in the items for recycle and reuse, so that the products are handed back to the compa-

ny and do not end up in the trash (Muthu & Gardetti, 2016). It is also done to provoke a new purchase and lead to revenue for the company. When companies implement such a system, where customers are awarded with a discount voucher, it might instead lead to negative and unwanted consequences from an environmental point of view. According to Muthu & Gardetti (2016) such a system, might lead to a user behaviour where a 'throwaway culture' is enhanced instead of suppressed, throwing away old products in a much faster pace and using the vouchers to shop new items, contributing to an unsustainable 'fast fashion'.

However, Muthu & Gardetti (2016) describes that 'slow fashion' brands, such as Nudie, can thanks to their in store second hand sales replace some of the purchases of new products that these vouchers generate. These second-hand resales also have the huge benefit of prolonging the product's life as well as giving a lower carbon footprint. The companies that use leasing as a business model are described to be an even better option, as the product lifespan is prolonged and used by multiple users, while the company keep the ownership and control of end-of-life, as well as giving a high displacement rate - replacing new purchases.

9.4 CONSUMERS BEHAVIOUR

To have an efficient take back system the type of collection activities that are chosen for collection of post-consumer products can play a crucial role in terms of customer engagement and will to hand in their shoes. In a report by Coates et.al (2007) consumer awareness and apathy for handing in their old shoes to recycling banks is discussed as one of the main barriers for shoe collection activities to be efficient. The report brings up suggestions, given from Nike on how to affect consumers will to hand in their shoes. According to Nike, shoe returning must be made more convenient for the consumer, to carry their old shoes around while shopping might not be a convenient solution. It is also suggested that investments in the public awareness, recycling technologies and infrastructure, is crucial to be able to involve more consumers in the collection activities.

In another report, focusing on textiles, by Elander and Ljungkvist (2016) it is argued that, an increased knowledge about the benefits of reuse and recycle textiles as well as about the environmental issues with textile production is crucial in order to change consumer mindsets. This type of consumer awareness might increase the number of used textiles that is being collected for reuse. However, it is stated that for an increased collection of used textiles to occur it is also necessary to develop new business models that makes it easier for the consumers to hand in their used items. Furthermore, as was mentioned by both recyclers and fashion companies, is that marketing could give a large impact on customers' awareness.

Another factor that can decrease the willingness of citizens to hand in their post-consumer items is discussed in a report from the Nordic Council of Ministers (Elander, et al., 2014). Except that consumers wants to get rid of their old clothes, they also want to ensure that the goods that they are donating is used for a good cause. The issue with unreliable organizations, could therefore be a factor that negatively affect the collection of post-consumer items from citizens.

Figure 41 is taken from a study made by Statistiska Centralbyrån showing how much of the consumed textiles, per person, during 2013 in Sweden that was collect for reuse and how much that went to household waste (Sörme & Allerup, 2015). The study did not include post-consumer shoes but can give an insight of how the returning verses waste behaviour in terms of post-consumer items was among Swedish citizens in 2013.

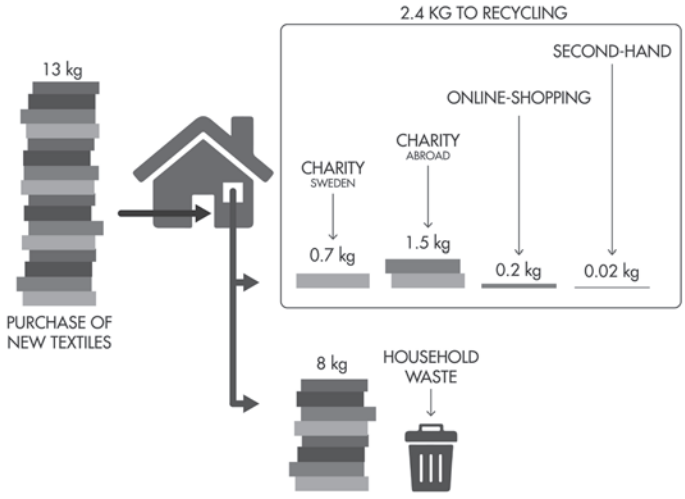


Figure 41. Consumption, reuse and waste of textiles data in Sweden 2013 from Sörme & Allerup, (2015).

9.5 CONSUMER DISPOSAL BEHAVIOR

This chapter deals with the results from the survey question; What do you do with your shoes when you don't use them anymore? The results can be seen in figure 42 and 43. This was asked in order to understand what users' habits regarding shoe disposal is today and how the condition of the shoes affect their disposal decision. Giving an understanding of users' habits, views and knowledge. The chapter is categorized according to the categories of shoe conditions that were posed in the survey.

Heavily worn, broken

A common tendency among both the respondents from the general survey and the Icebug customer survey, can be seen where heavily worn or broken shoes are thrown in the combustible or bulky waste. Some respondents in the Icebug survey, although very few, answered that they would leave them to charities, compared to none at all for the people answering on the general survey.

A bit worn

The general survey was the first one that was put out and because of the comments it generated a second answering category was added to the Icebug survey, 'keep, store at home'. This was added because it was found in the first survey that a lot of people in fact do not do anything with their old unused shoes, they simply just store them at home. Because of this the two surveys cannot be fully comparable to each other but it still gives a good indication of the differences.

An interesting find in these answers is that a slighter higher percentage answering on the general survey would donate their shoes to charity compared to Icebug's customers. While a higher percentage of Icebugs customers, almost double, would give their worn shoes to a family member or friends instead. An assumption that can be made is that Icebug shoes are in a quite high price range compared to other shoes, which might be the reason why people feel keener to hand the shoes down to their family and friends instead of charity. A large amount of people answer-

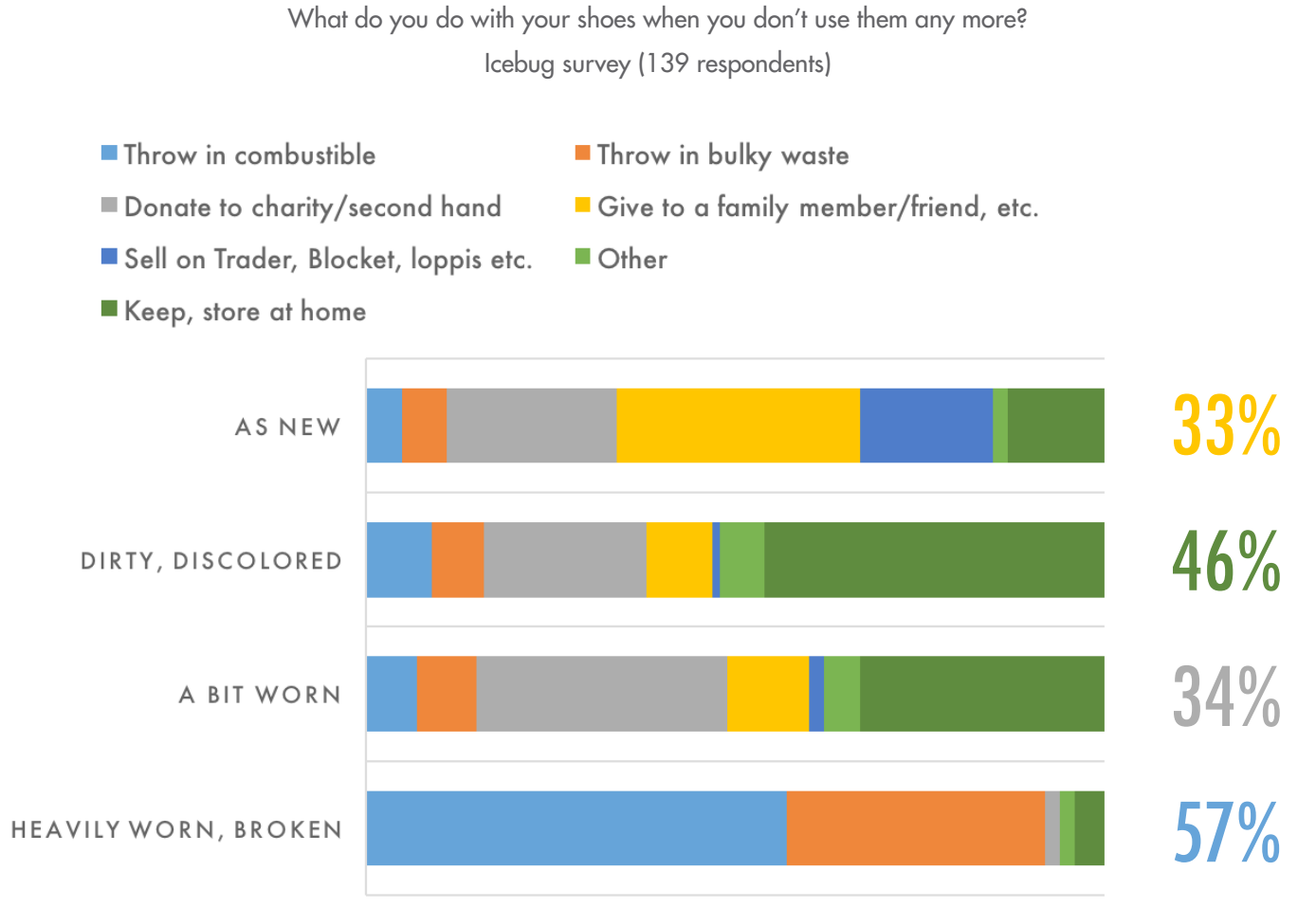


Figure 42. What do you do with your shoes when you don't use them any more - Icebug Survey.

ing on the Icebug survey, 33%, stated that they would store the shoes at home, making it to quite a big group of potential people which can be influenced to change their behaviour.

Dirty, discolored

For this category of used shoes the rate of people that would throw the shoes in the 'bulky waste' or the 'combustible' are almost exactly the same rate as the previous category for both surveys. What can be seen is that it is a higher degree of people that would keep and store the shoes at home, when looking at the results from the Icebug survey. Consideration have to be given to the fact that the general survey did not have this extra answering category.

As new

For shoes that are in really good condition people in both surveys tend to throw away less and make sure that the shoes are reused at a higher level than the other categories. The amount of shoes going to charity dropped from 30% to 22% in the general survey, while in the Icebug survey it raised by 1%. In the general survey, more people would sell their shoes second hand, 29%, than to donate them to charities, 22%, while it is the opposite for the people answering on the Icebug survey, where more people would give away to charities, 23%, than to sell second hand, 18%. The people answering on the Icebug survey are on the other hand more interested and keen to hand the shoes over to family and friends, 33%, where it was 19% in the general one.

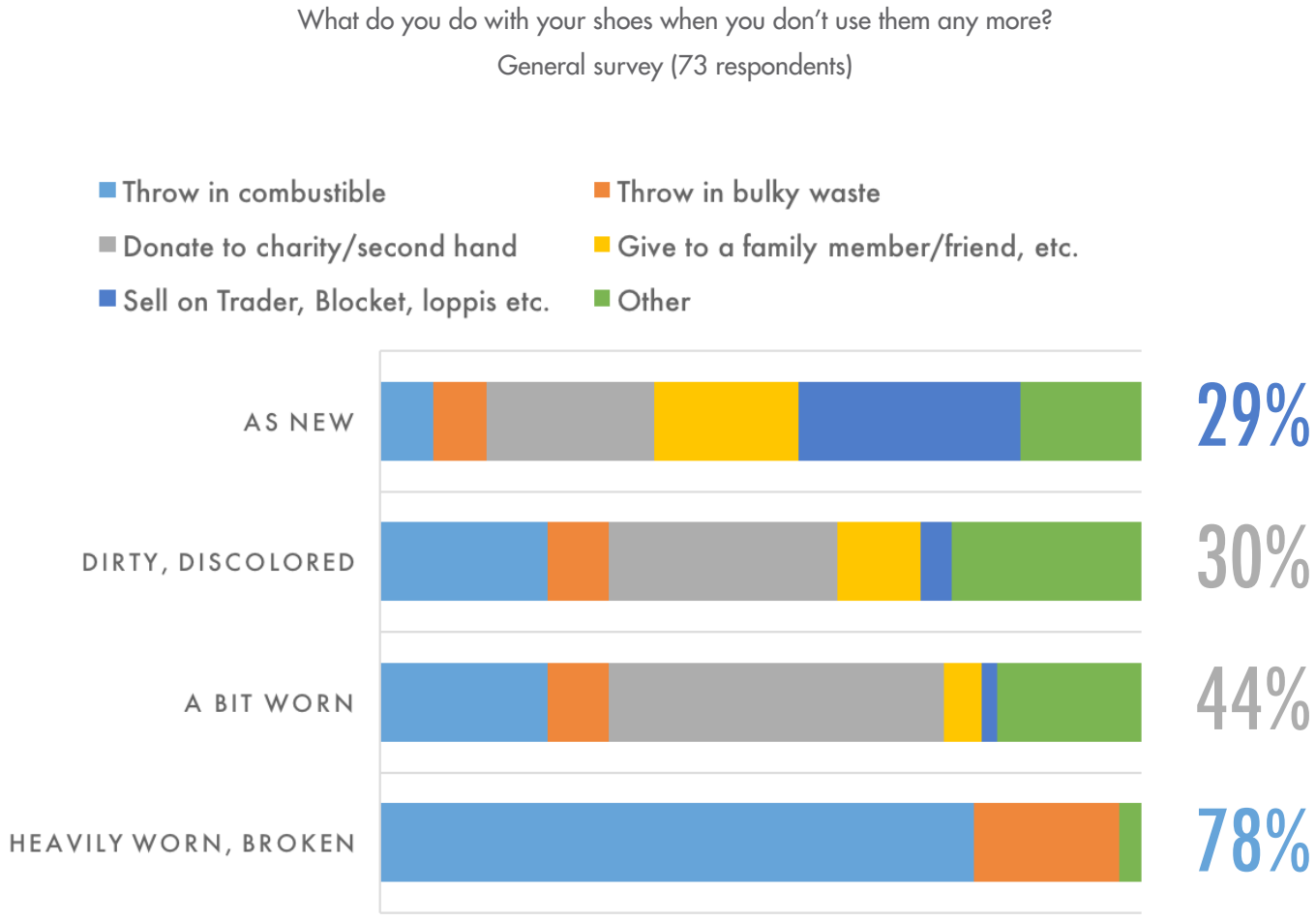


Figure 43. What do you do with your shoes when you don't use them any more - General Survey .

9.6 PREFERRED COLLECTION CHANNELS & INCENTIVES

In the survey, a question was stated related to consumers attitude towards different types of collection channels and their will to hand in their old shoes. 93% of the 73 respondents in the general survey and 92% of 139 respondents in the Icebug survey answered that they could imagine to hand in their shoes for reuse or recycle. Both surveys showed similar results, whereof most of them would do it for environmental reasons and on second place because it would go to people in need or because of the sheer knowledge that the shoes would be properly recycled, see figure 44 & 45. The need for such a service to be easy and accessible ended up on fourth place.

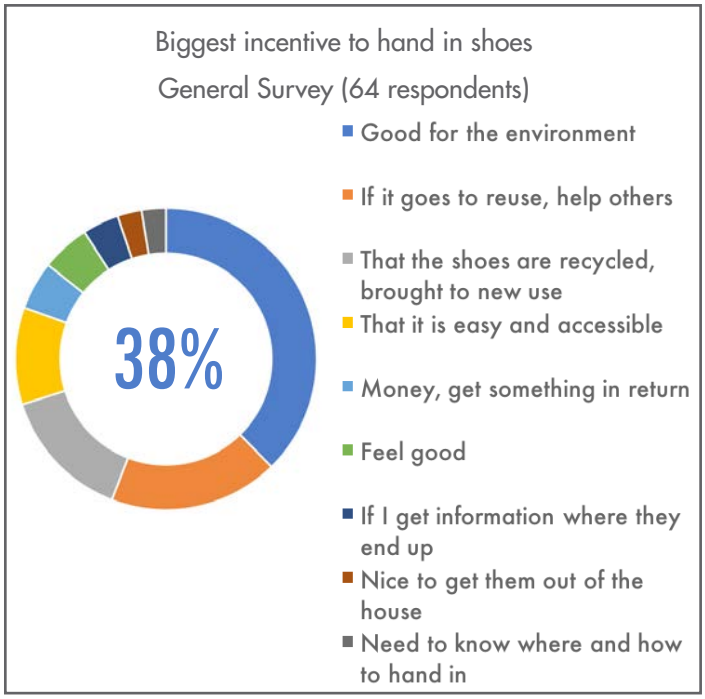


Figure 44. Biggest incitements to hand in shoes, KJ-analysis from general survey.

This gives the information that the greater good of returning shoes weighs heavier than money as long as it gives the feeling of being sustainable, that it goes to a good cause and that it does not demand a huge effort from the consumer. Transparency was also something that was commented upon as something important. This also goes together with the three first incitements, as knowledge about the system in turn gives the consumer their incitements, why it is something they should do.

> *"If I get information of where the shoes will go and how they will be processed, reuse? Recycling? Or to what?"*

> *"Knowledge about how the shoes really are being recycled and not thrown away or stored in a warehouse until somebody in the company figured out how they can be recycled."*

Figure 45. Biggest incitements to hand in shoes, KJ-analysis from Icebug survey.

The arguments that were given in the surveys to why they would not like to hand in their shoes were dominated by two reasons in the general survey. The reason was either because it felt wrong to hand in dirty and smelly shoes or that handing in shoes takes too much of an effort see figure 46. Surprisingly these answers differed with the reasons given to what would make them change their mind. Where transparency about where the shoes go and why, was the most common factor to what would change their mind. Easy accessible return stations, what would solve one of the main

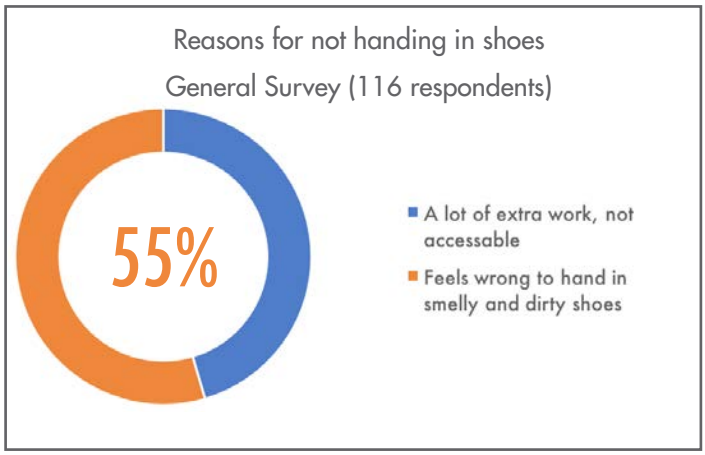


Figure 46. Reasons for not handing in shoes, KJ-analysis for the general survey.

factors for not handing in shoes, ended up on third place.

> *"If I obtained information that it lays a value (not financial) to hand in used shoes I would do it"*

This quote together with the results in figure 47 gives an indication that transparency is a powerful tool to give incitements and knowledge, affecting other reasons as well. The ones answering that nothing would make them hand in their shoes are probably the ones that feel that it is wrong to hand in dirty and smelly shoes to reuse and recycle. Giving a challenge to make them perceive used shoes from a different point of view, in terms of value.

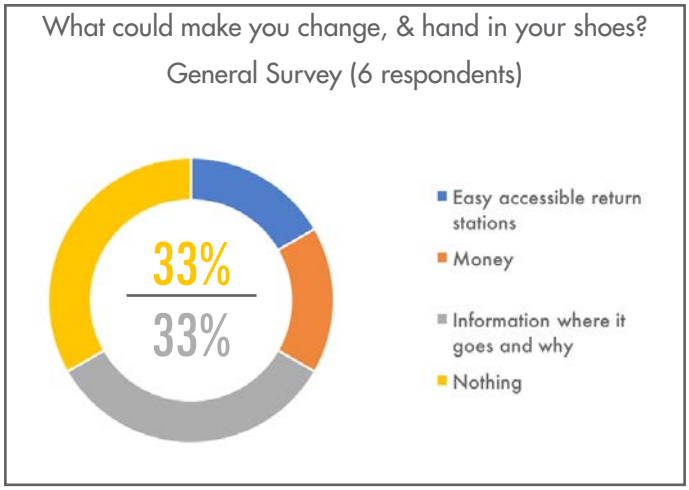


Figure 47. Reasons for why the ones that are not willing to hand in their shoes would. KJ-analysis for the general survey.

The dominant reason to not hand in shoes in the Icebug survey was that the shoes are too worn so that no one else could possibly use them, "They are not especially usable when I consider them as consumed." Because of this fact the system should be able to show that it is beneficial to hand in the shoes even if they are worn out. To encourage this target group to hand in for reuse or recycle.

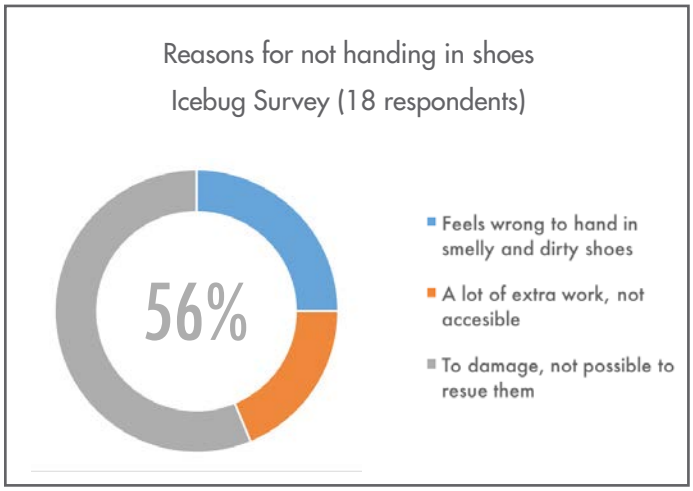


Figure 48. Reasons for not handing in shoes, KJ-analysis for the Icebug survey.

The other two mentioned reasons were, just as in the general survey, that it feels wrong to hand in smelly and dirty shoes, and that handing in shoes takes too much of an effort, see figure 48. The most frequently mentioned reason for changing their mind regarding hand in shoes was, in the Icebug survey, if they would know that their shoes are possible to reuse or recycle, where the results can be seen in figure 49. The percentage that mentioned money or some kind of profit for their effort, was bigger in the Icebug survey than in the public survey, as well as it was the second most mentioned reason in this question. Easy and accessible return, and information where it goes and why, was also important factors for some of the Icebug users, in order to increase the will for handing in their shoes.

The respondents were also asked, what type of collection activity they would prefer and why? In this question, the first survey had different options that the respondent could choose, but this was altered in the Icebug survey where they were not given options but was supposed to answer in free text. This gave a wider answering span and gave a better insight to why they felt that the option they chose were the best. Because

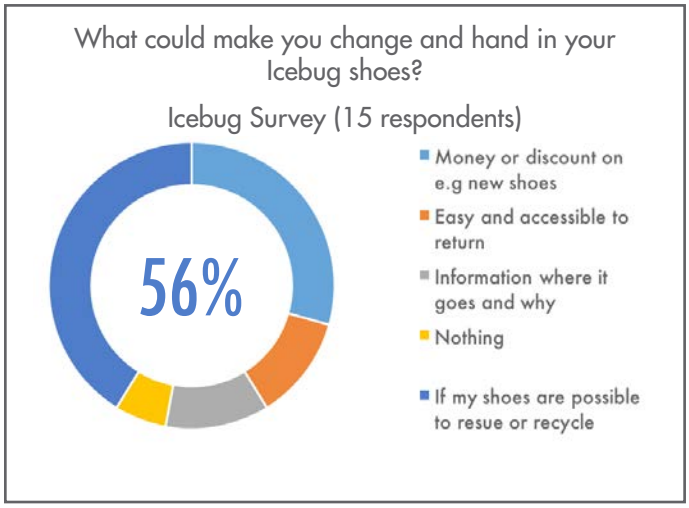


Figure 49. Reasons for why the ones that are not willing to hand in their shoes would. KJ-analysis for the Icebug survey.

of the free text answer a KJ-analysis was performed of the Icebug survey, as one answer could have an array of different reasons.

In both surveys, the respondents found public textile containers to be the best option in terms of handing in their old shoes, see figure 50 & 51. The majority choosing this option was because they found that the public containers are the most comfortable option. The reasons why it is the most comfortable option was explained in the Icebug survey to be that it requires less effort as they are going to the recycle centre anyway, it is simple, multiple drop-off spots are available, there are no closing hours and there is no human contact needed. The multiple drop-off locations are also connected to the second most common reason to why public containers are the best option, it is close by.

"Go back to the store where I bought them - then the store can see how I wore the shoes and can help me to find a new pair that is good for me"

"Leave them in a public textile container - Doesn't demand a lot of extra work. I go to the recycle centre anyway. Would absolutely not send with a package! Feels like a lot of extra work!"

"Hand them in by post - It is close to where I live, the nearest store which sells shoes are 15 km away"

Charity organizations was the second most preferred hand-in location for the Icebug respondents. Where the reasons were explained to be that then they are certain that the shoes go to reuse, it is the most comfortable option and that they trust that the shoes end up where they should. Also linking to the reasons chosen for preferring this collection channel in the general survey, 'most comfortable option' and 'the safest option'.

The option of returning the shoes back to the store, was the third most popular hand in alternative in the Icebug survey and around the same percentage choose this alternative in the general survey. In the Icebug survey, it was found positive to connect hand-in with a new purchase as it did not require such a big effort, as they are going there anyway. Another reason was that this option felt safe, that the shoes will end up in the right place and be properly taken cared of from an environmental perspective. A lot of people commented that they expect that shoes are reused to new shoes if handed in directly to the brand, and that it would be a good option because then the producing company take their responsibility. Making it clear that in such a solution it would be crucial to be transparent about what happens with the shoes in order to not give them a faulty image. Three other suggestions were also mentioned, to hand in to Sellpy, to hand shoes into a recycle station and a suggestion to hand shoes in on events, such as Öloppet.

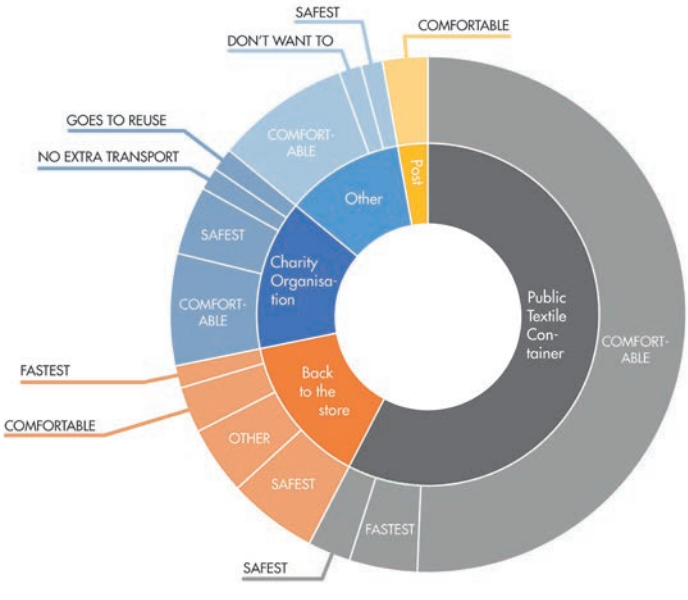


Figure 50. Most preferable hand in option - general survey.

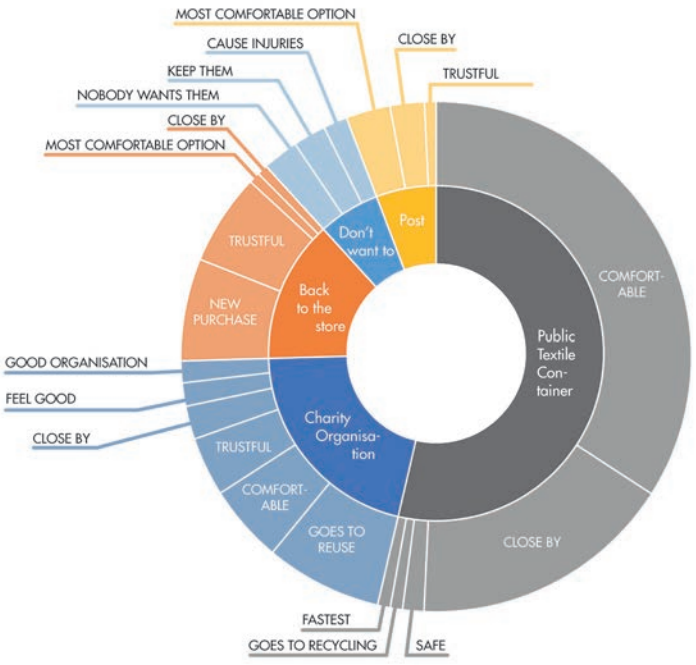


Figure 51. Most preferable hand in option - Icebug survey.

9.7 SUMMARY AND CONCLUSION: COLLECTION

A general conclusion that can be made from the survey results presented in this chapter is that the better condition the shoes are in the more people make sure that the shoes are reused in some way. A very small amount of people still throws their shoes away, making it an important group to try to influence, as the shoes are still able to be reused. The high amount of people that answered that they basically do not do anything with the shoes, just keep them stored at home, is another high potential group that can be influenced to change their behaviour. It can also be seen that the Icebug respondents seem to be more interested in sustainability issues as a smaller percentage throw the shoes away than the people in the general survey. This conclusion together with the fact that 92% of the respondents could imagine to hand in their shoes gives a positive indication that it is something that Icebug customers would be interested in and care about. The general response regarding handing in shoes were also at a high level, 93%, showing that it is a socially accepted concept and something that can be implemented when it comes to shoes.

Different types of collection channels to use in a take back system has been presented such as; physical drops of in-store, third party collection boxes, return by postage, public containers and collection through pick-up all with their advantages and disadvantages. Physical drop ofs in store could for example bring a direct in-store promotion of the take-back system and therefore make it easier for the customer to be aware of the system as well as it can work as a physical branding tool. Some drawbacks with this type of collection is that it might include a smaller customer range, depending on how many stores that are able to allow drop off, and it demands physical drop-offs by the customer as well as storage space. However, from the user study many of the respondents thought that returning used shoes back to the store where they were bought were one of the safest options.

The main positive aspect with using postage label as a collection channel is that it reaches a large customer range, since it is accessible for everyone. But to print out a label, package and post it requires some effort from customers and in the cases presented in this chapter the cost for the shipment is paid by the customer. The collection can also result in extended personnel duties, if the items are send to the company, since it demands activities such as receiving, unpacking, storing and shipping. However, if the items are send directly to the recycling centre, as in the case with PLUSfoam's take back system, the company can gain end-of-life responsibility with minimum effort. Returning post-consumer products by postage was not one of the most popular collection alternatives, although some saw it as the most comfortable and accessible option.

The public textile containers were chosen as the preferred hand-in option by the majority of the respondents. The public containers are often handled by a charity organization, but unfortunately all charity organizations in Sweden do not have public collection containers as for example Red cross. The reason why, is related to the ethical issues with unserious actors. This is one of the main drawbacks with public containers, and from the user surveys it can be concluded that many respondents did not prefer this option because it was the safest, the majority chose this because it was the most comfortable.

Pick up post-consumer products directly from customers is an existing service among external companies, such as Sellpy, but not a service that has been seen among producing companies. That Icebug themselves would offer such service is not an option but a collaboration with this type of service company could be a possibility, since that could give increased company responsibility but with minimum effort. Furthermore, such service requires very little effort from the customers as well.

As described in this chapter, many companies offering a take-back service, provide their customers with a voucher when handing in their products. There is both benefits and negative aspects with giving out voucher in this purpose, it can partly give more people an incentive to hand in their products as well as it might lead to purchases of new items and generating revenue for the company. On the other hand, discount on new items might lead to increased consumption and to an increased 'throwaway culture'.

Regarding generating revenue from a take back system studies have shown that it can have large benefits for companies offering such service. It can give

higher level of customer-brand interaction and create a stronger bond with the customer - increased value & customer loyalty. Furthermore, it has shown to be profitable in terms of getting insights in customer usage patterns, which can be helpful for R&D.

10. OPPORTUNITIES TO CREATE A CHANGED BEHAVIOUR THROUGH BRANDING

Green Branding can be seen as a tool to give consumers a better awareness over their purchases and to encourage a more sustainable behaviour, to educate and influence (Sarkar, 2012). It is also used to strengthen the image of a brand and help develop the brand towards becoming more sustainable in all aspects, to live up to their brand promise and be open for scrutiny. Although, it is important that an environmental strategy is incorporated into the business before green branding is used (Sarkar, 2012). In this chapter, a few important Green Branding strategies are presented that can help to spur a changed user behaviour.

10.1 TRANSPARENCY

To succeed with green marketing companies need to be transparent, to show both the good and the bad facts about their products and company in order to avoid being accused for 'greenwashing' and to create trust (Ottman, 2011). This term is used when companies display themselves to be more than what they actually are in terms of sustainability. As consumers are getting more aware of what kind of products that they buy and care more whether or not the products are sustainable, being accused of greenwashing can be very damaging for the credibility and trust of a brand. In a report from ISPO Textrends (2016) it was identified that one of the big megatrends for outdoor- and sport-brands today is on how to improve products end-of-life, to reduce, reuse and recycle. They also mention that one of the main reasons for why so many companies are focusing on it is because of pressure from consumers. Giving further indications of the impact of consumer interest and the importance of being transparent. According to Muthu & Gardetti (2016) Nudie is a company that is a very good example of a brand that have succeeded to bring transparency to their business, where they inform on all post-retail initiatives clearly on their homepage, see figure 52.

Figure 52. From Jeans to a new product, illustration from Nudies homepage (Nudie Jeans, n.d, B).

In a report from Nordic Council of Ministers (Elander, et al., 2014) it is described to be a lack of credibility for actors dealing with post-consumer textiles due to not enough transparency regarding what really happens after the post-consumer items are collected. This is also described to induce obstacles for increased textile collection in general. Proving the importance of being transparent and to provide valid information. According to Elander et. al (2014) the purpose of why the post-consumer items are collected must be informed to the consumers. How they are sorted, reused, recycled and what it is that happens with the items that cannot readily be recycled or reused. This is also something that was expressed by respondents to the survey, presented in chapter 9.6. Information

should also be given on where the reused items go and what the recycled materials end up as, otherwise the lack of information might harm the credibility of the company and decrease incentives to hand in post-consumer items.

10.2 EASY TO ACCESS INFORMATION

Consumers are more willing today to make their voice heard and react against companies that they think have done something that do not cohere with their brand promise (Sarkar, 2012). Ottman (2011) also mention that the social media and word-of-mouth are getting increased importance. Leidenkrantz (2016) also press on the importance of going digital and that it is of great importance for companies today to have a well-designed homepage where information is easy to access and easy to understand, to not cause confusion or misinterpretations. Muthu & Gardetti (2016) are also of the meaning that failing in communicating sustainability on the first page of the brands homepage will not be able to catch the interest of the consumers that are not actively in search for such information.

Muthu & Gardetti, (2016) takes Nudie as a good example of having a well-designed homepage where they give detailed information about their different sustainability initiatives. The information that Nudie present on their homepage regarding their sustainability initiatives are not presented under a page called 'sustainability', 'responsibility' or similar, it is located under what they call 'This is Nudie Jeans', making it clear that it lays deep within their core values and is a part of who they are, not just an add on. Patagonia is another example of a company that have a well-designed homepage, especially on how to repair your Patagonia garments. They give in detail information on numerous ways that a garment can break and how consumers themselves can fix it. Figure 53 displays step 1 of 10, all pictures showing detailed and clear instructions that even a sewing novice can follow.

Brands do not only use homepages to create easy attainable information for the customers but it is also communicated through other channels, such as their physical shops as well as the products they sell (Muthu & Gardetti, 2016). Nudie's stores are in fact not referred to as 'stores' but instead as 'repair shops' as a way of reaching out to people with their values and intent, to change a behaviour and make people keep their jeans longer, take care of them and repair when possible. These repair shops are a way of communicating their story directly to the customers (Muthu & Gardetti, 2016).

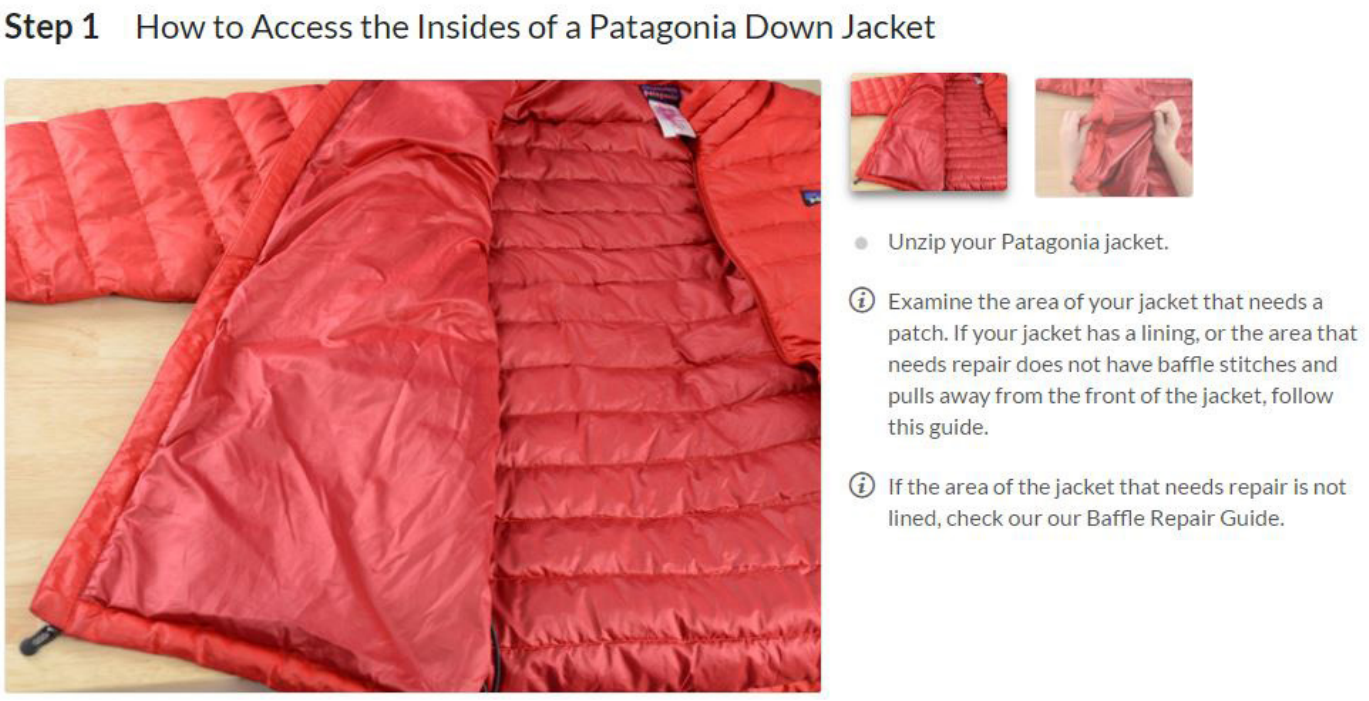


Figure 53. Repair instructions on Patagonia's Website (McCrigler, n.d).

10.3 TELL A STORY

Consumers today are well educated of what they are buying and do research to find out more before making a purchase (Ottman, 2011). Recommendations made from family and friends weighs more than advertisements and has therefore made social media more important in terms of branding. Ottman (2011) also mean that it is therefore of importance to give credible and readily available information that is easy to share among each other. It is also of importance to educate the users and engage them through storytelling, to have a story that gives meaning to the product beyond its mere functions and performance, to offer a customer an experience.

The Haglöfs Swapstories initiative, where they collect and sell Haglöfs garments second hand, uses stories to give an extra value to the second-hand items (Elander, et al., 2014). It makes the experience of handing in as well as buying the garments more personal. The concept is built on the idea that people handing in their old garments also hand in the life story of the garment, what adventures it has been a part of, making it more valuable and fun to buy. Patagonia uses a similar approach where people can submit a story from a beloved memory containing their Patagonia garment, called 'The Stories We Wear', see figure 54 (Patagonia, n.d, D). This is part of their 'Worn Wear' program where they aim to engage people to keep garments for a longer period of time. For the 'Stories We Wear' they have created a blog where people can share their stories and submit a photo, as a thank you Patagonia send out a 'Worn Wear' patch. This way their customers becomes brand ambassadors instead of customers and instead a part of the company and a community (Burke, 2014). Stories have the power to move people on a deeper level and create engagement. It is of importance though that the product story is coherent with the brand story otherwise it might cause a brand gap where the interpretation of the product story can give a different meaning to the brand (Hestad, 2013)

Another example of when companies use storytelling in order to catch interest and at the same time educate about their product is Timberland in their 'Drive. Recycle. Wear' concept, see figure 55. Through simple means they tell a story about the origins of the shoes components and make it to something more personal. In this project Timberland partnered up with a tire manufacturer that had the end-of-life goal to become shoe soles for a timberland shoe, carefully choosing the materials so that it would work for recycling into soles (Timberland, n.d). This way the consumer can drive on their Timberland Tires and know it will become new shoes one day that they can buy, involving the customers in the process.

Figure 54. Patagonia - The stories we wear (Patagonia, n.d, E)

10.4 CHAPTER SUMMARY & DISCUSSION: BRANDING

From this chapter, it is made clear that people are in need of transparency and valid information from companies in order to be spurred to change their behaviour. They need knowledge and reconfirmation that they are doing a good thing, why they are doing it and where it is going. A company that have a take-back system should be able to answer:

- Why the company is collecting post-consumer items?
- How they are sorted, reused and recycled?
- Where the reused items go?
- What the recycled material are used as?
- How is the company making profit from this system?

The brand should also be able to ensure and give proof that the donated items are used for the stated purpose and nothing else, as this is something that is lacking in today's systems. Trust need to be created as well as credibility among customers, why it is important to only go into collaborations with a trusted company or organization that stand for a similar cause. To be able to reach the consumer it can be beneficial to communicate through storytelling, to give a meaning to the products beyond performance. It is also of great important to create a coherence between the brand story and the product story, to not cause confusion. Which in Icebug's case can be to connect it to the forest which trail runners run in, to create a connection and incentive for the user.

It is also understood from this chapter that it is vital to provide information that is easy to attain and that is digital. The information need to catch the interest of the consumer and more than one information channel should be given to reach as many as possible, meaning not only digital. The information should also be easy to share between users and should encourage and engage the consumer.

A clear standpoint on sustainability should be shown from the company's side and sustainability should be made as a core value, not just an add on. Why the information given on the webpage should also be allowed to take up space and frontpage attention. In order to make the consumer make the right choice and change their behaviour regarding EoL they can be given responsibility, to empower them, and to include them, to make them feel part of a community. This is believed to bring a stronger sense of responsibility and encouragement for behaviour change.

Figure 55. Timberland - Drive Recycle Wear (Timberland, n.d).

11. REQUIREMENTS

This chapter presents the requirements that the system and redesign need to fulfil in order to meet and overcome the barriers that have been presented.

The re:design should:

- Be more sustainable than today
- Strengthen the different parts of the system
- Should be possible to clean/refresh the shoes
- Should be able to clean and dry without damaging components
- Be able to withstand dirt
- Overcome barriers in user behaviour
- Be able to separate, disassemble components
- Provide easy disassembly and assembly
- Be able to exchange and upgrade components
- Especially the midsole
- Enable better quality of the recycled material
- Avoid use of adhesives
- Minimise amount of different materials
- Avoid mixing materials
- Avoid prints, plastic or colour
- Provide durable and long-lasting components
- Eliminate unnecessary components
- Cohere with Icebug's visual brand and values
- Provide material identification
- Provide added value

The system should:

- Take responsibility for products EoL
- Provide a longer lifespan
- Ensure that reuse is the first step before recycling
- Offer local reuse options
- Avoid increased consumption
- Avoid landfill & incineration
- Offer options for Material recycling
- Provide possibilities for user repair
- Provide added value
- Provide novelty

Information

- Offer care information
- Offer repair instructions
- Provide instructions that are easy to understand
- Provide information that is easy to understand
- To not cause misinterpretations among users.
- Should inform about the risks of keeping shoes too long
- Offer more than one information channel
- To reach as many users as possible

Induce a changed User Behaviour

- Provide transparency & trust
- Answer to why the user should use the system, how the system work and where the profit and the post-consumer shoes will end up.
- Demand minimum effort from user
- Offer incentives to take care of shoes
- Offer incentives to reuse shoes

- Offer incentives to repair shoes
- Provide easy accessibility to care instructions
- Provide easy accessibility to spare parts
- Make it easy to sell and buy second-hand shoes
- Offer incentives to hand in post-consumer items
- Offer more than one collection channel
- Offer collection that is available for everyone in Sweden
- Provide collection possibilities that are easily attainable
- Educate & inform the user
- Encourage & inspire the user
- Branding

Create customer loyalty, increase customer-brand interaction

- Increase brand visibility
- Give a clear standpoint on sustainability
- Strengthen Icebug's sustainability image
- Use collaborations that have a good reputation
- Catch interest, be attractive, inspiring and fun
- Provide coherence between brand story and product story
- Provide information that is coherent with the brand

Icebug

- Give economic profit for Icebug, direct or indirect
- Collaborations should give minimum effort and investment
- Fit Icebug's size as a company
- Accept all of Icebug's shoes
- Not use too much of Icebug's storage space
- Provide a solution that can be implemented in the near future

12. PART I: DISCUSSION & CONCLUSION

From Part I it can be concluded that there are several important factors that need to be taken into consideration in order to create a system that have a holistic view of the matter and that can bring a better EoL solution to Icebug. The list of requirements, presented in the previous chapter, is the backbone for the concept development.

From the studies and investigations that were made it was found that there are basically three main areas that need to be attended to, Care & Repair, User Behaviour and Reuse & Recycle, see figure 56. From Part I it can be understood that there are different focus areas within these main areas and that some already have existing solutions that easily can be implemented by Icebug. Care & Repair is one of these area where a lot of solutions already exist and which Icebug merely just have to include. Such as, to provide easy access to spare parts, educate about how to properly care and take care of shoes as well as to give information and instructions on how easy repairs can be done. This will in turn help to prolong the life of user shoes and can also help to create a stronger user-product bond where they want to keep them longer.

A problem area which is a far bigger challenge and which do not have a clear path for how it can be done is, Reuse & Recycle. Here the main difficulty is that there are limited recycling possibilities available and it is not something that is known by users and well embedded in their habits - because the possibility of shoe recycling in Sweden does not exist. Therefore, the knowledge of both the problem that EoL of shoes give and the recycling possibilities that exist are low or

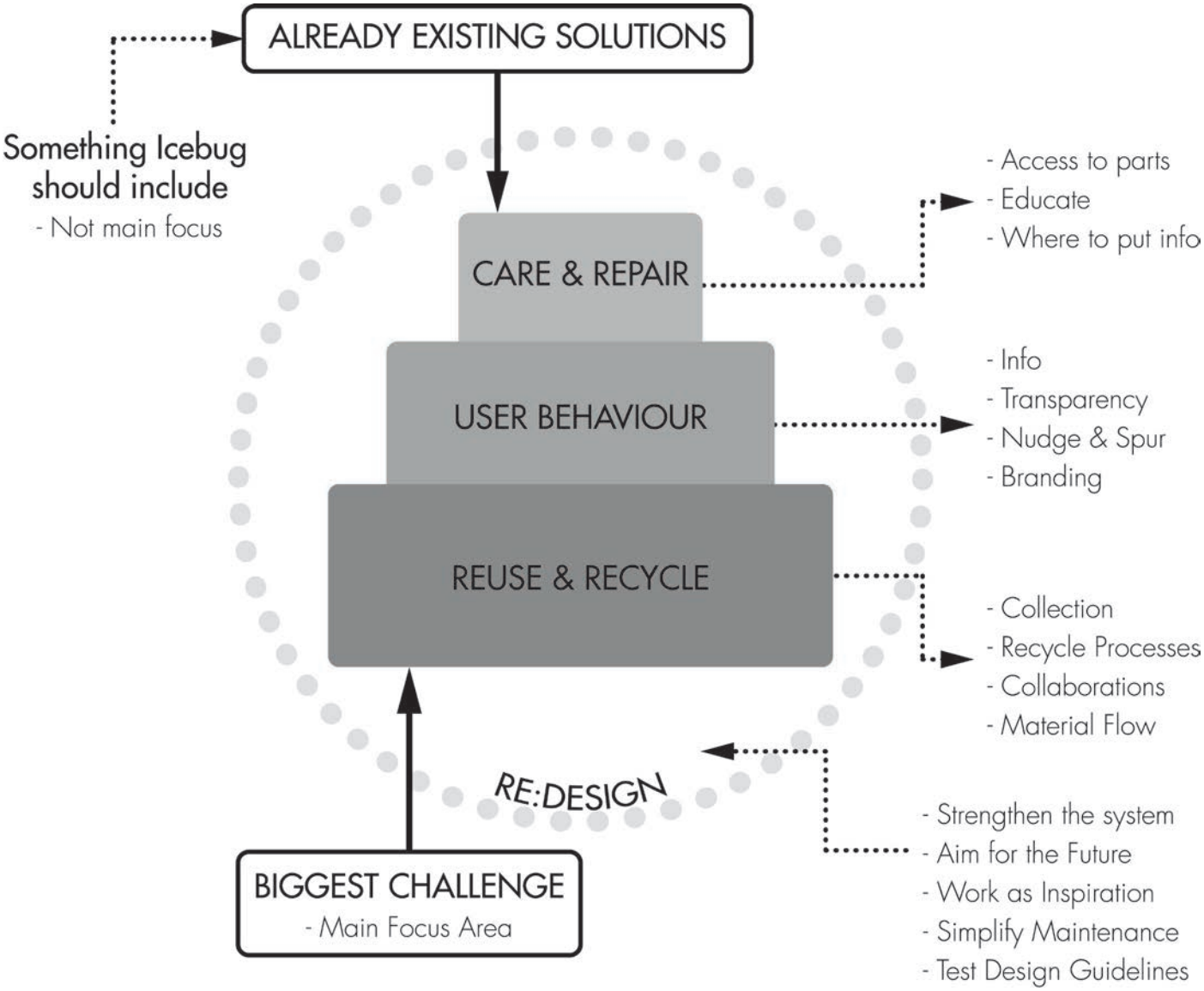


Figure 56. Areas of development for the final solution

non-existing among users. Making it important to attend to the area of, User Behaviour. Where the importance of giving correct information, being transparent, educate, nudge and spur is something that need to be taken into consideration in order to provide a successful system.

In the area of Reuse & Recycle there is also not a widespread and easy attainable system for collection of post-consumer footwear. Here it becomes of importance to understand which collection options that will suit Icebug the best and that will be used by their customers. Something to consider when creating a system that will successfully steer consumed shoes to a better EoL is that there are a lot of different stakeholders that will have to be involved. This is because of the fact that Icebug is a smaller company and will not implement an own recycling plant or collection service for customers all over Sweden. Therefore, they will need to collaborate with a range of stakeholders. The ones that are the best suited for such collaborations and that can give fairly simple implementation and security will be of importance when creating the system. That the material flow of the shoes is properly thought of in order to give the best EoL possible will also have to be considered in the system design in order to give a more circular approach in Icebug's business model.

Because of the difference in regards to challenge and design of the final concept the main focus will be laid on finding the best solution for Reuse & Recycle, as this is the biggest obstacle that Icebug have in order to create a better EoL for their shoes. More simple suggestions will be given for how Icebug could see to the longevity of their shoes regarding Care & Repair, but is not the main focus. User Behaviour is something that affects all parts and will be a part and taken into consideration for the entire system design.

Something else that also includes the entire system is the Redesign of a shoe. This includes all parts of the system and its main goal is to strengthen the system and be of an inspiration for Icebug for how they can work and think regarding their design of shoes and provide them with sustainable design guidelines. It is also an aim for the future, which should attend to the difficulties that have been identified regarding upgradability, maintenance, easy reuse, repair and recycling. It attends to the barriers that shoe design gives today for the main areas in the system, such as the short lifespan of a shoe, that makes it difficult to recommend reuse and longevity because the risk of injuries and the difficulties to repair and recycle because of the heavy use of adhesives and mixed materials. The findings regarding User Behaviour also implies barriers that can be solved by a better design, for example that people are not keen to buy or sell second hand shoes because they are unsanitary, smelly and broken in by another foot type.

PART II:
SUGGESTION FOR A FUTURE SYSTEM & REDESIGN

-BRIDGING THE GAP BETWEEN PROBLEMS AND OPPORTUNITIES

1. SYSTEMS FOR REUSE & RECYCLE

The concept development for reuse and recycling resulted in seven different suggestions, including solutions for collection, transport, reuse, recycle, information channels, means for incitements and branding. These concepts will be presented in this chapter.

Concept 1: Icebug Second-Hand Store

Concept 1 suggests that Icebug will have their own second-hand shop, both in store and on their webpage, see figure 57. This is a good option for those that feel that the action of handing items back to the shop is the most convenient way, as well as for those that feel that it is the safest option, as they trust that the company will handle the goods in a proper manner. This system can also generate more customers, as the ones handing in their old shoes might be looking for new ones. It is also a possibility to gain a closer connection to the user where Icebug can gain valuable user information that can aid the product development of new shoes. It is also something that will give direct branding opportunities in the store, giving a direct connection to their brand.

The concept works so that customers can hand in their shoes directly to Icebug's shop in Gothenburg. The customer will get a 10-20% voucher in return when handing in their shoes. This is used to give a clear incitement for the customer to actually go to the store and hand their shoes in, instead of just throwing them away at home. The money that Icebug earns from selling the second-hand shoes can go either to internal R&D projects for sustainable development or to a charity that Icebug have chosen, one example for a possible charity could be SOEX Pilot project for footwear recycling in order to help their further development. The user handing in their shoes can then choose where they want the money to go. This gives a serious impression from the company and it also gives control to the user which might be an incentive. This system also gives an increased transparency of where the money from the second-hand sales are going, something that a lot of users are requesting. It also gives a "feel good" sensation for the customer, the feeling that they are doing something good through the act of handing in their shoes. The voucher is also a tool to give Icebug increased sales and a way to get their customer back to them.

The shoes will then be manually sorted by the shop staff and put on a second-hand shelf in Icebug's store and on Icebug's webpage to reach an increased number of people, not only in Gothenburg. The selling and shipping of the shoes use the same purchase system as new shoes on Icebug's homepage. Customers can therefore shop Icebug's second hand shoes, either directly in store or from the web page, giving two purchase channels and a wider spread.

To communicate this take-back system to Icebug's customers there will be a print on the shop window of Icebug's store, that illustrates this service to everyone passing the shop, see figure 58.

Figure 58. Concept 1- Branding and communication channels.

Figure 57. Concept 1 - Icebug Second hand store.

This is used to create an interest from people passing and an incentive to go in and learn more about how it works. Information about the system will also be given on the homepage where it will be explained why they are having such a system, how it works and where they go. This is used to give the user more detailed information and answer those questions that users are demanding.

A collection box in the store will be used to collect the shoes together with a path leading up to the box. The idea with the path is to nudge the users to make a sustainable decision. The path is also used to make the box more visible for all of the customers visiting the store, to make them interested, to learn more about the system and hopefully start using it in the future. This path is also used to communicate the goal for Icebug, their core values as a company through being highly visible in the store.

Concept 2: Collaborati on with Myrorna

This concept is based on a collaboration with Myrorna. This collaboration enables the use of a variety of different collecting channels which is profitable in terms of accessibility for the users. These collection channels are illustrated in figure 59, which are collection box in Icebug store, Myrorna's public container, drop off at Myrorna second hand store and pick up of sample shoes from Icebug headquarter, using Myrorna's pick up service. Similar to concept 1, the instore collection box in the Icebug Gothenburg store gives a purchase opportunity and gives closer connection to Icebug users. This concept also includes the most preferable collection channel, public containers, referring to the results from the surveys.

The last square in figure 59 illustrates the possible fates for the shoes after donated to Myrorna, in first case the shoes will be sold in their local second-hand stores, where the profit that Myrorna gets from sold items will go to charity. However, if the shoes would be in too bad condition Myrorna will send the shoes to incineration.

Figure 60 shows the branding and communication idea in order to engage the customers in this take-back system. The first picture is an illustration of a patch placed in the tongue of the shoe, which aims to encourage the user to give the shoe more than only one owner, to "hand it down". The concept also includes an info page on Icebug's webpage that should inform the user that this collaboration exists as well as how, why and where. At this page Icebug will also offer a digital map informing where the customers can drop off their shoes and includes a link to Myrorna's webpage. The third figure shows the collection box in Icebug store, which is exposed in the same way as in concept 1. The incentives for people to hand in their shoes would be; get rid of old shoes, trendy, feel eco-friendly and for good will, which is based on the survey.

Figure 60. Concept 2 - Branding and communication channels.

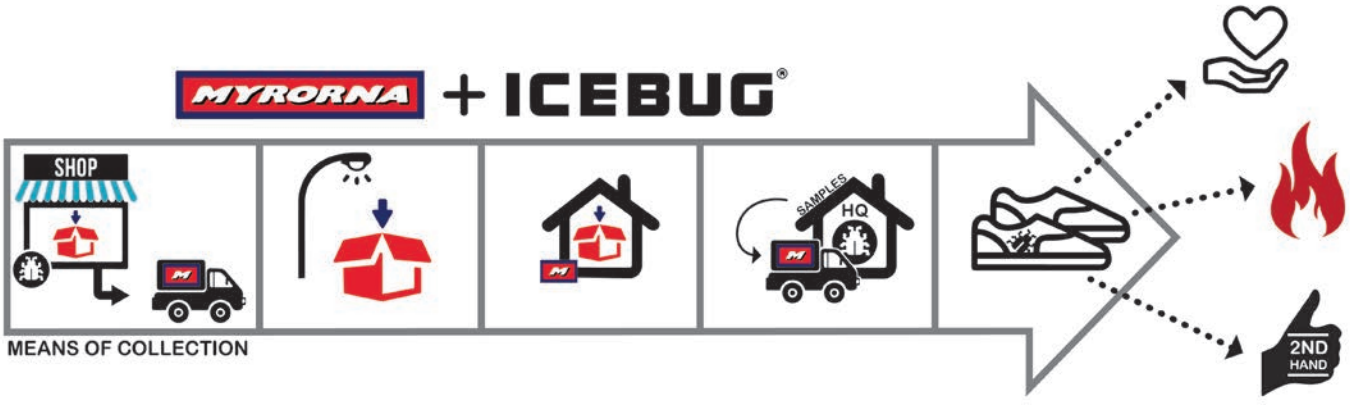


Figure 59. Concept 2 - Collaboration with Myrorna.

Concept 3: Collaboration with PLUSfoam

Concept 3 is built on a collaboration with PLUSfoam and the collection activities therefore differs a bit from the other concepts. This concept requires that Icebug uses PLUSfoam's materials in parts of their shoes, as for example the midsoles and/or outsoles. As illustrated in figure 61, information to the customers how the take-back system works is given on both Icebug's webpage and PLUSfoam's webpage, this will also give Icebug double exposure.

In order to reach out to the customers who are not buying the shoes from Icebug's webpage, a poster in all shops selling Icebug will be put up together with information regarding the PLUSfoam soles and the collaboration will be added on the shoebox PLUSfoam's URL info will also be integrated directly on the sole of the shoe. The aim is to make the info accessible at all time, making it clear that this is a PLUSfoam sole that can be recycled and eliminating the risk to lose the info.

The shoes are send directly to PLUSfoam's recycling facility in Germany by the customer themselves. A shipping label can be printed out at PLUSfoam's webpage, the customer pays for the shipping and in return they get a voucher to use at Icebug's webpage or in store. Since Icebug is quite a small company this concept is preferable because the user send the shoes directly to PLUSfoam which eliminates the need for Icebug to collect, store and send the shoes to recycling centers. Hence, quite a small effort is needed from Icebug's side.

The shoes that are sent to PLUSfoam will go to material recycling, which gives this concept its advantages because it offers a more closed material loop. But in order to encourage the customers to first let the shoes live a bit longer before they are send to PLUSfoam's recycling plant, this concept includes the "hand me down" patch in the shoe tongue just as in concept 2, see figure 62. Except from the voucher, further incentives for people to hand in their shoes would be; get rid of old shoes, trendy, feel eco-friendly and for good will, which is based on the survey.

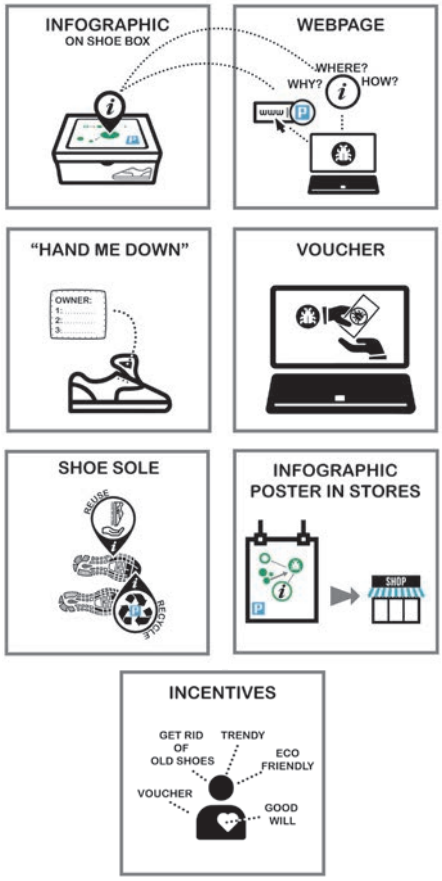


Figure 62. Concept 3 - Branding and communication channels.

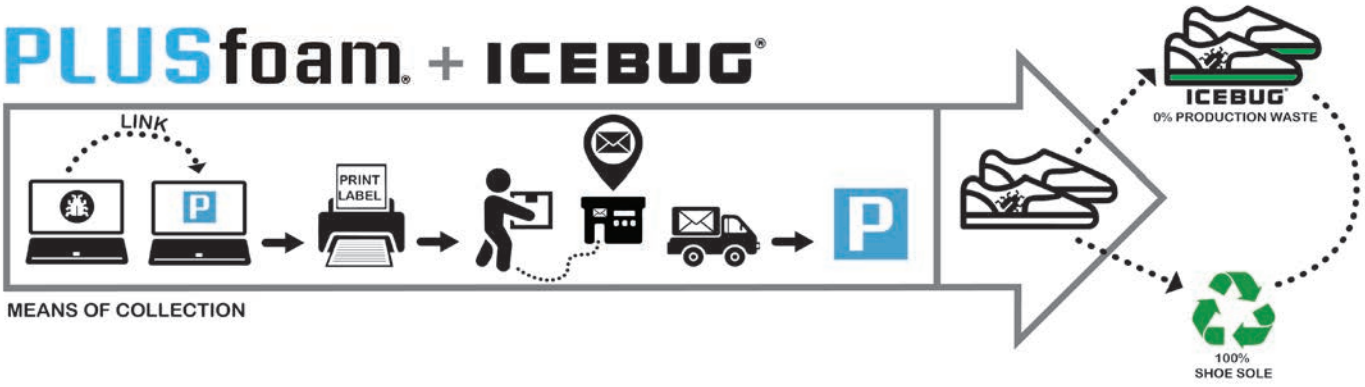


Figure 61. Concept 3 - Collaboration with PLUSfoam.

Concept 4: Collaboration with the Red Cross & SOEX

Concept 4 suggests a collaboration with Red Cross, and since Red Cross already collaborates with SOEX, it also makes them a part of the system, see figure 63. The collection is made through Icebug's store and all Red Cross second hand shops. Samples from Icebug is also handed in to Red Cross, but only if they are in pairs. The drop off at the second-hand stores are made by the customers themselves, whilst the shoes that has been handed in to Icebug's store is transported to Red Cross by one of Icebug's employees. The shoes that are in good condition will be sold second hand locally whilst the worn-out shoes will be sent by Red Cross to SOEX for material recycling. The reason for having an in-store Red Cross box in the Icebug store in Gothenburg and not only refer to Red Cross, is done much because of the reasons given in concept 1, to gain direct marketing, a closer relationship with customers and a possibility to generate new sales. It is also implemented in order to give the customers another channel of handing in their post-consumer shoes.

After the shoes are handed in to Red Cross they are responsible for the selling, redistribution and shipping to SOEX, giving less effort for Icebug. The reason for giving unused sample shoes to Red Cross, apart for the obvious environmental reasons, are to obtain a higher level of exposure of the Icebug brand, where more of their shoes are seen on the streets and being used by people.

As in concept 3, one branding channel for this concept is the shoebox with infographics together with information on Icebug's website about the system as well as location for the drop-off stations, see figure 64. For the collection in the Icebug store, a box in combination with a path leading to the box, just as in concept 1, was included. Moreover, this concept suggests a drive, in order to get people aware of the system and kick start it. An idea to such a drive could be that the customers will be asked to take a selfie when handing in their shoes to a Red Cross store or to the Icebug store, send it to Icebug and include a story related to the shoes. For the effort, a free totebag could be given to the customer, or a voucher. This would hopefully create a buzz around the concept and also be a way to change behaviours, to start handing in their shoes. The story of their shoes, what good memories they have from using them could be a way of strengthening the brand story and the brand.

Figure 64. Concept 4 - Branding and communication channels.

Figure 63. Concept 4 - Collaboration with Red Cross & SOEX

Concept 5. Collaboration with SOEX & I:CO

The means of collection for this concept is shown in figure 65, which includes collection in the Icebug store and at affiliated retailers, collection at events by Icebug, such as running events, and collection via postage. The collection at retailers is needed for this concept in order to reach a higher amount of collected post-consumer shoes, which I:CO and SOEX requires. Collection via events is also chosen for this reason and collection via postage is offered in order for the system to be as accessible as possible. Collection via postage lets the customer send their shoes to Icebug's HQ for free by offering a free postage label that can be printed out from Icebug's homepage. Collected shoes in store is picked up by I:CO and then transported to SOEX recycling plants in Germany. Shoes that are being collected at events are taken to Icebug's HQ and then picked up by I:CO, including the shoes that has been sent by postage from the customers. By using SOEX and I:CO as collaboration partners the EoL possibilities for the shoes in this concept will be local second hand, material recycling (if the shoes go to the pilot program) or charity. As in concept 3 & 4 one of the biggest advantages of this system is that it offers material recycling of shoes.

The branding strategy for this concept is shown in figure 66. The first figure illustrates an Icebug shoebox with printed infographics that shows the possible journey for the product from usage to EoL. This infographic also include the link to Icebug's webpage, informing the customer that they can read more about the take-back system at the webpage. By offering a digital map at the webpage the customer gets to know where it is possible to drop off their shoes. Furthermore, the shoe sole is provided with icons and text saying that these shoes are aimed to be recycled or reused, further encouraging the customer to engage in the service. The incentives for people to hand in their shoes would be; get rid of old shoes, trendy, feel eco-friendly and for good will, which is based on the survey.

Figure 66. Concept 5 - Branding and communication channels.

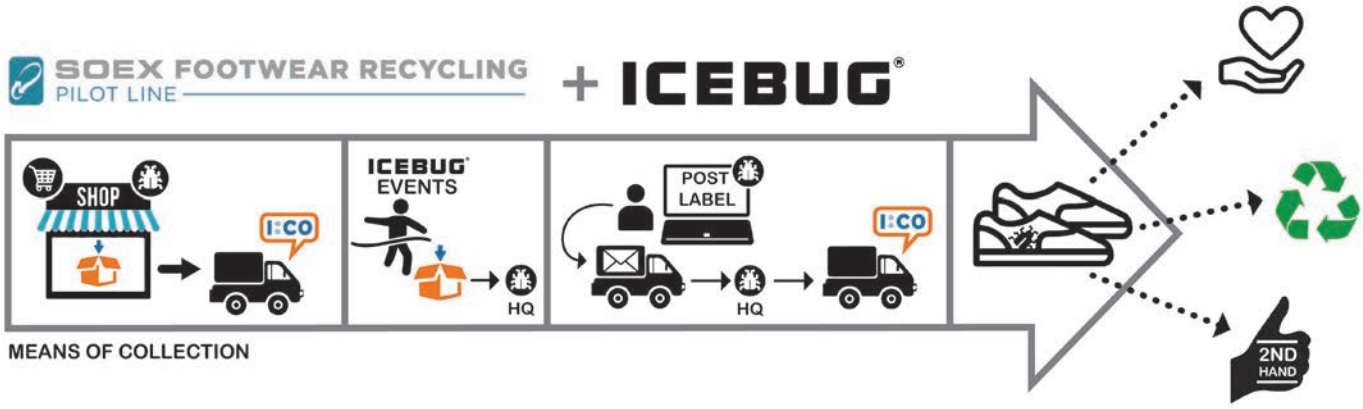


Figure 65. Concept 5 - Collaboration with SOEX & I:CO.

Concept 6: Second Hand Collaboration with Sellpy

The concept aims to encourage customers to use Sellpy's online second-hand service to improve the EoL for their shoes. The idea is a collaboration between Icebug and Sellpy, where Icebug refers to Sellpy through giving information about the benefits of using their service and to link to their homepage. In return Sellpy gives Icebug an own heading on their homepage where all Icebug's second hand shoes are collected, making it easier for users to find them. Sellpy uses Tradera for their auctions, meaning that the shoes will also be exposed on Tradera's webpage. The collection of second hand shoes is made by Sellpy, illustrated in figure 67 and described in chapter 9.1. Shoes in good condition are posted on Sellpy's webpage and on Tradera, and the person who sell the shoes earn 50% of the selling price. Second hand shoes valued below 50 kr are send to charity organizations and shoes that are broken or not in a good enough condition are sent to recycling for incineration. The positive aspect of creating a collaboration with Sellpy are the multiple exposures that are gained through them as well as Tradera and how little effort that is needed from the user. Something that is otherwise a great obstacle for collection of post-consumer goods and the reason why many items never are handed in. Another strong incitement for handing in shoes through this kind of system is that there is money that can be earned from old, unused items without an effort. This system does not require any effort from Icebug except for giving information to the customer.

One information channel for this concept is a folder that is placed in the shoe box, see figure 68. The folder will inform the customer about the collaboration with Sellpy, information is also given on Icebug's webpage. Another branding channel for this concept is the patch in the tongue of the shoe, as in concept 3 and 2, aimed to encourage customers to give their shoes a second or third life. The fact that the people who uses this service will most likely get money in return will also be used to market this system.

Figure 68. Concept 6 - Branding and communication channels.

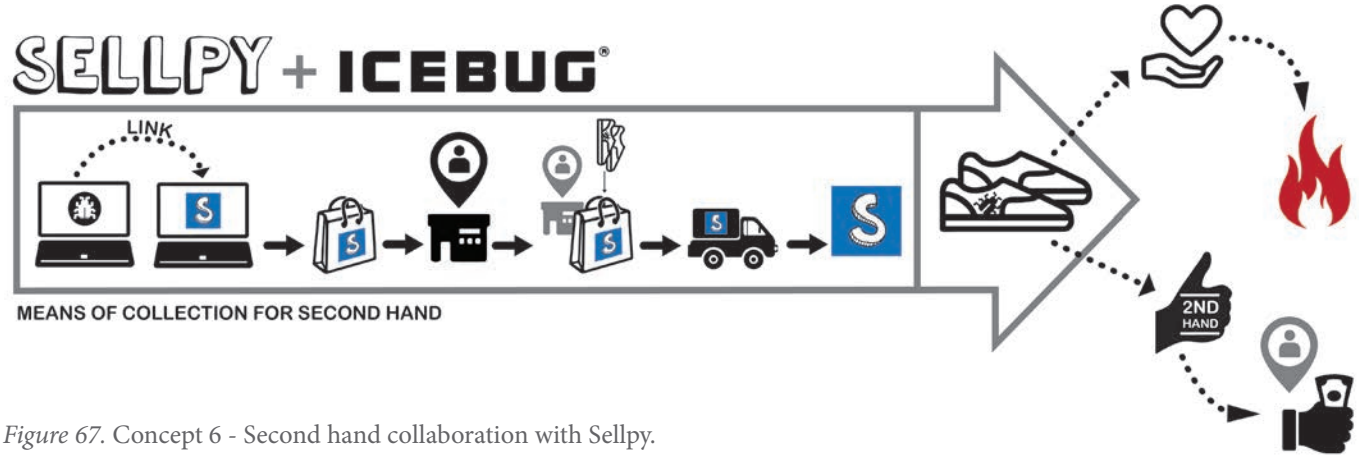


Figure 67. Concept 6 - Second hand collaboration with Sellpy.

Concept 7: Second hand collaboration with Tradera

In this concept, it is suggested that Icebug should go in with a direct collaboration with Tradera, see figure 69. The concept builds on the fact that Icebug would have a website on their homepage which is assigned to as "Second-hand shoes" and where all Icebug shoes that are put up on Tradera is shown, meaning that Icebug get double exposure. The customer can buy the shoes either from Icebug's webpage or Tradera's but every legal aspect of the purchase goes through Tradera's principles and is their responsibility.

The patch on the tongue of the shoes, shown in figure 70, is used in this concept to work as an encouragement to give the shoes a longer life. Furthermore, information on the webpage regarding the benefits of selling and buying secondhand shoes are explained. The information provided should also educate the user in terms of flow of shoes and their lifecycle to further encourage a changed behaviour. This system proposal would give the customer money for their sold shoes as well as the possibility to buy shoes that have been used for a lower price. Since Icebug shoes are quite expensive the possibility to buy the shoes for a lower price enables Icebug to reach out to a wider target group as well as more people gets the chance to wear their shoes.

Figure 70. Concept 7 - Second hand collaboration with Tradera.

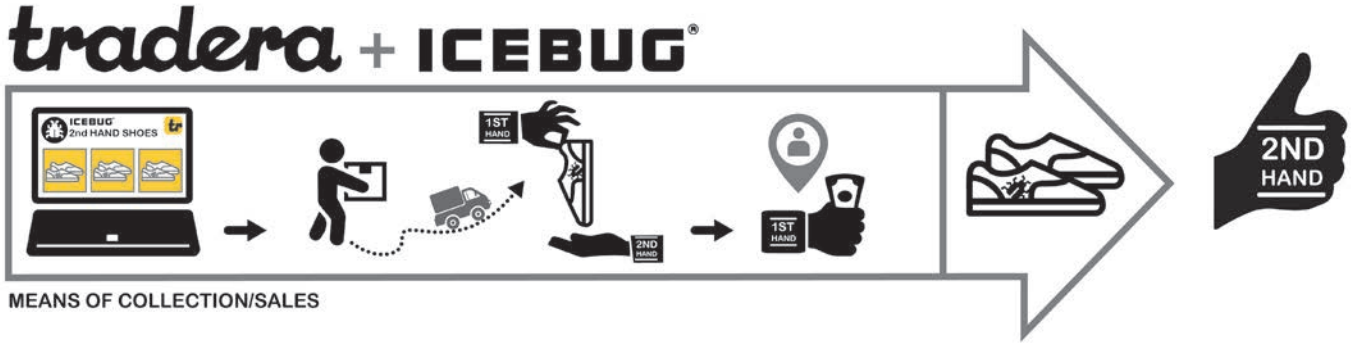


Figure 69. Concept 8 - Branding and information channels.

1.2 SYSTEM EVALUATION FOR REUSE & RECYCLE

The evaluation of the system concepts can be found in appendix IV. The final results can be seen below in table 6. The higher the number, the better the concept is, compared to the others. As can be seen by the points, the collaboration with PLUSfoam and Red Cross have the highest score from the evaluation, tightly followed by Sellpy. This is mainly because of the fact that PLUSfoam offer material recycling, where the most challenging material to dispose of in a shoe today, the rubber and EVA, are 100% recyclable. Making it a closed loop system where the post-consumer material is upcycled instead of downcycled like the material is in the other concepts. It is also a good option in terms of production, where it has 0% production waste. Because of this it gained high points regarding means of recycling. As PLUSfoam also have a implemented consumer reclaim service, offering both recycling and collection in the same collaboration it gained high points regarding the effort needed from Icebug's side. It is also an innovative solution which can encourage people to use it. It also shows that there is still a value in worn out shoes, a means to change consumer behaviour. Because of its innovative approach it also shows people that Icebug is a forward moving company that want to close the loop and making Icebug's products and approach stand out on the market compared to others. This is the main parts why it stood out compared to the other concepts that was presented.

Red Cross in combination with SOEX also gained high scores regarding its material recycling. Although in comparison with PLUSfoam it is downcycling of the materials, but on the positive side they accept all kind of shoes and do not require any new material implementations to be made. But due to the fact that it is a pilot programme it can only process a limited volume of shoes. Red Cross also offer reuse as the first option before letting the shoes go to recycle, something that is not included in the PLUSfoam concept. A collaboration with Red Cross would be fast to implement for Icebug and would require quite low effort from both customer and company. In similarity with the PLUSfoam concept this concept also shows people that post-consumer shoes still have a value and that material recycling might be an extra incentive for customers to hand in their shoes.

The main reasons for why Sellpy got such a high score is because of the very low effort that it gives, both to the customer and Icebug because of the fact that they pick up post-consumer waste directly from the customer's front door. The concept offers collection, reuse and recycling in the same service, bringing the need for multiple collaborations to a minimum. This concept also increases the brand visibility for Icebug and gives a double exposure on their webpage. In similarity with PLUSfoam it gives the user a profit, in PLUSfoam's case a voucher, from which they can buy new shoes with - giving Icebug loyal customers and profit. Although it is important to consider that an increased consumption should not be encouraged. Comparing Sellpy to Red Cross and PLUSfoam it does not offer any material recycling, instead it goes to incineration, resulting in a lower total score.

Because of this, it was decided to further develop the PLUSfoam concept in combination with Red Cross. This way it is possible to gain a circular material flow but to also be able to offer local reuse, which is preferred by the waste hierarchy. In the further development, it was also decided to add the Icebug 2nd Hand Store. This gained the least score in the concept evaluation but this was mainly because it does not include any solution for recycling, only reuse. But as PLUSfoam do not offer any reuse possibilities it was seen as a fast and easy concept to implement, that would offer more collection channels and be a good way to draw a clear and direct connection to Icebug's sustainability approach. Being a great marketing opportunity and directly visible for their customers. The combined concept was further developed and merged with the chosen solutions for care and repair which is presented in the next chapter.

Table 6. Evaluation results of system for reuse & recycle

	SECOND HAND STORE	MYRORNA	PLUSFOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Total	-1	7	15	14	7	12	8

2. SYSTEM FOR CARE & REPAIR

The concept generation for the care & repair part of the system resulted in different suggestions regarding how and where to give information in order to educate and encourage the users in the most effective way. The different concepts are shortly described for each category, Shoe care, why repair and care, how to get repair parts, instructions how to repair and upcycling tips.

SHOE CARE

1. Shoe care - information folder in shoebox

In order to give the user instructions about correct usage and shoe care the idea is to include an information folder in the shoebox when the customer buy their Icebug shoes. This folder will include general advice about shoe care and proper usage as well as more specific instructions to each category of shoes. The reason for providing an instruction folder in the shoe box is to make the customer aware of how they can prolong the lifespan of their shoes already before they start to use them. The chances for preventing wear increases the earlier they start to take care of their shoes, why it is necessary to educate the user early in the usage phase.

2. Shoe care - information on homepage

Another idea is to further develop the shoe care instructions that Icebug offers on their webpage, by making it easier to understand the different categories of shoes through adding pictures of a typical shoe in each category. Moreover, to make the shoe care instructions easier to find on the webpage by giving it an own tab on the top of the webpage instead of the bottom, as it is today, and link it to other sustainable focus areas that Icebug have.

WHY REPAIR & CARE

1. Infographic on homepage

A infographic that gives visual information to users on how they can prolong the life of their shoes and why they should do it. This is used to encourage and educate people and to catch interest due to its visual elements. By using a infographic it can provide a full holistic view directly at one glance and create a clear understanding for the cause.

2. Inspirational movie with a story, on homepage

This concept contains of a movie that is supposed to give a inspiring story and reason to why people should care enough to maintain and repair as a way to prolong the shoes life. The short clip is supposed to be placed on Icebug's homepage. Through a movie it is easy to convey the right feeling and message in a relative short time. It can also contain a lot of information and still be easy and fun to watch. The story in this context is supposed to be something that weaves in the Icebug brand and the goal to improve EoL of shoes and create an experience for the user that they can relate to, in order to change behaviour as well as strengthening Icebug's brand.

3. Infographic printed (stitched) on tote bag that is used instead of a shoebox

This concept consists of a totebag, a bag made out of fabric, which is used instead of a shoebox. On the totebag there is a printed or stitched infographic that informs about the system. Compared to an ordinary shoebox which is thrown away, a totebag is something that can be kept and used by the customer and therefore the information is kept. This gives a continuous reminder about the system as well as to why it should be used. The information also reaches everyone that buys a pair of Icebug shoes. There are also other positive aspects by using a totebag instead of a shoebox, less cardboard is used - meaning reduced recycle costs for Icebug, it distinguishes itself from other brands, it gives a luxury feeling and the Icebug brand is shown every time the totebag is used - giving more brand exposure. It also reaches the ones that do not use the internet and it is also good to store shoes in a breathable bag between activities to prolong the life of the shoes. This gives a good opportunity to give a solution to a suggested tip on "how to prolong the life of your shoes" - to use a totebag.

HOW TO GET REPAIR PARTS

1. Specific repair-parts in webshop and repair-kit in-stores

This concept consists of a small repair kit that can be bought in shops, which sell Icebug shoes, and specific repair parts, such as studs, that can be ordered from Icebug's webshop. The kit should include repair parts that are needed for the most common repairs, such as studs, small tube of glue, fabric patches, strong needle and thread. The idea with having the possibility to order specific repair parts online is so that the customer does not get any unnecessary components that they do not need, as it is negative from environmental reasons to overconsume. This option is not given in-

stores to make the effort minimal for the shop staff and also make it easier for the customer in terms of options given. In contradiction to overconsumption, the repair kits in store can give extra sales, increasing Icebug's profit, and can off course be used to repair shoes from other brands. By offering repair parts and whole kits both in the webshop and at every retailer, it reaches everyone. The repair kits also work as a brand symbol, communicating Icebug's values.

2. Studs ordered online and given out to retailers

In this concept customers can order free spare studs on Icebug's homepage or pick them up where they bought the shoes. Spare parts are given out to retailers to give out whenever a customer might need and ask for it. This makes sure that the spare parts are only given out when they are actually needed. Information that free studs can be given out upon request is given out on the homepage where customers also can find retailer shops.

3. Order pre-filled repair-kit online and buy in store, can contact Icebug for more specific spare parts for their shoe model.

In similarity with concept 1, this concept offers pre-filled repair kits that are sold in-store but in contrary to concept 1, the kit is also sold in the web shop. Having a pre-filled repair kit is easy to prepare as there is no need to manually pick specific spare parts.
Although, if a customer is in need of specific parts for their shoe model it is marketed that they can contact Icebug. Then they can ask for help or make a claim for a specific part, such as a zipper, studs etc. Depending on the claim Icebug can choose if it can be given out for free or if a small fee will be taken.

INFORMATION HOW TO REPAIR

1. Repair videos on homepage

The idea is that instruction videos for different repair is available at Icebug's webpage, as for example a movie that shows the different steps on how to replace a stud. The idea with instruction movies is that it offers the possibility to explain and demonstrate at the same time and it is possible for the user to follow the instruction closely step by step.

2. Repair explanations and images on homepage

This concept uses images and text instead of a movie. The reason why this concept includes pictures and not only text is to make the instructions as clear as possible, pictures with text can work as a good complement to each other. The amount of text needed to describe the different steps can be reduced since the pictures can, to some extent, speak for themselves, which makes it easier for the user to follow.

3. Link to DIY webpages

In similarity to Patagonia's strategy for giving repair information, the third concept suggest that Icebug should provide necessary repair information by linking to DIY webpages. There is a lot of repair tips and tricks connected to shoes that is possible to find on the web, both movies and descriptions. This concept therefore has the possibility to offer a wide variety of repair instructions without the need for Icebug to develop their own instruction material.

4. Community - DIY, post repair tips

In this concept, the idea is that Icebug creates a community on their webpage where customers or visitors to their homepage can post repair tips and instructions for shoes. In this way people can inspire others and be a part of a community where the aim is to encourage a more sustainable user behaviour. Just as in concept 3 there is a possibility to gather a wide variety of different tips and instructions without the need for Icebug to develop it as well as to collect it.

5. An instruction folder included in repair kit + inspirational story on the backside

This concept aims to provide a physical folder that should be included in the repair kit to give step-by-step instructions to how common repairs can be done. With a physical folder, it reaches people that do not use the internet as well as people that are not looking for information, it is already there. The folder should also communicate why it is important to start repairing to prolong the life of shoes, in order to encourage and inspire the users to keep up the good work. It is also a way of giving the customer the full experience of the product and the brand of Icebug and to make it fun.

UPCYCLING TIPS

1. Tips'n'tricks on upcycling - Icebug suggestions + customers upload their own

Tips'n'tricks on upcycling is supposed to be a fun and inspiring way to inform people what they can do with their old Icebug shoes if they do not want to sell or give them away. The idea is to provide a visual data bank of different upcycling ideas that brings a different use to the shoes and a way to keep and love the shoes a bit

longer. It is also supposed to be a community where Icebug users can upload their own creations and ideas of what can be done. This concept might catch the people that do not like the idea of giving away their used shoes. The community and sharing of own ideas might also give a feeling of belonging and a strong connection to the brand of Icebug.

2. Tips'n'tricks on upcycling - Only Icebug suggestions

This concept is similar to concept 1 but the possibility for people to upload their own tips'n'tricks is excluded. The reasons for suggesting such a concept is to eliminate the risk for unserious posts that Icebug could not stand behind and in order to make it easier for Icebug to have control over their webpage without the need for any extra work.

2.1 SYSTEM EVALUATION FOR CARE & REPAIR

The evaluation of the concepts for care & repair was based on the requirements presented in chapter 11, with considerations to the concept chosen for reuse & recycle and through discussions based on verbal user scenarios. The results from the evaluation can be seen in appendix V. The final concept choices for the different categories are presented in table 7.

These concepts were chosen due to their high score in the evaluation. The crucial aspects for these concepts is that they would offer accessible information, and repair parts, for everyone and information that do not get lost during usage. Hence, the choice to include information on the web page for some of the concepts. Furthermore, these concepts have potential to give information in an interesting and inspiring way that can encourage the customer to care more about their shoes. Besides this the tote bag and repair-kit can also work as branding tool for Icebug. These concepts were further modified and put together with the concept for reuse & recycling to a complete final solution.

Table 7. Concept choice Repair & Care

CATEGORIE	CONCEPT CHOICE
Why care & repair	Infographic on a tote bag together with info on the webpage
Shoe care Information	A folder included in the tote bag and instructions on the web page
How to get repair parts	Pre-filled repair-kit possible to buy online and in Icebug store
Instructions how to repair	Step-by step instructions on the web and a folder included in the repair-kit

3. RE:DESIGN OF A SHOE

The aim for the redesign is to create an inspirational concept for the future, target the difficulties that was identified in Part I, strengthen the system design and test how well the design guidelines can help the process for when designing footwear. Because of the explorative and iterative work method that was used for the redesign, this chapter do not present individual concepts but rather the incremental changes that was done in the end-phase of the ideation together with the continuous evaluation that was made. Some of the sketches that lead up to the design concepts can be seen in figure 71 .

Figure 71. Sketches of shoe design concept.

It was clear that a shoe without the need for glue was necessary in order to simplify separation of materials and to be able to prolong the life of the shoe, as it would then become possible to exchange the midsole, the component that have the shortest lifespan. These two factors were the main challenge of the redesign. Only through achieving this, all other parts of the system would be improved, it would become easier for the user to disassemble the shoes themselves, to be able to wash and repair the shoes, to be able to upgrade components and simplify the recycling for all stakeholders. This could in turn meet the barriers that was mentioned in the survey, why people do not want to buy and sell second hand shoes, as parts could be washed and exchanged to new ones. Eliminating the fear of shoes that are formed by their previous owner,

old and no cushioning left in the midsole and dirty and smelly shoes. The multifunctionality and the simplicity in the design was also strived for, to be able to keep the number of different materials and components to a minimum and to open up the possibility for a longer usage span. The range of different design guidelines that was used in the making of this redesigned shoe is presented in chapter 2.6.

3.1 CONCEPT DESCRIPTION & EVALUATION

The concept of how the mechanical lock between the midsole and outsole should work was decided to be kept as simple as possible, eliminating the number of different components needed. Therefore, the rubber outsole covers some of the uppers in order to create a closure around the foot, making the gravity take care of the mechanical lock for the midsole, which is placed loose inside of the rubber outsole. This way no extra inserts are needed to lock the EVA to the rubber which was first ideated around. Through such a enclosing solution, extra protection for the toes can be given as well as an extended grip surface, good for running on slippery stones. The height of the rubber at the midfoot area is attempting to be high enough to not make dirt and stones fall in when running, as well as low enough so that the area will not cause creases on the rubber upon impact and bending of the foot.

To create a multifunctionality for the running shoe it was also decided to create a shoe that can work as a running sandal in the summer. Hence, the open solution. Different concepts for how the straps, enclosing and securing the foot, is shown in figure 72, 73, 74 , and 75. The concept 1 and 3 was considered more aesthetically appealing and it was decided to move forward with the third concept due to the fact that the first concept would need more components, two buckles instead of one and the added fabric underneath the buckles and straps.

It was also decided to use a webbing in the heel to further secure the sock to the rubber heel, to avoid shaving and movement, which can be seen in figure 73.

Figure 72. Shoe Re:design Concept 1.

Figure 74. Shoe Re:design Concept 2.

Figure 73. Shoe Re:design Concept 1, backside.

Figure 75. Shoe Re:design Concept 2.

The chosen concept was then modelled in Fusion 360 where two different solutions regarding the heel design was presented to Icebug's product development team, figure 76 and 77. The changes were proposed due to the fact that it was feared that the heel design would cause friction for the heel and cause shavings and blisters for the user. Through the discussions with the product development team it was decided to keep a small elevation in the heel in order to give extra support and stability for the heel, see figure 78. Due to the now more open heel design a webbing with velcro was added in the back to secure the foot into place, in similarity with sandal designs.

Figure 76. Concept shoe in fusion 360, high heel counter.

Figure 77. Concept shoe in fusion 360, low heel counter.

Figure 78. Concept shoe in fusion 360, low heel counter with webbing.

4. FINAL CONCEPT

This chapter presents the final concept which main parts can be seen in figure 79, consisting of:

Information - that informs and educate the customer in order to change their behaviour, make them aware of the problems and spur and encourage them to use the system as well as take care of their shoes. It also offers transparency about the system and answer the questions: How? Where? and Why? they should use the system. This is given through different information channels in order to reach as many as possible and to not be forgotten, offering a constant reminder. The different channels being; folder, homepage, tote bag, shop window and shoe sole.

A repair kit - that makes spare parts easy accessible and inform the users that they can in fact repair some parts by themselves. Making sure that the prerequisites for longevity is offered to Icebug's customers.

Icebug 2nd Hand Shop - offers a reuse system that can be fast to implement, being low hanging fruit, and gives physical in store branding opportunities that communicates Icebug's values. It also gives a new and wider customer base and can give a closer customer relationship and loyalty.

Red Cross - widens the reuse and recycle option for Icebug's shoes and can be implemented in short, being low hanging fruit. Offers local reuse options and the possibility for material recycling, being a trusted organization that is available all over Sweden.

PLUSfoam - offers a circular solution for Icebug's shoes as well as a reclaim service, which is possible to implement in the near future.

Re:Design - gives a future opportunity and inspiration for how a shoe can strengthen the total system and to be beneficial for all stakeholders. Where it through its ability for easy disassemble can offer easier production, upgradability, maintenance, reuse, repair and recycle. Making the design together with a changed user behaviour affect its longevity. It is also able to be customized to users' individual needs and offers multifunctionality, spanning over different seasons of the year and activities.

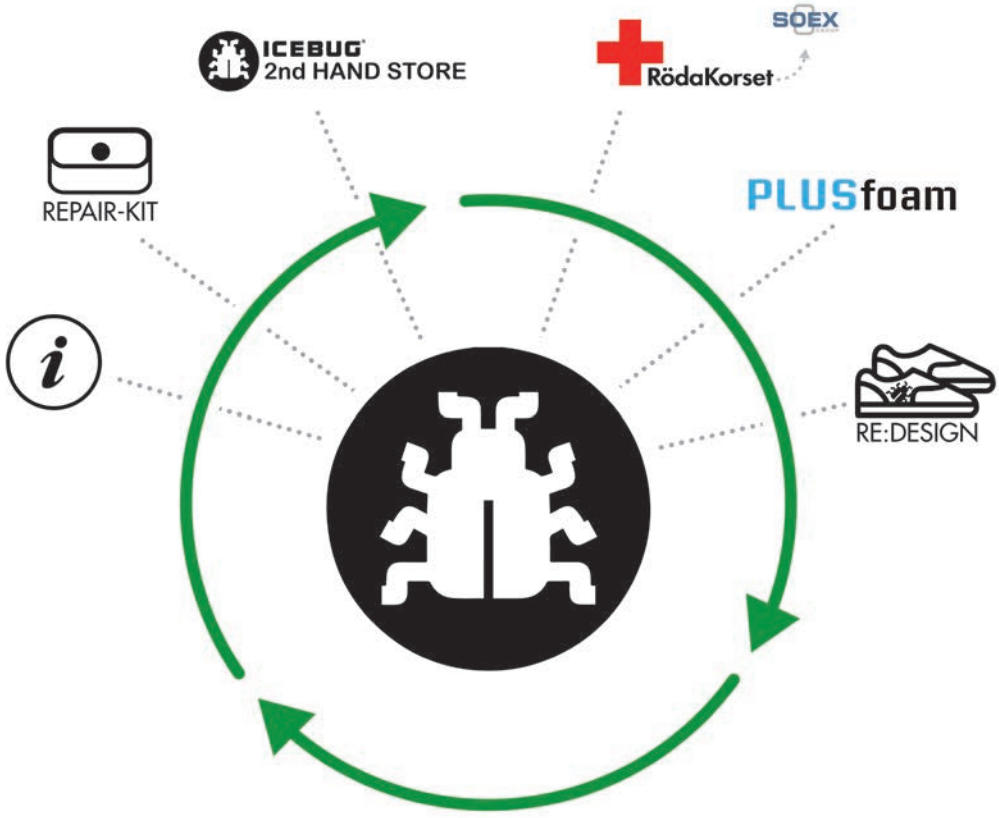


Figure 79. Icebug system, final concept.

4.1 USER JOURNEY THROUGH THE SYSTEM

To provide a deeper understanding of what the system actually offers and how it works it will be explained through a user journey. The first phases being shown in figure 80. In the pre-purchase phase, the user is exposed to the information on the brand shop in Gothenburg or the information on the Icebug homepage. The system logo and a concise and inspiring slogan could preferably be used on the shop window to create an interest to come in and get to know more. An example of a slogan that is suggested can be seen in figure 81.

This slogan in combination with the more in-depth information on the homepage informs the customer, already in the pre-purchasing phase, about the existing system and why it is something positive from an environmental point of view. The environmental benefits were found to be the biggest incitements for customer to hand in their shoes for reuse and recycling, and therefore crucial to pinpoint when branding the system. The information will consist of, how to properly use and take care of shoes, how to repair and what the customer can do with their shoes when they do not want them anymore. The information about the take back system, aimed for reuse and recycling, will be clearly showcased regarding what will happen to

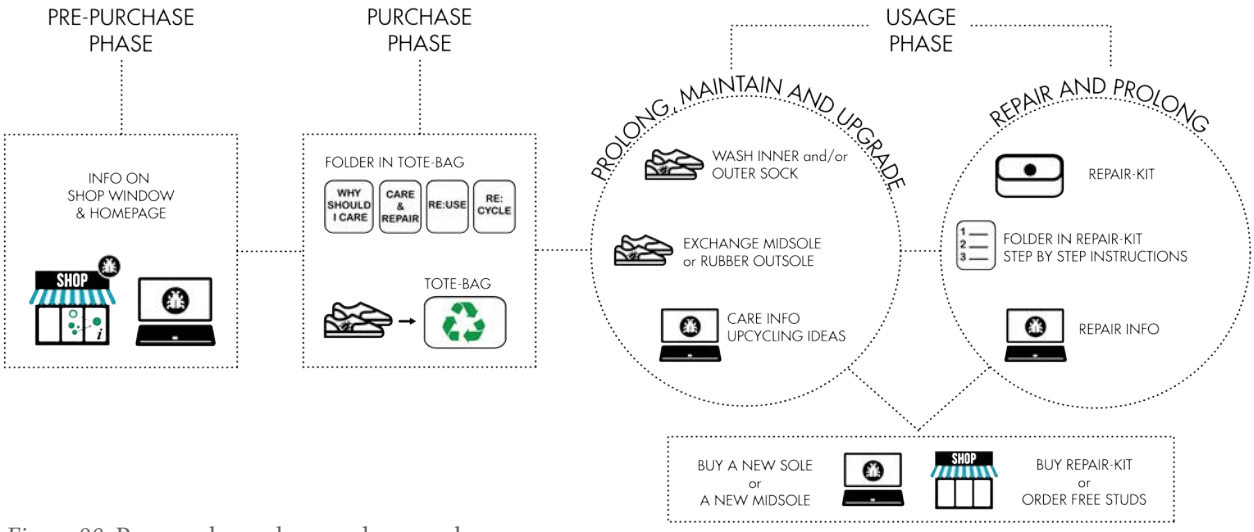


Figure 80. Pre-purchase phase and usage phase.

Figure 81. Slogan and infographic on Icebug shop window.

their shoes when handed in. This is in order to give a transparent picture to Icebug's customers - to increase the interest and trust. From part I it was concluded that, transparency and the knowledge of what benefits it will bring to hand in shoes was a crucial aspect in order to give an incentive and to give trust to customers. The reason to give this information in the pre-purchasing phase is to educate and trigger the customer to reflect upon the usage and the shoes EoL before it is too late. The information is given on both physical and digital channels in order to reach out to as many customers as possible.

The next phase that is entered, the usage phase. In this phase, the customer come home with their new pair of Icebug shoes which they carried home in their totebag, see Figure 82. This totebag replaces the shoebox that is used today which eliminates the need to take a plastic bag from the store and being something that the user can keep and give a second usage. Keeping shoes in a well ventilated shoebag between activities is also advised to prolong the life of the shoes and by automatically offering such a storage bag through a shoe purchase, the user is nudged to take properly care about their shoes. The minimized use of cardboard also gives less recycle fees to Icebug. Moreover, by using a tote bag instead of a shoe box it offers Icebug the possibility to distinguish themselves from other shoe brands where the majority use cardboard boxes.

The logo for the system, which can be seen in figure 83 is placed on the outside of the totebag, encouraging care, repair, reuse and recycle, and constantly remind the user about system.

Figure 82. Totebag, used instead of a shoebox.

Figure 83. Totebag, with logo for the system.

Inside of the totebag there is a folder which aim is to inform, encourage and inspire the user to understand why they should care about their shoes and what they should do at their EoL, see figure 84. It also informs about how to properly care and repair shoes and about the existing Icebug's system regarding its reuse and recycle possibilities. Information about the repair kit and that specific spare parts can be ordered, is given in the folder as well.

Figure 84. Information folder given upon purchase, informing about care, repair, reuse & recycle.

The third phase, the usage phase, first consist of the prolongation, maintenance and upgradability of the shoe. In the scenario where the redesigned shoe has been bought its design makes it possible to take out and wash the inner sock when it need to be refreshed. Parts can also be exchanged and upgraded to new ones, buying new parts from Icebug. This enables a longer usage period because parts of the shoes that have a short lifespan, such as the midsole, can be replaced. Care info for all types of shoes and upcycling ideas are also available on Icebug's homepage where the user can have a look for inspiration and advice. The user can also upload their own upcycling ideas, making them feel more connected to Icebug and a part of the Icebug-community. An example for what ideas that might be put there is displayed in figure 85.

Figure 85. Example of a running shoe modified into a sandal.

The next step in this usage phase is the repair and prolong, where the user can purchase a repair kit from Icebug or contact Icebug to make a claim for specific spare parts. This makes sure that if they only need, for example studs, they do not have to buy the entire repair kit. The repair kit consists of strong needle and thread, glue, textile patch and some studs.

A folder with step-by-step repair instructions are also placed in the repair kit, see figure 86. Repair instructions are also available on the web. Both the textile patch in the kit as well as the repair kit bag which they come in, are made of textile scraps from the shoe production, making use of the waste. By offering accessibility to parts through a repair kit it enables the user to take care and prolong the life of their shoes for as long as possible.

Figure 86. Repair instruction folder, included in the repair kit.

The fourth usage phase is the end-of-life phase of the shoes first usage cycle which can be seen in figure 87. The initiating step for encouraging a change behaviour in this crucial step are the four means of educating and inspiring the user to make the right choice, the "Hand me down"-tag, the information on the shop window, the webpage and the folder given upon purchase. The "hand me down"- tag on the inside of the shoe tongue should subconsciously nudge the user to understand that the shoes are meant to be reused by someone else. The first user writes down their name on it and so does the second and third user. This is supposed to give a connection to the shoe and also create a kind of story behind its usage, giving it value.

The web page and folder in the tote-bag should inform the user that a system exist. If the redesigned shoe has been bought there is a marking in the shoe sole with the PLUSfoam homepage on it, informing the user where they can hand it in for recycling. All of this should give the user the right tools and knowledge to make the right decision in the last stage of their interaction with the shoes.

The information that they are provided with should inform them that reuse is the first step, if the shoes are in a good enough condition, and can then either be handed in to Icebug's store or to Red Cross. If the shoes are in poor condition they can be handed in to the nearest Red Cross store or, if they have a shoe with PLUSfoam material, it should be shipped to PLUSfoam. This information and guidance is given on Icebug's homepage and folder in totebag, the illustration of this can be seen in the right box in figure 87.

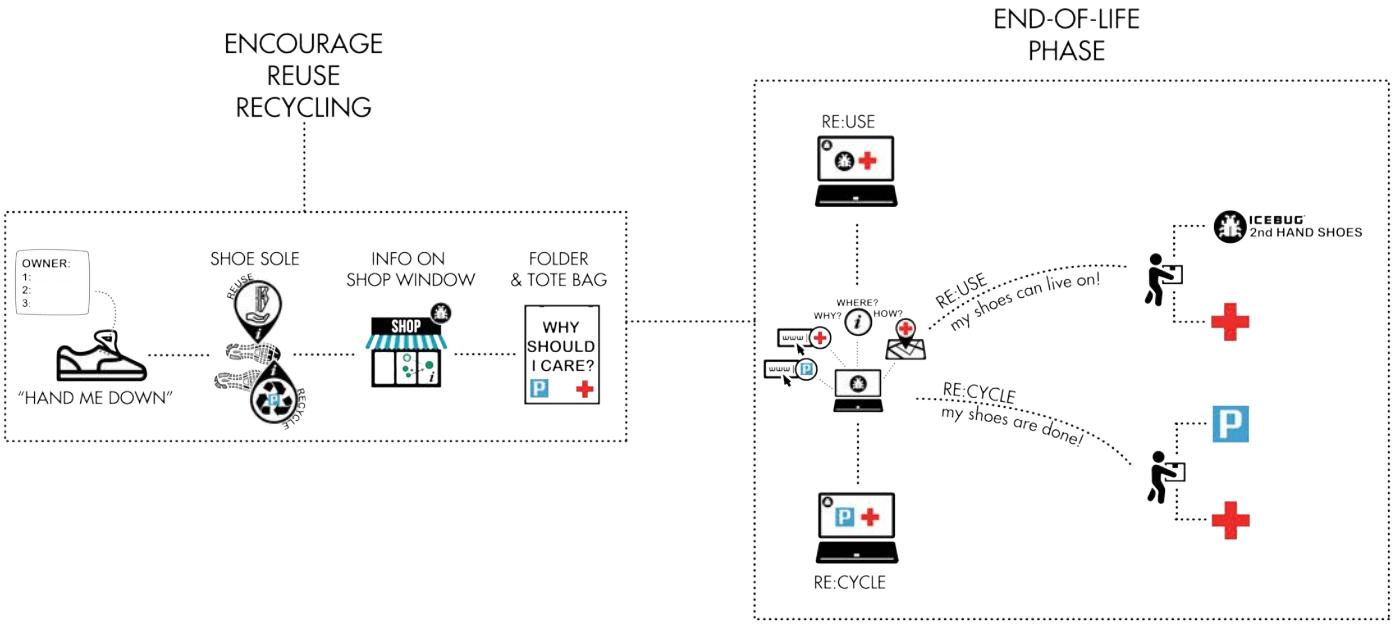


Figure 87. End-of-life phase in the first usage cycle. Left box - four means of educating and inspire. Right box – information and guidance on wepage.

If the customer feel like their shoes are in good enough condition and want them to be reused by someone else one option is to physically bring them to Icebug's brand store in Gothenburg. This option is illustrated in figure 88.

This is especially suiting for the people that feel that handing post-consumer items directly back to the store is the safest option, that they feel like the brand makes sure that the shoes will end up at the right place. When they have dropped their shoes off in the store they gain a voucher for their troubles, it also works as an incentive for the user to take action and actually bring in the shoes. The user can then also decide whether or not they want the money from the sales to go to Icebug's continuous R&D work for sustainable development or to a charity organization that Icebug have pre-selected, giving empowerment and transparency to the user regarding where the money goes.

This is the end of the user's interaction with the product. Now the staff in the store give the shoes a suiting price and displays it in the store as well as on their webshop. The second hand webshop have its own tab to make it easy to find and follows their normal web sales directives, with the exception that the money goes directly to the chosen location, charity or R&D. If the shoes are sold the new user can enjoy the Icebug shoes and make them last a bit longer. Eventually the shoes will go back into the Icebug system again.

If the shoes are not able to be sold the Icebug store staff can either bring it to the nearest Red Cross store, where it will go through their system and hopefully go to reuse or to material recycling. If the shoes contain any PLUSfoam material, Icebug's store staff send the shoes to PLUSfoam for material recycling and production of new products.

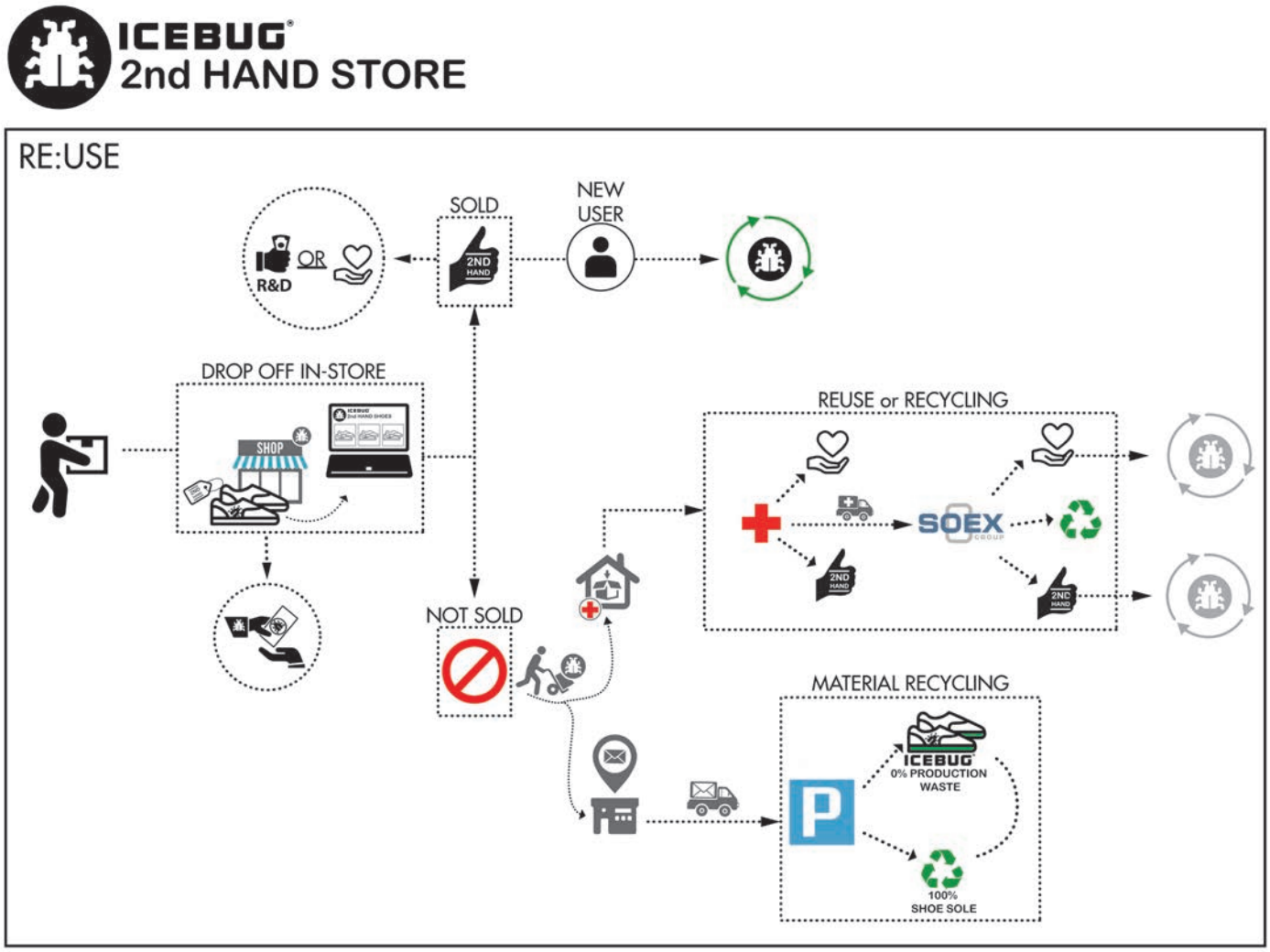


Figure 88. Icebug second hand store for reuse of shoes.

The customers that wants to hand in their shoes for reuse but do not live near the Icebug brand store will be directed to hand in their shoes to the nearest Red Cross second hand store, see figure 89. The customers that do not find their shoes in good enough condition to be reused, and do not have PLUSfoam shoes are also directed to hand in their post-consumer shoes to Red Cross. Red Cross is a well-known and respected organization that are serious about their sustainability work and continuously work to improve their waste management of unsold products. Making them a good collaboration partner for Icebug. Furthermore, Red Cross has confirmed that such a collaboration would be possible, making it to a rather easy implementation to start off with.

Samples from Icebug and unsold second-hand shoes will also be handed in to Red Cross by one of Icebug's employees. When the shoes have been handed in to Red Cross, they will be sorted and the ones that are considered to be in good enough condition will either be sold in their second hand shop or donated to local charity, in both cases the shoes will get a new user. The target is to have the shoes go back into the Icebug system again after its second user.

Shoes handed in to Red Cross that are considered to be in poor condition will be sent to SOEX recycling center in Germany. At SOEX the condition of the shoes will be controlled again, if any shoes are possible to reuse, SOEX will sell them to second hand stores in Germany or donate them to charity. The shoes that cannot be reused will hopefully be given to SOEX pilot project for material recycling of shoes. Although, since this is a pilot project and under development it cannot be guaranteed that all shoes that are send to SOEX will be material recycled due to the limited volume that they can process, so unfortunately if they are not directed to the pilot project they will be incinerated. This will be informed to the customer through the folder in the totebag and on the homepage, to provide transparency and trust.

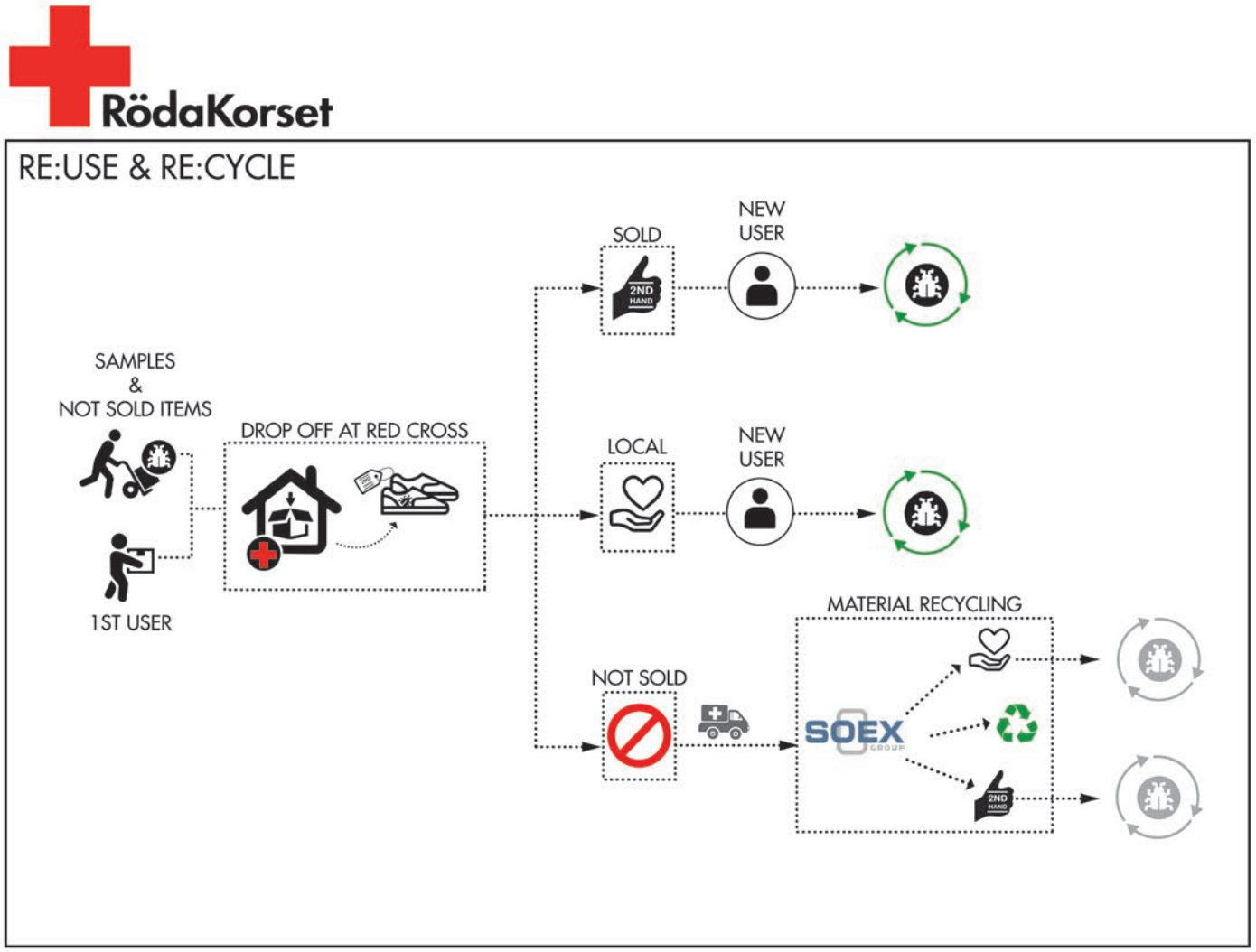


Figure 89. Red Cross collaboration, for reuse & recycle of shoes.

For the PLUSfoam system it all starts with having a shoe that is produced with PLUSfoam material, see figure 90. In the user phase when the user has decided that the shoes have lived a long and happy life and it is time for them to be recycled into new shoes. The link to PLUSfoam's reclaim page can be found on the sole of the shoes as well as on Icebug's homepage. The information on the sole is given in order to clearly indicate that this is contain PLUSfoam material and can therefore be send to PLUSfoam for material recycling. From PLUSfoam's reclaim page the customer can print out a post label. They then pack the shoes, go to the post office and ship the shoes to the nearest PLUSfoam recycle center. This is also done by the Icebug store staff if second hand shoes, from PLUSfoam, that have been handed in from users have not been sold. The PLUSfoam material is 100% recycled and can be used for new shoes or other products, being successfully upcycled, closing the circle. The textiles are responsibly taken cared of by PLUSfoam.

4.2 RE:DESIGN OF A SHOE

The conceptual proposal of a redesigned shoe, designed to optimize the possibilities for maintenance, upgradability, repair, reuse and recycling through disassembly, is presented in this chapter. The shoe is designed to be a running shoe but can also be used as a sandal in warmer summer days, offering extended usage, see figure 91 & 92.

Another upper can also be included, made from a water resistant fabric, using an outer sock and an inner sock, facilitating the usage during cold and wet winter days. The shoe consists of three main parts, the rubber outsole, the midsole - giving the cushioning, and the upper which can be seen in figure 93.

The rubber outsole is aimed to be manufactured in one piece, eliminating the need for glue, and is designed as a frame that encloses the medial and lateral

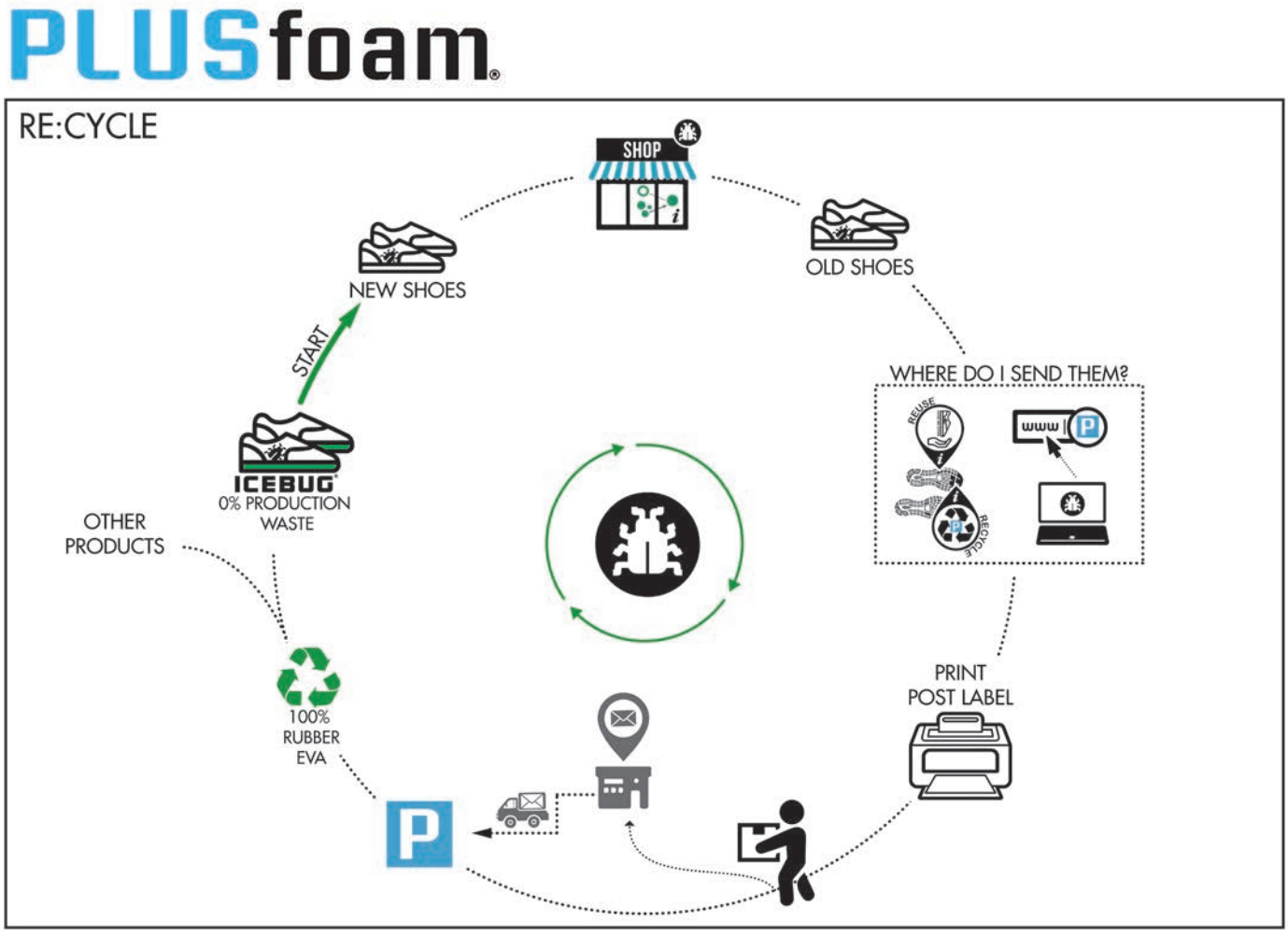


Figure 90. PLUSfoam collaboration, for recycle of shoes with PLUSfoam material

side of the foot including toe and heel. This design is aimed to keep the foot in place, give stability, support and to avoid that too much coarse sand and dirty will slip into the shoe. Furthermore, the sole has a groove to mechanically lock the midsole in place, see figure 91 & 92. The rubber sole is also provided with slots on both sides near the front section of the foot and near the ankle, as well as two on each side of the heel. This is where the webbing to secure the foot will be attached. A webbing was chosen instead of regular shoelaces in order to evenly distribute the pressure and to give a snug fit for the foot, as well as making it more comfortable when using the shoe without the sock, as a sandal. The webbing also provides a durable and long-lasting material that is difficult to break. It is also a standard component for many products, such as backpacks and can be found at textile shops, making spare parts easy to find.

The midsole is designed to perfectly snap into the grooves of the outsole frame, as described above, and this is the only mechanism that attaches the midsole with the outsole. Hence, no fasteners or glue is used to attach these components to each other, making the two components possible to separate from each other. This enables the possibility to replace the midsole, which is the component that has the shortest lifespan in a shoe, for example if it has lost its cushioning, or if the user wants to exchange it to a softer or harder midsole. It also opens up for the possibility to offer midsoles with different arches, making it possible to customize the fit. The outsole could also easily be replaced with a studded outsole, for slippery running conditions, making the shoe more flexible for different usages. Moreover, the two components can be recycled separately, enabling a higher degree of quality for the recycled material. Both the outsole and the midsole is made of PLUSfoam material, meaning that the sole is 100% recyclable and produced with 0% production waste.

The upper is a separate piece that has a knitted construction, eliminating waste in the production, and due to the knitting technique, the upper can be designed with reinforced sections to improve the comfortability, without the need to use mixed materials. Due to the fact that the pieces can be separated from one-and-another it is possible to wash and care for the different components in the way that is best suited, the uppers can for example be dried separately, meaning that the need to expose the outsole and midsole to heat can be eliminated. From the user survey, it was

Figure 91. The redesigned running shoe

Figure 92. The redesigned shoe as a sandal.

Figure 93. The main parts of the shoe, with the blue upper, the grey midsole and the black rubber outsole

concluded that two of the main barriers for not buying or giving away shoes for second hand was due to sanitary reason and that the shoes have been worn in by somebody else and lost cushioning. But by making it possible to clean the uppers by putting it separately in the washing machine, dirt and sweat can be properly removed from the shoe. This helps to overcome the barrier and making it possible for a higher degree of people finding it acceptable to use and give away old shoes. The decision to use a dark blue colour on the upper is also because dirt will not be as visible than if a lighter colour had been used.

The shoe consists of two separate webbings, the main one that crosses over the dorsum of foot and one that wraps around the heel, see figure 94. The main webbing is attached to create a tight and comfortable fit that gives an even pressure over the foot. The main webbing can be tightened or loosened with the help from the buckle, see figure 95. This fastening is also more secure than tying laces, which often unravels, giving easy and fast adjustment possibilities. The heel webbing is also possible to tighten and is provided with a velcro instead of a buckle, to enhance the comfort around the heel. Two webbing loops are attached to the upper to aid the action of getting in and out from the sock.

The Icebug logo as well as the PLUSfoam logo is infused in the materials, not needing to add any plastic coatings or paints on the materials which would make the recycling more difficult, see figure 95 and figure 96. The PLUSfoam logo on the sole together with the recycle sign is supposed to inform the user that the shoes can be recycled. The homepage is also supposed to be included in the sole of the shoe so that the user can easily find it. This way the information is always with the user and cannot be lost and it also follows to the second user of the shoes.

4.3 DESIGN GUIDELINES

In the redesign of the shoes, the various design guidelines that was presented in chapter 2.6 was used and together with the barriers presented in Part I the guidelines were further developed to suit footwear. The illustration in figure 97 displays the ones that were deemed suiting and helpful in the making of the shoe and that is suggested to be used in Icebug's product development. The design guidelines are aimed at the longevity and EoL for footwear.

Figure 94. Top and side view of the redesigned shoe, showing the placement of the webbing.

Figure 95. The buckle and the Icebug logo infused in the buckle and in the rubber sole.

Figure 96. PLUSfoam's logo infused in the rubber sole.

DESIGN GUIDELINES

FOR SUSTAINABLE DESIGN OF FOOTWEAR LONGEVITY & END-OF-LIFE

DESIGN FOR A NEED

To design a shoe that there is not a demand for is not the best option for either the company or the environment. Consider, why should somebody want to use this shoe?

CREATE TIMELESS AESTHETICS

Designing for longevity is also to design for classic and timeless aesthetics. This minimises the risk for the user to find a need to purchase new, more trendy shoes.

CREATE AN EMOTIONAL CONNECTION

Design and use branding in a way that foster an emotional attachment to the shoes. This way it increases the chance that the user will care more about their shoes, to keep them for longer.

OFFER MULTIFUNCTIONAL USAGE

To give the shoes a wider usage area will decrease the need to own multiple shoes and lower the environmental impact.

OFFER EASY MAINTENANCE

Make it easy to wash and refresh the shoes without the risk of affecting the material or letting out toxic residues.

MAKE IT EASY TO UPGRADE PARTS

Making it easy to upgrade parts gives the user the possibility to personalize their shoes as well as to exchange parts that have a short lifespan, such as the EVA midsole. It also makes it possible to follow trends, without having to buy a entirely new shoe.

This way injuries can be avoided and needs can be met such as different foot arches.

MAKE IT EASY TO REPAIR

Make it easy to repair the shoes, to for example be able to resole, repair holes in the uppers and broken heel-counters.

Also, make it possible for users to be able to repair the shoes themselves.

DESIGN FOR SAFE DISPOSAL

Use as pure materials as possible. Make sure what suspected materials the product can contain and design the process for disassembly after that.

DESIGN FOR SECOND LIFE & FUNCTION

Consider and inspire for second usage areas of the shoes, when they no longer can be used. With the intention of upcycling them.

DESIGN FOR DURABILITY

Design shoes that will last for a long period of time. Use materials that is durable against wear and tear.
Avoid paint and coatings, to for example including the brand logo on the shoes. It wears down faster than if it is incorporated in a plastic or metal imprint. It also makes it more difficult to recycle materials with a coating on it.
Use materials that can withstand dirt in a good way as well as to use colours where dirt is not as visible.

KEEP IT SIMPLE

Design with simplicity in mind. This way unnecessary components can be avoided, keeping the amount of different materials to a minimum. This is also an opportunity to keep the weight of the shoe as low as possible. Minimise fastener types and use of different materials. This can reduce, material cost, labor time, make it easier to disassemble and repair as well as to facilitate sorting and recycling.

USE STANDARDIZED COMPONENTS

This way the same components can be used in different models and can work as spare parts for a range of different shoes. It also brings down the production costs.

MINIMISE WASTE

Design with the intent to minimise the waste at production and EoL of the shoes. Consider possibilities to reuse the waste to something else, a new product perhaps. Design improvements that reduces the waste for the products EoL could for example be a shoe designed with as little amount of material as possible.

ACCESSIBLE INFO & SPARE PARTS

- Provide instructions that cannot be lost and that reaches everyone, not only the ones using a computer.
- Provide easy to understand instructions that anyone can follow and understand.
- Provide easy access and knowledge about where to get spare parts for own repairs.

PROVIDE EASY DISASSEMBLY & ASSEMBLY

Avoid permanent fixings of different materials, such as adhesives and co-moulding. Consider ways to stitch, lace or mechanically lock materials together instead. This will simplify almost every aspect for longevity and EoL. Enable fast assemble/disassemble.
Guide the user how they should disassembly and assembly the shoe, include arrows, signs or colour coding.

EVA IS THE LIMITING FACTOR, REPLACE IT!

The midsole loose some of the shock-absorption properties after 1 to 2 years, even if not worn and used. The biodegradability of EVA is also very poor. In terms of preventing injuries EVA have to be improved or replaced in order to be able to offer proper shock absorbing properties for a longer period of time and kilometres.
Try to design the shoe where the EVA can easily be replaced or can you find a alternative material that is more durable?

AVOID USING ADHESIVES

This will create an increased demand for recycled material as well as lower the environmental impact of the shoe. Consider what impact the material will give throughout its lifetime, how is it made, how will it tear, how will it be disposed of and can it be reused?

PROVIDE IDENTIFICATION OF MATERIALS

To aid the recycling of materials it is crucial to provide international material identification that is clearly visible and do not wear down after time. Fake leather is especially difficult to identify.

MAKE METAL PARTS EASY TO REMOVE

If metal components are used in the design, make them easy to separate. Using ferrous metals are one way of doing it.

Smaller zipper parts can be processed but hard plastic and aluminium are difficult to process. Really compact resistant and hard metals, such as the ones used in the toe cap of working shoes, are not even accepted by shoe recycling facilities.

DON'T MIX MATERIALS

Try not to use non-textile (metals, plastic, etc.) materials in textile products. Don't use plastic prints on textiles or use different lining and outer materials in textile production. Avoid spandex, lycra, elastane mixed in textiles. Try not to use threads in different materials than the fabric.

USE RECYCLABLE & NON-TOXIC MATERIALS

This will create an increased demand for recycled material from shoes as well as lower the environmental impact. Consider what impact the material will give throughout its lifetime, how is it made, how will it tear, how will it be disposed of and can it be reused?

DON'T MIX RUBBER WITH PLASTICS

Mixing rubber with plastics, or thermoplastics with thermosets, complicates the recycling process. This is something that is seen to be worse than to mix metals with plastics. Since they behave differently when heated and melted.

USE RECYCLABLE MONO-FIBERS

By using recyclable mono-fibers in the uppers the recycling process gets a lot easier. Where it can produce more pure recyclates that can be used in new products.

Figure 97. Design Guidelines for footwears

4.4 SUGGESTIONS FOR IMPLEMENTATION STEPS

The system as a whole provides possibilities for a slow adaption and different implementation steps, making it easier for Icebug to implement over time and create a plan for the future. The repair-kit, the repair instructions and the care information is vital and easy to implement in Icebug's current business, not requiring a lot of further development, and can still give a huge impact in terms of prolonging the life of Icebug's shoes and changing user behaviour.

The solution for the take back system suggests three different tracks, two that can be implemented relatively fast, without any changes in the design of shoes - Red Cross and Icebug's 2nd Hand Store and one that is more of a suggestion for the future, since it requires to change some of the materials in Icebugs shoes - PLUSfoam, that need to go through tests and to include a new material supplier. The later is therefore a suggestion that need more investment and time for development, but is however seen as a very promising concept to incorporate in terms of creating a more circular business model.

The time-aspect for how Icebug can implement the different suggestions to be able to offer a prolonged life for their shoes as well as to provide proper recycling at their EoL is important in order to provide a momentum and a change, to not cause the feeling of being an overwhelming task. An example of implementation steps could be:

Step 1.
The first and easiest step is to include the information regarding proper care and to provide the information that free studs can be ordered, which are easy to replace, together with instructions on how to replace the studs. It is suggested that Icebug should provide the studs free of charge as a sign of quality from the brand and that they believe in their products. Because of the fact that users find their Icebug shoes to be consumed when only losing a few studs it is crucial for Icebug to alter this behaviour, to inform, educate and provide the tools so that their users can change their behaviour. It is such an important aspect because it is a big part of who Icebug is as a brand and why they are unique on the market, their grip. This is also why it should be the first implementation step. It can first be provided through their webpage and the care and repair folders can be included in a later stage.
In this initiating step Icebug can also start to hand in their sample products to Red Cross for proper reuse and recycling, which requires very low effort in terms of time, engagement and investments from Icebug's side. This is also a good time to start to refer Icebug's customers to Red Cross and inform them why they should not throw their shoes away. To educate the customers, to provide the knowledge that shoes have a value and that today's system is not a sustainable option. This is an easy implementation as Red Cross have already said that Icebug can refer their customers to them, it does not involve bigger investments from Icebug's side other that it need to be marketed for. It is important to start this at an early stage as the problems regarding shoes EoL is not considered common knowledge, why it is important to start affecting customer behaviour early, to make easier to implement the other stages of the suggested solution.

Step 2.
The next step should be to include the repair-kit, to provide further possibilities for the user to prolong the life of their shoes and give a statement that Icebug as a company are striving towards becoming sustainable. In the beginning it can be sold through their webshop and in their brand store in Gothenburg, to scan the market and to check the demand for it. It also need to be promoted and marketed for in order to enlighten why the customer should repair their shoes, what benefits it gives, in order to educate and inspire the customer why they should purchase the repair-kit. If demand is increasing it can be widened and offered through different retailers. The repair folder should also be included in this repair-kit to provide easy access to how they can repair.

In this stage they can also start the Icebug 2nd Hand Store. They can start by selling their samples and shoes that have been used as test shoes by Icebug's employees in their brand store in Gothenburg. To get a number of shoes that can be put on the second hand shelf in the store, so that it is not empty, waiting for the first customer. The customers should be informed in the shop about the system and it should be properly marketed for to get the concept going. A following step, when the concept has been fully implemented in the store and that customers are starting to make use of it, the shoes that are handed in can be sold in their webstore, offering all of Icebug customers to buy second hand shoes.

Step 3.
The totebag should be further developed and tested regarding its usability and possibilities for efficient stapling and shipping so that it can be implemented instead of the shoebox that is used today. This can efficiently strengthen Icebug's sustainability image further and offer their customers a product with extra value that do not need to be thrown away and that can help them to take proper care of their shoes.

PLUSfoam's material should also start to be tested, to see how it can be used in Icebug's shoes and how it can be implemented as a concept in their business. As a suggestion they could start with one shoe design. This requires some R&D investments and time in order to go into full scale production. It is although a key element to how Icebug could elevate their sustainability work to the next level and make a truly circular system where they can offer their customers shoes that does not only offer excellent grip, but shoes that is a sustainable choice. This can give them an advantage on the footwear market and make them prepared for future legislations regarding shoes EoL.

Step 4.
In this step the care and repair information as well as the accessibility to spare parts are fully implemented in Icebug's business and the 2nd Hand Store is up and running. The collaboration with Red Cross is also implemented and users have gained a knowledge for why they should use the system. The next step should therefore be to launch a shoe containing PLUSfoams material and to market their full and complete system. Because of the earlier implementations users should have the right knowledge why they should care and why they should use the system.

The concept shoe that is supposed to work as an inspiration for new product development should be considered from the very start. In a future step it can be a shoe that through further development can be produced. It has huge potential to be a product that can show the way for sustainable design for the footwear industry and change the view on how shoes should look like and be produced. This type of shoe can also aid users to use a shoe in a more sustainable way as well as all other stakeholders, making the care, reuse, repair and recycling easier.

5. PART II: FINAL DISCUSSION

The aim of this project was to investigate how the lifespan and EoL for Icebug shoes can be prolonged and improved. This was done by suggesting a system that can give Icebug a more sustainable business model, a redesign of a shoe, that improves and strengthens the system, as well as providing them with design guidelines, giving inspiration to what it is that need to be considered when designing for longevity and EoL.

How can the system be designed so that Icebug's shoes are reused or recycled in an efficient and correct manner?

The study shows that there are great challenges in terms of footwear but there have also been proven to be opportunities and possibilities that can improve the lifespan and EoL of shoes. The project manages to give clear suggestions on how a take back system can be designed to fit a relative small footwear company such as Icebug as well as their customers.

Both PLUSfoam and Red Cross gives the opportunity to take responsibility for the EoL of shoes, by the material recycling they can offer, but PLUSfoam is offering a more circular concept where the material is upcycled instead of downcycled, such as when Red Cross send the shoes to SOEX. But both options offer material recycling of shoes unlike other actors on the recycling market, making the suggestions into the best possible solutions for EoL processing of footwear. However, there are some drawbacks with SOEX pilot project, it is currently under development and therefore their capacity to recycle all the shoes that are send to SOEX is not possible today. But by incorporating them in the solution it might help them getting recognized on the market, that people understand why such a facility is needed, which might give more investments and subsidies from companies and governments. This is also why it is suggested that the money made from the second-hand sales should go to this project.

As one of the main goal with the system is to prolong the life of the shoes through reuse it does offer a difficulty regarding the fact that footwear has a very short lifespan. Where using the shoes too long can induce injuries, especially with regards to the midsole, cannot be replaced in today's design. Making it to an ethical question if longevity and reuse can be promoted, which are the preferred first options before recycling. In the care instructions, it becomes vital to inform about these issues and to educate the user about the signs that can be seen on a shoe that indicates that it is consumed. It is off course also something that the individual has to decide upon, to feel that their shoes are done.

The two systems for reuse and recycle, requires transport to Germany, hence it has to be discussed if shipping second hand goods for possible reuse and recycling is environmentally viable, in comparison to incinerating the goods locally for energy. According to Watson & Palm (2016) they argue that it is far more beneficial for the environment to send the post-consumer products abroad for reuse than to incinerate them locally. This is also the meaning of Naturvårdsverket (2016), that material recycling is the preferred option even if it requires transport. In an article by Seltenrich (2013), he brings up a result from a previous study that claimed that recycling solid waste can save up to five times more energy than burning the waste for electricity. In a study by Morris (1995) it is also stated that the energy needed to recycle materials is way lower than the energy needed to extract virgin material. This study included all the different steps required for material recycling, the energy that is needed for collecting, sorting, processing and shipping the recycled materials (Morris, 1995). It can therefore be said that the system that have been suggested in this project is environmentally viable and that it improves today's situation by great means. Thus, meeting the target for this project, offering a suggestion for a more sustainable business model to Icebug.

How can the system be designed so that it encourages user involvement and a changed behaviour?

In order to affect the customer behaviour, inspiration from other companies branding techniques have been used as well as the "design strategies for sustainable behavior" where it was chosen to motivate users through enlightening them, spurring them and to nudge them into the right direction. These are known strategies for affecting user behaviour and something many other brands are using today. The brands that have been researched use extensive branding to market their systems, where they educate their customer, why they should use it, how they use it and where the items and money goes afterwards. This enlightens the user and therefore influences the user's knowledge, values and norms, which can in turn motivate them to a more sustainable behaviour. According to inter-

views it became known that there is a high interest among customers to use these existing systems, proving that it is an approach that works well. This kind of transparency was also expressed as something important by the users themselves and its necessity was further proclaimed for in the literature study. For this project, this kind of knowledge was spread through the information channels of, the folder in the totebag, the information on the shop window and more extensive information on the webpage, in an attempt to motivate a changed user behaviour.

An additional motivation tool that was used in the project was to spur the user and create an incitement for handing in their old shoes, this was done by giving out a voucher. This way the user is rewarded for their actions which in turn can create a changed behaviour and motivation. A negative factor that vouchers can give, is an increased consumption behaviour, but according to Muthu & Gardetti (2016) implementing a second-hand shop, such as the Icebug 2nd Hand Shop, it can replace some of the purchases that is generated by the vouchers. Furthermore, the second reason given in the Icebug survey for why people not willing to hand in their shoes would change their mind, was money, or discounts on new shoes. Proving that it is something that can give enough incitement for people to change their minds. To make it possible to reach this group of people together with the fact that the positive aspects of prolonging life of shoes, through second hand, it is believed that it overcomes the fact that the vouchers can bring new purchases. Which it also can be argued, would happen anyway, but that the old shoes would then probably be stored at home or be thrown in the trash. So therefore, it is believed that the positive aspects overcome the negative ones regarding vouchers.

Through adding the homepage of PLUSfoam underneath the soles of the shoes, changing the design of the shoe as well as to include an airy shoe bag with every purchase, the user can be nudged towards making the right choice on a more unconscious level. To wash and dry the uppers separate from the rest of the shoe, to be encouraged to upgrade parts instead of feeling that the shoe is all used up, to store it properly between activities and to know exactly where it should be handed in. Furthermore, by offering a repair kit it makes spare parts easily accessible and together with the DIY-repair instructions it can change user behaviour and extend the life of shoes. By offering accessibility to spare parts it informs and educates users that it is something that should be done and can change their mindsets and view on when a shoe is broken and used up. This is a possibility to alter the behaviour of those in the survey that found their Icebug shoes to be consumed when they had lost studs, something that is really easy to repair. The inspirational upcycling tips are ways of encouraging a changed view on how customers use their products today and that everything has a value, also being a fun way to spread the information and creating a customer community collecting different ideas. This is believed to make the customers feel more connected to the Icebug brand.

The type of collection channels that the system offers was discovered to be another important factor in terms of increasing the interest to hand in shoes for reuse and recycle.
However, because of the fact that the system required collaboration partners that could take care of the sorting and recycling of shoes for Icebug it was hard to combine the most preferred hand-in option from the survey, with the most preferred recycling option. This is due to the fact that existing recycling and second-hand options already have their established collection methods. The choice to priorities the possibilities for material recycling before the most preferred hand-in-option was based on the aim that the system should be able to offer a better EoL option for shoes than today and that an increased interest for handing in shoes can be accomplished by offering a solution that can show the customers that worn out shoes still have a value.

However, by including Icebug's 2nd Hand Shop, Red Cross, and PLUSfoam in the system three possible hand in options is offered to the user. Though, all options will not be available for everyone, since Icebug's 2nd Hand Shop is limited to customers living near the store and PLUSfoam's postage collection is of course dependent on Icebug's choice to use their material in their soles. Both Red Cross and Icebug's 2nd Hand Shop offers physical hand-in, but appeals to different users, as it was mentioned in the surveys, that some experience it safer and a better option to hand in post-consumer items directly to the brand store as they felt that the products they hand in would be taken care of in a correct manner. Others rather hand-in to charities as they feel that is the safest in terms of where the product end up and that they feel good as it goes to a good cause. The Red Cross collection is also available all over Sweden, reaching out to as many users as possible, hence making this collection chan-

nel available for a large group of people. Furthermore, PLUSfoam offers postage, which was the preferred and most convenient option for some people, especially the ones living in the outskirts. It is therefore believed that the system has the potential to attend to the barrier of collecting post-consumer shoes in a viable and realistic manner. Although a more holistic solution to this problem, within all industries have to be made to create better collection opportunities, and is not something that Icebug can tackle by themselves.

How can a redesign overcome the barriers that affects the longevity and EoL of shoes?

The suggested redesign of a shoe solves one of the main barrier for recycling of shoes, the challenges in separating the different materials, by making the shoe design without using adhesives. In a reuse context, a disassembly shoe can be very beneficial, where it is possible to properly wash the areas that are especially exposed to sweat and germs as well as to replace parts that has a short lifespan. Together with the PLUSfoam take back system this shoe can also offer a circular model for shoes, where waste becomes valuable material for new products.

Moreover, through the redesign it was possible to test and evaluate design guidelines aimed for sustainable design. It was found that the design guidelines in combination with the identified barriers worked as an efficient method to reach the aim with this redesign. The final redesign concept proves that the guidelines and underlying knowledge of the problems was a good tool in order to not miss the important aspects that had been specified in the course of this project, to be able to offer improved maintenance, disassembly, upgradability and recyclability. By using the design guidelines other aspects that are good from an environmental point of view could also be offered other than the main aim of this project, such as the possibility to make the shoes optimized for the individual and to offer multifunctionality, extending the usage of the shoes. Showing the potential of working with guidelines in an ideation process, to spur ideas and to not forget something. This approach also made it possible to formulate sustainable design guidelines, focusing on longevity and EoL for footwear, that can be beneficial for Icebug's product development in order to push their environmental work further.

The Methodology

Early in this project if was found that improving the EoL for shoes is a complex and multi-layered problem, mainly due to the fact that the environmental impact footwear inflict in their EoL is not generally known. The problem is further enhanced by the fact that the issues are currently not given enough attention.

The interviews that was performed in the beginning of the project gave inspiration and the opportunity to exchange ideas. This was of great importance to inspire and push the project further as the project scope was discovered to be a bigger challenge than what had been expected in the beginning. The important aspect from these initial interviews was that it gave confirmation that it is a difficult field, which was important to hear from people active in the field of sustainable development. They were also able to give encouragement and inspiration to dig deeper, as not a lot have been done in this field. This made the project look less daunting. Furthermore, the interviews performed with the different stakeholders gave answer to questions that could not be acquired from the literature study or on the web, making it to a very important part for this project.

The methodology approach that was chosen for this project had a lot of focus and time on the research part, to truly specify the problem. It was important to consider all parts that affects the system and design, to gain insights from all relevant stakeholders in order to understand the bigger picture and to get a holistic understanding of the barriers and possibilities that existed to be able to find the solutions. Why an important advice that can be given to others that are encountered with a similar project, where the challenges are bigger than expected, is to not give up but to instead widen the perspective and to search for all possible solutions that can improve the current state.

Using a wide approach to the project was quite challenging and required a very structured work and planning to not lose sight of what parts that was useful for the project. This lead to the definition of which parts that affects the longevity and EoL for shoes, where consideration to both internal and external factors was taken and how they are interdependent. This was found to be the appropriate approach for this project as it would otherwise be difficult to create a complete understanding of the problem at hand. It can however be discussed if some parts could have been exclud-

ed from the project, to be able to have time to make proper validation of the final results. Usage tests on the final concept could for example have been done. If there would have been time, a focus group could have been used, where the different scenarios of the system could have been tested, gaining an understanding of the user's attitude to the solution as well as feedback. On the other hand, the final solution is able to provide a holistic solution to the longevity and EoL of shoes thanks to the extensive research that was made. It also suggests possible solutions and a knowledge bank for care, repair, reuse and recycling of shoes. The end result has also been validated with the list of requirements, which is the compilation of all important findings from the study.

There are no directives on how to build a system for improving the longevity and EoL for shoes. But the theories presented in the frame of reference worked as a support to at least understand what this type of system should provide. What type of activities that can be used in such a system and what the preferred outcome is and what the purpose is to design a system for preventing waste of resources. It is strongly recommended to gain this type of basic knowledge to be able to perform this kind of developing project. The benchmarking of other brands, worked as a good complement to these theories, in order to find existing proof that brands have successfully implemented similar systems in their businesses. The benchmarking also worked as a source of inspiration.

Overall Findings

It is believed that this project, due to its wide focus area, can be of inspiration and be a source of helpful information for Icebug and other footwear companies. This study brings awareness around the subject of EoL for shoes and shows that the footwear industry need to start taking responsibility for their post-consumer products. The study shows that it is a big problem that the industry is facing today and where more focus need to be put on reuse and recycling of footwear as it is today overseen by many. Where a bigger focus is put on the textile industry today, even though recycling of footwear is actually a bigger issue and more difficult to solve. The producing industries should start to use recycled material in order to push the demand for it and make recycling of shoes beneficial for recycling centers, giving them the possibility to grow and keep developing new and improved methods. This study also demonstrates that there is a trend and a will among users, that they are interested to get to know more and that they are also putting demands on the producing companies to start taking responsibility for their merchandises. Furthermore, what has been seen is that some of the bigger footwear brands have take-back systems but it is not a widespread activity among smaller footwear brands. This study can therefore be of help to smaller footwear brands that, just as for Icebug, do not have the opportunity to implement their own recycling facilities such as NIKE. Hence, it can be said that this report has gathered some of the more promising collaboration partners for implementing a more circular business model for smaller footwear brands. Moreover, this study presents design guidelines that can be used as inspiration when designing footwear.

5.2 SUGGESTIONS FOR FURTHER DEVELOPMENT

This chapter will present suggestions for further development that should be considered if the company chooses to implement something from the final solution.

Icebug's core value as a company is to offer the best grip possible for their customers and much of that lays in their rubber compound that they use. PLUSfoam claimed that it is possible to make compound adjustments together with the company using their material. Although, it is something that will have to be tested and approved by Icebug. This off course something that effects if they can implement it in their system, why it is also seen as a concept that can be implemented in a near future and not straight away. If the rubber that Icebug uses today need to be kept, if PLUSfoam's rubber is proved to not live up to Icebug's demands regarding grip, the PLUSfoam EVA could still be used. Which is a good improvement as well, due to the fact that there are few recycle possibilities out there that can material recycle EVA.

The collaboration with Red Cross is rather fast to implement but a further development possibility could be to include a time limited drive, such as the one presented in chapter 1, Part I, in order to open people's eyes regarding the problem of shoes and that is beneficial to hand them in to Red Cross. Such a campaign would be a way of setting off the collaboration and get some attention. As the collaboration with Red Cross as well as the own second-hand shop that Ice-

bug is advised to have, both use the same collection method, physical hand-in. It could therefore be positive to be able to add another means of collection. A conversation together with Red Cross could be started as well as with the municipality of Västra Götalands region, in order to push the collection of post-consumer goods forward, to make it more attainable and convenient for users.

Icebug should further develop the repair kit and the totebag if they wish to implement them. To investigate if textile scraps from the production is a possibility in terms of volumes and production possibilities. To investigate the usability of the totebag and if it is a good option in regards to stapling in stores, transporting from the production and if it can be produced for a reasonable price.

Another area of improvement and further development possibilities regarding the collection, is to provide more options regarding the Icebug 2nd Hand Store. The users could for example be given the opportunity to themselves upload and sell their shoes on Icebug's homepage or alternatively send them in by postage to Icebug. In the first case the seller gain money themselves and would also take control over the entire sale responsibility and ship to the 2nd user. The risks associated with this is that there might be unserious sellers, giving a risk for Icebug's brand. The second would give more work for Icebug but the user would get a voucher, like the final concept, and the selling would follow Icebug's directives and pricing. This option would give Icebug more work but also more control and avert unserious actors.

The design of the redesigned shoe also need to be further developed as it is now in its initial concept phase and where the main focus has been on the environmental aspects for longevity and EoL. Suggested alterations can be to open up the bottom of the rubber sole and let some of the EVA be exposed underneath the sole in an attempt to save weight. As the rubber do not need to fill the entire sole of the shoes, only specific key areas.

Another possibility that the design of this shoe gives is that a rock shield, protecting against rock impacts, could be added in between the midsole and the outsole. Groves could be made in the midsole so that it would fit perfectly and be locked in mechanically. The same option appears for integration of studs. Where studs with threads could be inserted from underneath into the outsole and then be mechanically locked into place with a screw nut from the inside. Having countersinks in the rubber from the inside, making sure the screw nuts are not felt by the foot, then place the midsole on top. Thus, integration of studs for this shoe would not need glue like it does today and the user could buy one outsole and a set of studs that could be screwed in when necessary. Giving even more multifunctionality and ways to personalize them as well as making it easier to upgrade worn out studs and to recycle the shoes.

The redesign would also have to go through user tests where the bending of the rubber caging the upper should be tested, due to the increased bending forces. To see if the curve need to be lowered or changed in any way. When the foot bends it gives creases on the rubber and might give the user a uncomfortable feeling or be a area of stress for the material, which could possibly crack after a longer usage when the rubber is dry. A usability test should also be made on the separation of the EVA from the outsole, to see how it can be improved. Furthermore, the material choice for the shoe should be considered where the best options in terms of durability, longevity and sustainability should be applied.

Last suggestions for Icebug is to take use of the design guidelines that are given but to also complement them with guidelines for the entire life phase for a product, not just the specific areas that have been attended in this project.

6. CONCLUSION

This chapter presents a list of conclusions that can be drawn from this project, with respect to the findings and the final solution.

- The EoL of shoes is a widespread problem and companies has to start taking their responsibility.
- Material recycling of shoes is not an established activity, no existing recycling facility in Sweden deals with material recycling of shoes.
- SOEX pilot project and PLUSfoam's take back service shows that there is ongoing development and an interest to make use of the materials from shoes.
- To increase the hand in of post-consumer products it is essential to find more innovative solutions for collection as it is one of the bigger challenges that have to be solved in order to close the gap between users and reuse, recycling facilities.
- The final concept makes sure that the options that are given the customer in terms of recycling are the best ones that exist today, to achieve material recycling and avoid incineration and landfill to the highest extent possible.
- The final concept is designed to fit Icebug and to offer suggestions for how they can increase their control and responsibility of their products after they are purchased. The final concept is also adapted to be realistic for the size of Icebug and can be of guidance for other small footwear companies.
- The final concept makes it possible to reach out to customers and by giving them the right tools, knowledge and solutions it is possible to engage and encourage the customers to prolong the life of their shoes and give them the best EoL scenario possible.
- Design strategies for sustainable behavior is a valuable tool to use in order to get a deeper understanding how and in what way it is possible to effect the users through different types of information.
- One of the main barriers for recycling of shoes is the challenges in disassemble the shoes, due to the large amount of adhesive and mixed materials.
- New design of shoes is needed in order to make it easier to maintain, upgrade, repair, reuse and recycle, with the aim to prevent the waste of resources.
- The shoe concept developed in this project shows that design guidelines is an efficient tool to work with in order to accomplish sustainable design.
- The redesign attends to all EoL phases, improving the possibility for easy care, repair, reuse and recycle. The concept shoe together with the design guidelines provides valuable inspiration and guidance that can be used in future development projects at Icebug.
- The branding possibilities that the system provides works as an inspirational tool to give a changed user behavior and is also a great opportunity for Icebug to communicate their values as a sustainable brand.
- The final concept can provide Icebug with a more sustainable business model that can improve their control and responsibility over their products, making them come closer to their sustainability target.

REFERENCES

Alammary, A. (2011). Conversation: "Life is Good When You're Barefoot". Retrieved 3 9, 2017, from Catalyst: http://catalystreview.net/life-is-good-when-youre-barefoot/

American Chemistry Council. (n.d). Sustainability: Polyurethane Recycling. Retrieved 02 20, 2017, from American Chemistry Council: https://polyurethane.americanchemistry.com/Polyurethane-Recycling/

Asplund, C. A., & Brown, D. L. (2005, January). The Running Shoe Prescription; Fit for Performance. The Physician and Sport medicine, 33(1). Retrieved 02 27, 2017, from http://www.isdbweb.org/documents/file/131_running.htm

Avfall Sverige. (2013). Textil Avfall. Stockholm: Avfall Sverige utveckling.

Baden, S., & Barber, C. (2005). The impact of the second-hand clothing trade on developing countries. Oxfam.

Better Shoes Foundation. (2016). Design process: Design strategies. Retrieved 03 27, 2017, from Better Shoes Foundation: http://www.bettershoes.org/home/design-process#design-strategies

Bohgard, M., Karlsson, S., Eva, L., Mikaelsson, L.-Å., Mårtensson, L., Osvalder, A.-L., . . . Ulfvengren, P. (2010). Arbete och teknik på människans villkor. Stockholm: Prevent.

Brunet, M. E., Cook, S. D., & Kester, M. A. (1985). Shock absorption characteristics of running shoes. The American Journal of Sport Medicine, 13(4). Retrieved 02 27, 2017, from http://journals.sagepub.com.proxy.lib.chalmers.se/doi/pdf/10.1177/036354658501300406

Brunick, T., & Burfoot, A. (1996, February). The care and feeding of your running shoes. Runner's World, 31(2). Retrieved 02 28, 2017, from http://search.proquest.com.proxy.lib.chalmers.se/docview/202768350?pq-origsite=summon

Burke, R. (2014). The Power of Your Story: Why to market your story and not your product. Minneapolis: Sundog. Retrieved 03 15, 2017, from https://www.sundoginteractive.com/uploads/whitepaper_attachments/Sundog_RobB_WhitePaper_2014.pdf

Casco. (2014, 10 08). LiquiSole 2990. Retrieved 03 01, 2017, from http://media-pms2.schoenox.net/casco/docs/cascoliquisoleblister_se_se_tds.pdf

Coates, G,. Rahimifard, S & Staikos, T. (2007). Recycling of Footwear Products . Loughborough: Centre for Sustainable Manufacturing and Reuse/recycling Technologies (SMART).

Danielsson, L., Elander, M., & Palm, D. (2015). Kartläggning av svenska kommuners arbete inom textil och textilavfall; Underlag för regeringsuppdrag. Retrieved 03 09, 2017, from https://www.naturvardsverket.se/Documents/publikationer6400/Underlagsrapport_till_6685-7.pdf

Design Council. (2015, March 17). The Design Process: What is the Double Diamond? Retrieved 04 26, 2017, from Design Council: http://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond

Diener, A. (2010, February 01). Afterlife: An Essential Guide To Design For Disassembly. Retrieved 03 17, 2017, from Core77: http://www.core77.com/posts/15799/afterlife-an-essential-guide-to-design-for-disassembly-by-alex-diener-15799

ECHA. (n.d). Substance information; Toluene. Retrieved 03 01, 2017, from European Chemicals Agency: https://echa.europa.eu/substance-information/-/substanceinfo/100.003.297

Elander, M., Palm, D., Watson, D., Kiørboe, N., Lyng, K.-A., & Gíslason, S. (2014). Towards a new Nordic textile commitment: Collection, sorting, reuse and recycling. Nordic Council of Ministers. Retrieved 03 14, 2017, from https://www.diva-portal.org/smash/get/diva2:721017/FULLTEXT01.pdf

Elander, M., & Ljungkvist, H. (2016). Critical Aspects in Design for Fiber-to-Fiber Recycling of Textiles. Mistra Future Fashion. Retrieved 05 15, 2017, from http://mistrafuturefashion.com/wp-content/uploads/2016/06/MFF-report-2016-1-Critical-aspects.pdf

Ellen MacArthur Foundation. (2015). Towards a Circular Economy: Business rationale for an accelerated transition. Ellen MacArthur Foundation. Retrieved 03 13, 2017, from https://www.ellenmacarthurfoundation.org/assets/downloads/TCE_Ellen-MacArthur-Foundation_9-Dec-2015.pdf

Ellen MacArthur Foundation. (2013). Towards the Circular Economy: Opportunities for the consumer goods sector. 2. Retrieved 03 13, 2017, from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/TCE_Report-2013.pdf

European Commission. (2016, June 09). Waste Framework Directive: Targets and reporting. Retrieved 04 26, 2017, from European Commission: Environment: http://ec.europa.eu/environment/waste/framework/targets.htm

FinanCE Working Group. (2016). Money makes the world go round; and will it help to make the economy circular as well? FinanCE Working Group. Retrieved 03 13, 2017, from https://www.ellenmacarthurfoundation.org/assets/downloads/ce100/FinanCE.pdf

Gibson, E. (2016, May 09). Roderick Pieters' Loper shoes are assembled with rope rather than glue. Retrieved 03 09, 2017, from de zeen: https://www.dezeen.com/2016/05/09/roderick-pieters-proef-loper-shoes-kickstarter-glueless-rope/?li_source=LI&li_medium=bottom_block_1

Goodship, V. (2007). (e-book collection) Introduction to Plastics Recycling (2nd ed.). Shawbury, U.K: Smithers Rapra Publishing.

GORE-TEX. (2017). Tvättråd. Retrieved 05 15, 2017, from GORE-TEX: https://www.gore-tex.se/support/tvattrad

The Gorilla Glue Company. (2015, 05 21). Safety Data Sheet - Gorilla Glue. Ohio. Retrieved 03 01, 2017, from http://www.gorillatough.com/sites/default/files/Gorilla%20Glue%20-%20North%20America%20SDS_0.pdf

Haglöfs. (n.d). Haglöfs Second Hand. Retrieved 03 09, 2017, from Haglöfs: http://www.haglofs.com/se/sv/swapstories

Harper, C. A., & AccessEngineering. (2000). Modern Plastics Handbook. New York: McGraw-Hill Professional Publishing.

Haworth, B., Heath, R., Staikos, T., & Rahimifard, S. (2006). End-of-Life Management of Shoes and the Role of Biodegradable Materials. In W. S. Engineering (Ed.), 13th CIRP International Conference on Life Cycle Engineering, (pp. 497-502). Loughborough University, UK. Retrieved from http://www.mech.kuleuven.be/lce2006/177.pdf

Hestad, M. (2013). Branding and Product Design. Surrey, England: Gower.

Houdini. (n.d). Sustainability: Second hand. Retrieved 03 21, 2017, from Houdini sportswear: https://www.houdinisportswear.com/se/sustainability/second-hand

Hultén, J., Johansson, M., Dunsö, O., Jensen, C., & Naturvårdsverket. (2016). Plockanalyser av textilier i hushållens restavfall: En kartläggning av mängder och typ av kläder, hemtextilier och skor. Norrköping: Sveriges Meteorologiska och Hydrologiska Institut.

Icebug AB. (2014). Icebug. Retrieved 01 18, 2017, from Icebug Home: https://icebug.com/

Icebug AB. (2016). Sustainability Vision [PowerPoint slides]. Provided from Director of Product at Icebug

IKEA. (2016). Annonsera på Köp & sälj: Ge dina begagnade IKEA möbler ett nytt hem. Retrieved 03 09, 2017, from http://www.ikea.com/ms/sv_SE/ikea_family/kop_och_salj/

Indiska. (n.d). Indiska i samarbete med Myrorna. Retrieved 03 08, 2017, from We Fight for Change: http://www.wefightforchange.com/myrorna/

Intertek. (2010, November). Footwear Materials: Adhesives. Retrieved 05 02, 2017, from wewear: https://www.wewear.org/assets/1/7/101311McConnell.pdf

Instructables. (n.d). How to Repair the Heel of Athletic Shoes. Retrieved 01 03, 2017, from Instructables: http://www.instructables.com/id/How-to-Repair-the-Heel-of-Athletic-Shoes/

ISPO Textrends. (2016). Textile Industry: Made-To-Waste Is No Longer a Viable Option. ISPO. Retrieved 03 14, 2017, from http://www.ispo.com/en/products/id_79640186/tid_pdf_o/textile-industry-made-to-waste-is-no-longer-a-viable-option.html

James, M. L., & Rahimifard, S. (2012, December). An air-based automated material recycling system for postconsumer footwear products. Resources, Conservation and Recycling, 69, pp. 90-99.

Jansson, T. (2015, April 22). Vad är cirkulär ekonomi? Retrieved 03 15, 2017, from Circular Economy: http://circulareconomy.se/vad-ar-cirkular-ekonomi/

Johannesson, H., Persson, J., & Pettersson, D. (2004). Produktutveckling: Effektiva metoder för konstruktion och design (1 ed.). Stockholm: Liber.

Kyungeun, S. (2015, April 13). A Review on Upcycling: Current Body of Literature, Knowledge Gaps and a Way Forward. 17(4), pp. 28-40.

Lidman, K., & Renström, S. (2011). How to design for sustainable behaviour? Department of Product & Production Development. Gothenburg: Chalmers University of Technology.

Leidenkrantz, T. (2016). How to transform a corporate brand based on leadership, differentiation and a well defined strategic process [Power-point presentation]. Göteborg. Retrieved 03 14, 2017

Lippa, N. M., Krzeminski, D. E., Piland, S. G., W Rawlins, J., & Gould, T. E. (2016, 10 9). Biofidelic mechanical ageing of ethylene vinyl acetate running footwear midsole foam. Sports Engineering and Technology, pp. 1-11.

Lundhags. (n.d). The Shoemaker's Guarantee. Retrieved 02 24, 2017, from Lundhags AB hosterspace: http://lundhagsab.hosterspace.com/the-shoemaker-s-guarantee/

Löp&Sko. (2017). Håll skorna rena och fräscha! Retrieved 02 28, 2017, from Löp&Sko: http://www.lopsko.se/vart-sortiment/skotselrad-skor

Matzler, K., Veider, V., & Kathan, W. (2015). Adapting to the Sharing Economy. MIT Sloan Management Review, 56(2), 71-77. Retrieved 03 03, 2017, from http://search.proquest.com.proxy.lib.chalmers.se/docview/1650910724?pq-origsite=summon

McDonough, W., & Braungart, M. (1998, October). The NEXT Industrial Revolution. The Atlantic, 282(4), pp. 82-92.

Mont, O., Lehner, M., & Heiskanen, E. (2014). Nudging: Ett verktyg för hållbara beteenden? Bromma: Naturvårdsverket.

Morris, J. (1995, July 26). Recycling versus incineration: an energy conservation analysis. Journal of Hazardous Materials, pp. 277-293.

Muthu, S. S., & Gardetti, M. A. (2016). Green Fashion. Environmental Footprints and Eco-design of Products and Processes, 1. doi:10.1007/978-981-10-0111-6

Myrorna. (2016, A). Om Myrorna. Retrieved 03 08, 2017, from Myrorna: http://myrorna.se/om-myrorna/

Myrorna. (2016, B). Var kan man skänka? Retrieved 03 08, 2017, from Myrorna: http://myrorna.se/om-myrorna/skanka-till-myrorna/

Myrorna. (2016, C). Vad händer med gåvorna? Retrieved 03 08, 2017, from Myrorna: http://myrorna.se/om-myrorna/vad-hander-med-gavorna/

Naturvårdsverket. (2016). Förslag om hantering av textilier – Redovisning av regeringsuppdrag. Retrieved 04 24, 2017, from https://www.naturvardsverket.se/upload/miljoarbete-i-samhallet/miljoarbete-i-sverige/regeringsuppdrag/2016/redovisade/redovisning-regeringsuppdrag-hantering-textilier-2016-09-26.pdf

Naturskyddsföreningen. (2015, December 02). Faktablad: Avfallstrappan. Retrieved 02 15, 2017, from Naturskyddsföreningen: http://www.naturskyddsforeningen.se/skola/energifallet/faktablad-avfallstrappan

Naturskyddsföreningen. (2008, September 28). Second hand-kläder märks med Bra Miljöval. Retrieved 03 15, 2017, from Naturskyddsföreningen: http://www.naturskyddsforeningen.se/nyheter/second-hand-klader-marks-med-bra-miljoval

Newlands, M. (2015, July 17). The Sharing Economy: Why it Works and How to Join. Forbes. Retrieved 03 03, 2017, from https://www.forbes.com/sites/mnewlands/2015/07/17/the-sharing-economy-why-it-works-and-how-to-join/#59f582fd58e1

Nike. (2016). How it's made. Retrieved 02 17, 2017, from Nike Grind: http://www.nikegrind.com/how-its-made

Nike. (2017). Nike reuse-a-shoe. Retrieved 2 22, 2017, from Nike get help: https://en-gb-help.nike.com/app/answer/article/recycle-shoes/a_id/60721/country/id

Nudie Jeans. (2015). Nudie Jeans Sustainability Report 2015. Nudie Jeans Co AB.

Ottman, J. A. (2011). The new rules of green marketing: strategies, tools, and inspiration for sustainable branding (Vol. 1st ed). San Francisco, California: Greenleaf Publishing.

Patagonia. (n.d, B). How to Recycle Patagonia Garments. Retrieved 03 08, 2017, from Patagonia: http://www.patagonia.com/recycling.html

Patagonia. (n.d, C). Patagonia® Returns and Repairs. Retrieved 03 08, 2017, from Patagonia: http://www.patagonia.com/returns.html

Patagonia. (n.d, D). Worn Wear. Retrieved 03 14, 2017, from Patagonia: http://www.patagonia.com/worn-wear.html

Patagonia. (2016, April 05). Patagonia Worn Wear Catalogue Europe. Retrieved 05 18, 2017, from issuu: https://issuu.com/thecleanestline/docs/worn_wear_catalogue_eu_english

Patagonia. (2011, September 07). Introducing the Common Threads Initiative – Reduce, Repair, Reuse, Recycle, Reimagine. Retrieved 05 18, 2017, from Patagonia: http://www.patagonia.com/blog/2011/09/introducing-the-common-threads-initiative/,

Poppelaars, F. (2014). Design for a circular economy - The conceptual design of a circular mobile device. Schmidt-MacArthur Fellowship.

PLUSfoam. (2017, A). About; It Started with a Pile of Foam. Retrieved 05 17, 2017, from PLUSfoam: http://plusfoam.com/about/

PLUSfoam. (2017, B). Smarter...Better™ materials engineered to replace foams, rubbers and plastics. Retrieved 03 08, 2017, from PLUSfoam: http://plusfoam.com/manufacturers

PLUSfoam. (2017, C). PLUSfoam Makes Recycling Easy. Retrieved 05 17, 2017, from PLUSfoam: http://plusfoam.com/consumers/

PLUSfoam, (n.d). PLUSfoam Aircell Master [Product Sheet]. PLUSfoam

PwC. (2015). Shared benefits; How the sharing economy is reshaping business across Europe. Retrieved 03 03, 2017, from PwC: http://www.pwc.co.uk/issues/megatrends/collisions/sharingeconomy/future-of-the-sharing-economy-in-europe-2016.html

Rahimifard, S., & Staikos, T. (2007). A decision-making model for waste management in the footwear industry. International Journal of Production Research, 45(18-19), 4403-4422. doi:10.1080/00207540701450187

Rahimifard, S., & Staikos, T. (2006, October 30). Post-consumer waste management issues in the footwear industry. Engineering Manufacture, pp. 363-368.
Regeringskansliet. (2016, October 04). Strategi för hållbar konsumtion. Retrieved 04 24, 2017, from rEGERINGSKANSLIET: http://www.regeringen.se/artiklar/2016/10/strategi-for-hallbar-konsumtion/

Röda Korset. (n.d). Second Hand: Vad gör röda korset med pengarna? Retrieved from Röda Korset: http://www.redcross.se/second-hand/vad-gor-roda-korset-med-pengarna/

Sarkar, A. N. (2012). Green branding and eco-innovations for evolving a sustainable green marketing strategy. Asia Pacific Journal of Management Research and Innovation, 8(1), 39-58.

Scandinavian Outdoor Group. (2015). The top Nordic outdoor companies. Scandinavian Outdoor News(2).
Scandinavian Outdoor Group. (n.d). Scandinavian Outdoor group. Retrieved 04 24, 2017, from About SOG: http://www.scandinavianoutdoorgroup.com/about/

Sellpy. (n.d, A). Ett enklare sätt att sälja!: Du packar din påse med det du vill få sålt - vi hämtar vid dörren, sköter försäljningen och delar på vinsten. Retrieved 03 09, 2017, from Sellpy: https://www.sellpy.se/#whatYouDontHaveToDo

Seltenrich, N. (2013, August 28). Incineration Versus Recycling: In Europe, A Debate Over Trash. YaleEnvironment360.

Seong, B. (2015, 01 07). How to fix a pair of old running shoes with contact adhesive. Retrieved 03 01, 2017, from Almost a Technocrat: https://almost-a-technocrat.blogspot.se/2015/01/how-to-fix-pair-of-old-running-shoes.html

Sika Sverige AB. (2016, 02 02). Säkerhetsdatablad; Casco LiquiSole. Spånga. Retrieved 03 01, 2017, from http://media-pms2.schoenox.net/casco/docs/cascoliquisoleblister_se_se_msds.pdf

SOEX Footwear Recycling. (2016, A). FOOTWEAR RECYCLING AROUND THE WORLD. Retrieved 22 02, 2017, from SOEX Footwear Recycling: http://footwear-recycling.com/2016/04/05/footwear-recycling-around-the-world/

SOEX Footwear Recycling. (2016,B). SOEX Footwear Recycling: Pilot LIne. Retrieved 02 22, 2017, from SOEX Footwear Recycling: http://footwear-recycling.com/

Soex Group. (n.d). group. Retrieved 2 22, 2017, from Soex Group: http://www.soexgroup.de/group.html?&L=1

Stadium. (2015, April 09). Skor får nytt liv i Stadiums kampanj re:activate. Retrieved from My News Desk; Stadium: http://www.mynewsdesk.com/se/stadium_/pressreleases/skor-faar-nytt-liv-i-stadiums-kampanj-re-activate-1140376

Svensk Handel. (2016). Svensk Handels Hållbarhetsundersökning 2016. Svensk Handel

Sörme, L., & Allerup, J. (2015, June 09). Hitta statistik: Artiklar: Här hamnar din gamla kläder. Retrieved 14 03, 2017, from SCB: http://www.scb.se/sv_/Hitta-statistik/Artiklar/Har-hamnar-dina-gamla-klader/

Thompson, R., & Thompson, M. (2014). Manufacturing Processes for Textile and Fashion Design Professionals (01 edition ed.). Thames and Hudson Ltd.

Timberland. (n.d). Drive. Recycle. Wear.: Turn your tires into shoes. Retrieved 03 15, 2017, from Timberland: https://www.timberland.com/moderntrail/timberland-tires.htm

Vincent, H. K., & Vincent, K. R. (2014). ACSM Information On…Selecting Running Shoes. American College of Sports Medicine. Retrieved 02 27, 2017, from https://www.acsm.org/docs/brochures/running-shoes.pdf

Watson, D., & Palm, D. (2016). Exports of Nordic Used Textiles: Fate, benefits and impacts. Copenhagen: Nordic Council of Ministers.

White, P., St. Pierre, L., & Belletire, S. (2013). Okala Practitioner - Integrated Ecological Design. Phoneix: Okala Team.

Wijkman, A., & Skånberg, K. (2015). The Circular Economy and Benefits for Society: Swedish Case Study Shows Jobs and Climate as Clear Winners. Club of Rome. Retrieved 03 13, 2017, from http://wijkman.se/wp-content/uploads/2015/05/The-Circular-Economy-and-Benefits-for-Society.pdf

Williams, F. (2008, 10 6). The Runner's Footprint: Our simple sport seems eco-friendly. But the truth is complicated. Retrieved 2 2, 2017, from Runner's World: http://www.runnersworld.com/other-gear/the-runners-environmental-footprint

Wilson, C. (2014; 2013). Interview techniques for UX practitioners: A user-centred design method (e-book collection). Amsterdam; Boston: Morgan Kaufmann. Retrieved from http://www.sciencedirect.com.proxy.lib.chalmers.se/science/article/pii/B9780124103931000028

World Footwear. (2016, July 27). World Footwear Yearbook: 2016 edition is now available. Retrieved 02 15, 2017, from World Footwear: http://www.worldfootwear.com/news.asp?id=1809&World_Footwear_Yearbook_2016_edition_is_now_available___

LIST OF FIGURES

Jansson, T. (2015, April 22). Vad är cirkulär ekonomi? [Electronic image]. Retrieved 03 15, 2017, from Circular Economy: http://circulareconomy.se/vad-ar-cirkular-ekonomi/

Lidman, K., & Renström, S. (2011). How to design for sustainable behaviour? Department of Product & Production Development [Electronic image]. Gothenburg: Chalmers University of Technology.

Lundhags. (n.d). The Shoemaker's Guarantee [Electronic image]. Retrieved 02 24, 2017, from Lundhags AB hosterspace: http://lundhagsab.hosterspace.com/the-shoemaker-s-guarantee/

McCrigler, B. (n.d). Worn Wear Guide [Electronic image]. Retrieved 06 11, 2017, from Patagonia: http://www.patagonia.com/worn-wear-guide/?gid=19428&langid=en

Nike. (2016). How it's made [Electronic image]. Retrieved 02 17, 2017, from Nike Grind: http://www.nikegrind.com/how-its-made

Nudie Jeans. (n.d, A). Stores: nudie jeans repair shop goteborg [Electronic image]. Retrieved 06 10, 2017, from Nudie Jeans: https://www.nudiejeans.com/stores/nudie-jeans-repair-shop-goteborg

Nudie Jeans. (n.d, B). This is Nudie Jeans [Electronic image]. Retrieved 06 10, 2017, from Nudie Jeans: https://www.nudiejeans.com/page/this-is-nudie-jeans

Patagonia. (n.d, E). Common-threads [Electronic image]. Retrieved 06 11, 2017, from Patagonia: http://eu.patagonia.com/enGB/common-threads/

Patagonia. (n.d, A). Product: expedition sewing kit [Electronic image]. Retrieved 06 10, 2017, from Patagonia: http://www.patagonia.com/product/expedition-sewing-kit/12000.html

Patagonia. (2016, April 05). Patagonia Worn Wear Catalogue Europe [Electronic image]. Retrieved 05 18, 2017, from issuu: https://issuu.com/thecleanestline/docs/worn_wear_catalogue_eu_english

PLUSfoam, (n.d). PLUSfoam Aircell Master [Product Sheet] [Electronic image]. PLUSfoam

PLUSfoam. (2017, B). Smarter...Better™ materials engineered to replace foams, rubbers and plastics [Electronic image]. Retrieved 03 08, 2017, from PLUSfoam: http://plusfoam.com/manufacturers

Sellpy. (n.d, B). Ett enklare sätt att sälja [Electronic image]. R etrieved 06 11, 2017, from Sellpy: https://www.sellpy.se

Seong, B. (2015, 01 07). How to fix a pair of old running shoes with contact adhesive [Electronic image]. Retrieved 03 01, 2017, from Almost a Technocrat: https://almost-a-technocrat.blogspot.se/2015/01/how-to-fix-pair-of-old-running-shoes.html

SOEX Footwear Recycling. (2016, C). SOEX Footwear Recycling; Pilot Line [Electronic image]. Retrieved 05 17, 2017, from Recycled Rubber Outsole: http://footwear-recycling.com/2016/10/02/recycled-rubber-outsole/

SOEX Footwear Recycling. (2016, B). SOEX Footwear Recycling: Pilot LIne [Electronic image]. Retrieved 02 22, 2017, from SOEX Footwear Recycling: http://footwear-recycling.com/

Timberland. (n.d). Drive. Recycle. Wear.: Turn your tires into shoes [Electronic image]. Retrieved 03 15, 2017, from Timberland: https://www.timberland.com/moderntrail/timberland-tires.htm

Vaggeryds kommun. (2016, 11 29). Återanvändning - tillsammans kan vi göra skillnad [Electronic image]. Retrieved 05 20, 2017, from Vaggeryds kommun: http://www.vaggeryd.se/bygga-bo-och-miljo/avfall-och-atervinning/kallsortering-och-atervinning/ateranvandning.html

Figure 15.
Alammary, A. (2011). Conversation: "Life is Good When You're Barefoot" [Electronic image]. Retrieved 3 9, 2017, from Catalyst: http://catalystreview.net/life-is-good-when-youre-barefoot/

Chua, J. M. (2009, September 10). Patagonia's Sugar & Spice: A Disassembling Shoe That Makes Recycling a Snap [Electronic image]. Retrieved 06 10, 2017, from ecouterre: http://www.ecouterre.com/patagonias-sugar-spice-a-disassembling-shoe-that-makes-recycling-a-snap/

Gibson, E. (2016, May 09). Roderick Pieters' Loper shoes are assembled with rope rather than glue [Electronic image]. Retrieved 03 09, 2017, from dezeen: https://www.dezeen.com/2016/05/09/roderick-pieters-proef-loper-shoes-kickstarter-glueless-rope/?li_source=LI&li_medium=bottom_block_1

Key, R. (2012, January 04). Sole Purpose: Shoe Repair has Aesthetic Value [Electronic image]. Retrieved 03 10, 2017, from The Future Labratory: https://www.lsnglobal.com/briefing/article/5027/sole-purpose-shoe-repair-has-aesthetic-value

Lyf. (n.d). Your Footprint [Electronic image]. Retrieved 3 9, 2017, from Lyf Shoes: http://lyfshoes.com/footprint/

Mahabis. (2017). Shop: the slipper. reinvented [Electronic image]. Retrieved 03 09, 2017, from Mahabis: https://mahabis.com/pages/classic-slipper

Nike. (2014, 12 23). News: The Nike Zvezdochka - The future returns [Electronic image]. Retrieved 3 9, 2017, from Nike news: http://news.nike.com/news/the-nike-zvezdochka-the-future-returns

Revolutionart. (2011, 9 13). URSHUZ: your shoes, your creation [Electronic image]. Retrieved 3 9, 2017, from Revolutionart Magazine: http://revolutionart-magazine.com/urshuz-your-shoes-your-creation/
+
Sole Collector. (2015, 04 22). How Nike's Considered Line Changed the Company for Good [Electronic image]. Retrieved 05 15, 2017, from Sole Collector: https://solecollector.com/news/2015/04/the-history-of-nike-considered

Trekitt. (n.d). Products: Arcteryx Mens Bora 2 Mid GTX Black [Electronic image]. Retrieved 06 10, 2017, from trekitt: http://www.trekitt.co.uk/11378/products/arcteryx-mens-bora-2-mid-gtx-black.aspx

APPENDIX

I: GENERAL SURVEY
II: ICEBUG SURVEY
III: SUMMARY OF INTERVIEW QUESTIONS
IV: EVALUATION MATRIX - REUSE & RECYCLE
V: EVALUATION MATRIX - CARE & REPAIR

Page 1:

End-of-life och underhåll av skor

Vi är två studenter från Chalmers som just nu gör vårt examensarbete på Icebug. Arbetet inriktar sig på hållbar utveckling med fokus på skors end-of-life. Vi skulle därför vara väldigt tacksamma om du vill ägna några få minuter på denna enkät för att hjälpa oss i vårt arbete.

*Obligatorisk

1. **Kön**
   Markera endast en oval.
   - ◯ Kvinna
   - ◯ Man
   - ◯ Övrigt: _____

2. **Ålder**
   _____

Skovård

3. **Tar du hand om dina löpskor, rengör, impregnerar, sprayar, vaxar etc?** *
   Markera endast en oval.
   - ◯ Ja
   - ◯ Nej

Page 2:

4. **Hur gör du det? Till exempelvis, hur rengör du dina skor eller behandlar?**
   _____

5. **Använder du dina löpskor till fler aktiviteter än till löpning?** *
   Markera endast en oval.
   - ◯ Ja
   - ◯ Nej

6. **Tar du hand om dina walkingskor, rengör, impregnerar, sprayar, vaxar etc?** *
   Markera endast en oval.
   - ◯ Ja
   - ◯ Nej

7. **Hur gör du det? Till exempelvis, hur rengör du dina skor eller behandlar?**
   _____

Page 3:

8. **Känner du att du har rätt kunskaper gällande underhåll av dina löpskor respektive walkingskor?** *
   Markera alla som gäller.
   - [ ] Ja, för mina löpskor
   - [ ] Nej, inte för mina löpskor
   - [ ] Ja, för mina walkingskor
   - [ ] Nej, inte för mina walkingskor

9. **Kommentar**

Lagning

10. **Har du någon gång lagat något på dina skor på egen hand?** *
    Markera alla som gäller.
    - [ ] Ja, på mina löpskor
    - [ ] Nej, inte på mina löpskor
    - [ ] Ja, på mina walkingskor
    - [ ] Nej, inte på mina walkingskor

11. **Om ja, vad har du lagat och krävdes det något extra material för att laga?**

Page 4:

12. **Eller har du någon gång lämnat in dom till en skomakare?** *
    Markera alla som gäller.
    - [ ] Ja, mina löpskor
    - [ ] Nej, inte mina löpskor
    - [ ] Ja, mina walkingskor
    - [ ] Nej, inte mina walkingskor

13. **Om ja, vad lagade dom?**

Dina förbrukade skor

14. **Vad gör du med skorna när du inte använder dem längre? (skicket på skorna är beskrivet till vänster)** *
    Markera endast en oval per rad.

	Slänger i brännbart avfall	Slänger i grovsopor	Lämnar in till välgörenhet/second-hand	Ger till en kompis, familjemedlem etc	Tradera, blocket, loppis etc	Om annat kommentera
Jätteslitna, trasiga	◯	◯	◯	◯	◯	◯
Lite slitna	◯	◯	◯	◯	◯	◯
Skitiga/missfärgade	◯	◯	◯	◯	◯	◯
Som nya	◯	◯	◯	◯	◯	◯

15. **Kommentar**

16. **Vad är det som gör att dina skor känns förbrukade?** *

Page 5:

17. **Vad är den vanligaste anledningen till att du byter/köper nya skor?** *

Inlämning av dina gamla förbrukade skor

så att skorna går till återvinning eller återanvändning för att undvika förbränning

18. **Skulle du kunna tänka dig att lämna in dina skor när de är förbrukade?** *
Markera endast en oval.

- ◯ ja
- ◯ nej

19. **Om ja, vad är största incitamentet för att du gör det?**

20. **Om nej, vad är det som gör att du inte vill göra det?**

21. **Om nej, vad skulle få dig att lämna in dina förbrukade skor?**

Page 6:

22. **Vart skulle du helst vilja lämna in dina skor så att de skickas vidare till återanvändning eller återvinning?** *
Markera endast en oval.

- ◯ Gå till Röda Korset eller liknande välgörenhetsorganisationer för fysisk inlämning
- ◯ Gå tillbaka till butiken där du köpte dom
- ◯ Lämna av dom i en inlämningscontainer för textilier på offentliga platser
- ◯ Skicka in dom som paket via posten
- ◯ Jag gillar inte tanken på att lämna in mina skor
- ◯ Övrigt: _____

23. **Varför valde du det alternativet? (kommentera gärna ditt svar)** *
Markera endast en oval.

- ◯ Säkrast
- ◯ Bekvämast
- ◯ Snabbast
- ◯ Övrigt: _____

24. **Kommentarer**

Second-Hand

25. **Skulle du kunna tänka dig att köpa skor som redan har använts av någon annan?** *
Markera endast en oval.

- ◯ Ja
- ◯ Nej

26. **Om nej, varför inte? Vad är största barriären?**

28. **Om ja, vad är det som gör att du kan tänka dig att köpa second-hand?**

Page 1:

Dina Icebugskor

Vi är två studenter från Chalmers som just nu gör vårt examensarbete på Icebug. Arbetet inriktar sig på hållbar utveckling med fokus på skors end-of-life. Vi skulle därför vara väldigt tacksamma om du vill ägna några få minuter på denna enkät för att hjälpa oss i vårt arbete.

*Obligatorisk

1. **Lämna din email om du vill delta i utlottningen av ett par skor.**

2. **Kön**
   Markera endast en oval.
   - ◯ Kvinna
   - ◯ Man
   - ◯ Övrigt: _____

3. **Ålder**

Page 2:

4. **Hur många år har du haft dina äldsta Icebugskor?** *
   Markera endast en oval.

	1	2	3	4	5	6	7	8	9	10	
år	◯	◯	◯	◯	◯	◯	◯	◯	◯	◯	10 år eller längre

5. **Vilken modell är det?** *

6. **Hur ofta brukar du använda dina Icebugskor? (flera gånger per vecka, nån gång per månad, varje vecka på vinterhalvåret etc.)** *

Skovård

7. **Tar du hand om dina Icebugskor, rengör, impregnerar, sprayar, vaxar etc?** *
   Markera endast en oval.
   - ◯ Ja
   - ◯ Nej
   - ◯ Övrigt: _____

8. **Hur tar du hand om dina skor? Till exempelvis, hur rengör du dina skor eller behandlar?**

9. **Känner du att du har rätt kunskaper gällande underhåll av dina skor?** *
   Markera endast en oval.
   - ◯ Ja
   - ◯ Nej

Page 3:

10. **Kommentar**

Lagning

11. **Har du någon gång lagat något på dina Icebugskor på egen hand?** *
Markera endast en oval.
- ◯ Ja
- ◯ Nej

12. **Om ja, vad har du lagat och krävdes det något extra material för att laga?**

13. **Eller har du någon gång lämnat in dom till en skomakare?** *
Markera endast en oval.
- ◯ Ja
- ◯ Nej
- ◯ Övrigt: _____

14. **Om ja, vad lagade dom?**

Dina förbrukade skor

Page 4:

15. **Vad gör du med skorna när du inte använder dem längre? (skicket på skorna är beskrivet till vänster)** *
Markera endast en oval per rad.

	Slänger i brännbart avfall	Slänger i grovsopor	Lämnar in till välgörenhet/second-hand	Ger till en kompis, familjemedlem etc	Tradera, blocket, loppis etc	Behåller, lägger på lager hemma	Om annat kommentera
Jätteslitna, trasiga	◯	◯	◯	◯	◯	◯	◯
Lite slitna	◯	◯	◯	◯	◯	◯	◯
Skitiga/missfärgade	◯	◯	◯	◯	◯	◯	◯
Som nya (fast du vill inte ha kvar dom av någon anledning)	◯	◯	◯	◯	◯	◯	◯

16. **Kommentar**

17. **Vad är det som gör att dina skor känns förbrukade?** *

18. **Vad är den vanligaste anledningen till att du byter/köper nya skor?** *

Inlämning av dina gamla förbrukade skor

så att skorna går till återvinning eller återanvändning för att undvika förbränning

19. **Skulle du kunna tänka dig att lämna in dina skor när de är förbrukade?** *
Markera endast en oval.
- ◯ ja
- ◯ nej

Page 5:

21. **Om nej, vad är det som gör att du inte vill göra det?**

22. **Om nej, vad skulle få dig att lämna in dina förbrukade skor?**

23. **Vart skulle du helst vilja lämna in dina skor så att de skickas vidare till återanvändning eller återvinning?** *
Markera endast en oval.

- ◯ Gå till Röda Korset eller liknande välgörenhetsorganisationer för fysisk inlämning
- ◯ Gå tillbaka till butiken där du köpte dom
- ◯ Lämna av dom i en inlämningscontainer för textilier på offentliga platser
- ◯ Skicka in dom som paket via posten
- ◯ Jag gillar inte tanken på att lämna in mina skor
- ◯ Övrigt: _____

24. **Varför valde du det alternativet? T ex nära till där jag bor, säkraste valet så att det kommer dit det ska, kräver inte mycket extrajobb etc.** *

Second-Hand

Page 6:

25. **Skulle du kunna tänka dig att köpa Icebugskor som redan har använts av någon annan?** *
Markera endast en oval.

- ◯ Ja
- ◯ Nej

26. **Om nej, varför inte? Vad är största barriären?**

27. **Om ja, vad sätter du för krav på skorna?**

28. **Om ja, vad är det som gör att du kan tänka dig att köpa second-hand?**

29. **Vill du få Icebugs nyhetsbrev till din mejl?**
Markera endast en oval.

- ◯ Ja tack
- ◯ Nej tack

APPENDIX III: SUMMARY OF INTERVIEW QUESTIONS

Shoemakers and Löp & Sko

- *What is the most common things that you repair on a shoe?*
- *Have you noticed that some materials are less durable than others, and which ones in that case?*
- *Do you receive running shoes for repair, and in that case for what type of repair?*
- *Can you separate the outsole and midsole from the upper on a running shoe?*
- *Is it possible for you to exchange the midsole on a shoe?*
- *What makes some shoes easier to repair than other?*
- *Is it easy to repair the seams on sneakers?*
- *We have noticed that the heel cap often gets broken or becomes worn, is that part of the shoes easy or hard to repair?*
- *It is quite common that shoes with a textile upper gets worn or even broken around the toes, is that something you repair and how in that case?*
- *Is it possible to answer which parts of a shoe that most commonly wear first?*
- *What is the lifespan on a pair of running shoes, and what do you recommend to your customers? (löp & sko)*

Lundhags, Urban - main questions stated

- *How does your repair service for you customer's work?*
- *Are their many customers that use your repair service?*
- *What is the most common thing to repair?*
- *What in the design is it that makes a pair of Lundhags shoes possible to repair and maintain?*

Red Cross, Eva Maria Rudbäck - main questions stated

- *Do you accept and recycle shoes?*

How does the process work, you have collaboration with SOEX?

- *Money (does the company get money or is it a service you have to pay for)?*
- *What is required from the company, in the case of a collaboration (Icebug)?*
- *Do you collaborate with any other footwear companies today?*
- *Do you put any requirements on the shoes (should be clean etc.)?*
- *What do you do with the shoes you receive today?*

APPENDIX III: SUMMARY OF INTERVIEW QUESTIONS

- *Are they reused or recycled?*
- *How does that system work?*
- *Where do you send them, locally or abroad?*

Stena Recycling, Taina Flink + ReturTex - main questions stated

- *Do you accept and recycle shoes?*
- *How in that case, material recycling or incineration?*
- *Is it possible to recycle the material that is included in these shoes (got a list of the material content in the shoe) - how or why not?*
- *In which type of products could this type of recycled material be used in the next step?*
- *What could possibly facilitate the recycling process of shoes?*

SOEX pilot project, Benjamin Marias

- *What is the main difficulties with recycling footwear?*
- *Some of Icebugs shoes contain carbide studs, could that be a problem?*
- *How is it with I:CO, they collect we pay them, you pay for the materials? Or how is it?*
- *Is the re-wear locally distributed? "Choices from the brand" Can Icebug choose how the second-hand shoes should be distributed?*
- *Can you make soles with the reused rubber that Icebug can buy? Can any type of tooling be used or is it one kind of sole you can do?*
- *Can you make new EVA soles from recycled EVA? Or some kind of substitute?*
- *What other kind of products can you do with the material?*
- *Do you have a minimum volume? Can customers post shoes directly to you?*
- *What is it that makes this process, easier/harder in terms of shoe design?*
- *Do you know about any other companies that can do similar recycling, except Nike?*
- *Do you have any other good suggestions or tips of what to think about, in general for our project?*

APPENDIX III: SUMMARY OF INTERVIEW QUESTIONS

I:CO, Paul Dietzsch Doertenbach

- *How is the collaboration with a company set up?*
- *What can you offer in terms of collection and logistics?*
- *What kind of transport do you use, in terms of environmental effects?*
- *Who is paying for this service, as there lays a value in the shoes collected?*
- *What is required from the company's side?*
- *Do we as a company have to accept all kind of textiles and shoes and not only from our own brand?*
- *Do you have demands regarding amount of minimum volume collected?*
- *Are there any specific demands on the shoes, cleanliness etc.?*
- *What other shoe companies do you have collaborations with?*

PLUSfoam Compound Technologies, Bridgette Roberts

- *As we have seen on your homepage there are mostly flip-flops or shoes with simpler constructions in comparison to a running or a walking shoe. We could find in the text that if the soles are connected to textiles you can remove it before recycling the soles, is this possible for a more complex kind of shoe?*
- *In the case of removing textiles, what happens to them? Incinerated, recycled etc.?*
- *As it says that PLUSfoam can replace rubber and foam, is the sole manufacturing only one piece or is it made then by two separate pieces? One midsole and a rubber outsole?*
- *Is it possible to make a midsole suiting a running shoe?*
- *If mixing PLUSfoam rubber outsole and plusfoam midsole, does they have to be separated when recycling?*
- *Would it be possible to get some more information about the material properties that you can produce, EVA substitute, Rubber substitute and any harder kind of plastics etc.*

We also have questions regarding:

- *How is the collaboration with a company set up?*
- *What would be required from Icebug's side?*
- *Who is responsible for the shipment and collection (In terms of paying the shipment costs)?*

APPENDIX III: SUMMARY OF INTERVIEW QUESTIONS

Nudie Jeans, Eliina Brinkberg - main questions stated

- *How does your system work, have you meet any difficulties, how is the response from you customers?*
- *Do you feel that your customers show an interest for your service and a will to prolong the life their jeans, or do they rather chose to donate them and get 20% of a new pair of jeans?*
- *How does the service work for those who are not living near any of you repair shops?*
- *How is the interest for the repair-kit?*
- *General perspective on the customer behaviour when it comes to repair and reuse, can you give any tips and advice to our work?*

Peak Innovation, Joel Svedlund - main areas discussed

- How to design a successful take back system
- Customer behaviour - how to effect
- Environmental materials
- Tips on recycling plants in Sweden/Europe
- The barriers with lack of demand for recycled materials from shoes
- SOEX, Red Cross, I:CO
- Collection possibilities
- Reuse locally or abroad, what is best
- Advice for design of a disassembly shoe

Chalmers University of Technology, Antal Boldizar - main areas discussed

- Barriers with material recycling in relation shoes
- Recycling in relation to different materials, especially plastics
- Recommendations to our work

Chalmers University of Technology, Isabel Ordonez Pizarro - main areas discussed

- Circular economy
- Barriers with recycling in relation shoes
- Where to put the focus in the life cycle of shoes.
- Recommendations to our work

APPENDIX IV: EVALUATION MATRIX - REUSE & RECYCLE

Each concept is rated in comparison to each other, gaining a (+) or a (-) regarding to how the factor elevates or lowers the concept, where Factors that are particularly negative or positive gain more than one (+) or (-). Factors that are in common for all concepts are not included in this comparison to present the differences between them in a clear and comprehensive way. The evaluation is divided into different focus areas that are specified in the left column, which are based on the requirement list.

	SECOND HAND STORE	MYRORNA	PLUSFOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Collection channels	- Only drop-of in store	++ Several hand-in locations + Public Collection boxes (1st preferred) + Hand in to charity organisation (2nd preferred)	+ Not locked to a specific hand-in location, postage reach every one - Only offer postage take-back - - Take-back scheme only valid for PLUSfoam's products	- Only have 'in-store collection' at Icebug and Red Cross (physical hand in) + Hand in to charity organisation (2nd preferred)	+ Collection at events + Collection at retailers, reach more people - Collection channels that might not fit all customers (in-store, events & postage)	+ Not locked to a specific hand-in location, postage reach every one	+ Not locked to a specific hand-in location
Volumes	- Small volumes due to one collection channel + Control over the number of shoes that are sold second	+ Icebug can choose what to collect in their own store - No control over volumes collected except in-store	- Can take time to reach high volumes of post-consumer shoes + Icebug gets control over number of shoes that are handed back	+ Icebug can choose what to collect in their own store - No control over volumes collected except in-store	+ Get bigger volumes + Postage, most comfortable option for people living far out → Survey - No control over number of shoes that are handed in except shoes collected in store	- No control over number of shoes that are sold second hand	+ Knowledge about number of shoes, that are sold second hand via Tradera

APPENDIX IV: EVALUATION MATRIX - REUSE & RECYCLE

	SECOND HAND STORE	MYROR-NA	PLUS-FOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Storage	- Requires some storage in Icebug store	- Requires some storage at Icebug's HQ		- Requires some storage in Icebug store	- Requires storage at retailers		
Trustful	+ Hand in to company, convenient and safe option (survey)	+ Well known and trusted organisation		+ Red Cross is a well known and trusted organisation + International organisation			
Means of reuse & recycling	+ Local second hand - Offer no solution for recycling of shoes	+ Local second hand and incineration - Incineration	+++ Material recycling ++ 0% production waste +++ 100% recyclable material - Goes directly to material recycling - no reuse	+++ Goes to material recycling through SOEX + Local reuse, first hand	+++ Goes to material recycling (although not all of the shoes) + Possible to choose reuse local or abroad	+ Shoes that cannot be sold goes to charity - Goes to incineration if the shoes cannot be reused	- - System is only for second-hand, if not sold what happens then?
Implementation	+ Quite easy to implement due to no collaboration setup - Requires a new business plan	+ Possibility for an easy and fast implementation (if Myrorna want to collaborate)	+ PLUSfoam can make both EVA substitute, rubber soles and PU - - Icebug needs to use PLUSfoam's material in their shoes, new development	+ Easy & fast, already in contact	- Requires a collaboration not just with I:CO but also with retailers - Require longer implementation time	+ Possibility for an easy and fast implementation (if Sellpy want to collaborate)	+ Possibility for an easy and fast implementation (if Tradera want to collaborate)

APPENDIX IV: EVALUATION MATRIX - REUSE & RECYCLE

	SECOND HAND STORE	MYRORNA	PLUSFOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Cost/profit	+ Might give increased sales due to voucher + Possibility for R&D investment from second hand profit + People that look for second-hand shoes might purchase new shoes instead - Might redirect purchases of new shoes to second-hand shoes	+ Might increase sales as customers come in to the store to hand-in old shoes, might find new ones	+ With a voucher people come back and buy new shoes, loyal customers - Customer need to pay postage - 10-30% higher cost on EVA standard substitute	+ Might increase sales as customers come in to the store to hand-in old shoes, might find new ones	+ With a voucher people come back and buy new shoes, loyal customers + Can make profit, depending on reverse logistics possibilities, otherwise no cost, no profit. (profit goes to investment in R&D or charities) - Cost, postage label	+ Possible profit for sales - people get money to buy new shoes ++ Free shipping cost for customers and Icebug - Might redirect purchases of new shoes to second-hand shoes instead	+ People that look for second-hand shoes might purchase new shoes instead + + People sell own shoes, get money to buy new ones, generate sales - Icebug might have to pay Tradera - Might redirect purchases of new shoes to second-hand shoes
Effort	- Icebug need to collect, sort and post on webpage - Physical hand-in to Icebug store needed from customer - Icebug need to get rid of unsold shoes	++ Pick up from HQ Quite low effort for both company and customer - Icebug have to transport from store to HQ for storage	++ No effort from Icebug regarding collection + PLUSfoam deals with all logistics (together with the customer) - Demands more effort from the customer - Customer need to pay postage	+ Quite low effort from company and customer - Requires effort from Icebug storekeeper to bring it to Red Cross	- Postage requires extra work for Icebug - Requires effort from Icebug and retailers	+ Very low effort for Customer ++ Very low effort for Icebug + Responsibility and legal aspects are handled by Sellpy - Pick-up only in bigger cities --> need to go to Schenker	++ Very low effort for Icebug + Easy for customers to find and sell second-hand Icebug shoes + Responsibility and legal aspects are handled by Tradera - Effort from the customer, to deliver product in some way.

APPENDIX IV: EVALUATION MATRIX - REUSE & RECYCLE

	SECOND HAND STORE	MYRORNA	PLUSFOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Information	+ Own Second hand homepage, possibility to spread other info + Info on window, might encourage people to step in to find out more - No info about the second hand at retailers' store	- When buying shoes at retailers, get no information about the collaboration	+ Infographics on box reaches every customer + Info on sole reaches all customers, available at all time + Poster in store creates interest, reaches the one's not visiting the homepage	+ Info on window, might encourage people to step in to find out more + Infographics on box reaches every customer	+ Infographics on box reaches every customer + Info on sole reaches all customers, available at all time	+ Folder in box reaches everyone, gives customers information - the ones not visiting the homepage	+ As selling/ buying are done on Icebug's own homepage it gives loyal customers, opportunity to spread other information to them. - Customers have to visit the homepage
User behaviour	+ Path on floor creates interest and encourage changed behaviour - - Shoes have to be in good enough condition, loose people that do not find their shoes to be valuable - Voucher might encourage increased consumption	+ "Hand-me-down" and path on floor creates interest and encourage changed behaviour	+ "Hand-me-down" creates interest and encourage changed behaviour - Voucher might encourage increased consumption behaviour	+ Time limited drive give a kick to the concept and ignite a changed behaviour + Path on floor creates interest and encourage changed behaviour	- Voucher might encourage increased consumption behaviour	+ "Hand-me-down" creates interest and encourage changed behaviour	+ "Hand-me-down" creates interest and encourage changed behaviour - - Shoes have to be in good enough condition, loose people that do not find their shoes to be valuable
Innovativeness	- Low innovativeness	- Low, why start using Myrorna now?	+ Circular system, innovative solution, encourage people + Shows that worn out shoes still have a value (material recycling)	+ Shows people that worn out shoes still have a value (material recycling)	+ Shows that worn out shoes still have a value (material recycling)	- Low innovativeness	- Low innovativeness

APPENDIX IV: EVALUATION MATRIX - REUSE & RECYCLE

	SECOND HAND STORE	MYRORNA	PLUSFOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Incentives	+ Customer gets voucher as an incentive		+ Because of the material recycling more people might be given an incentive to hand in + Customer gets voucher as an incentive and makes up for postage costs	+ Because of the material recycling more people might be given an incentive to hand in	+ Because of the material recycling more people might be given an incentive to hand in	+ Customer get rid of old shoes and gain money to buy new ones	+ Customer get rid of old shoes and gain money to buy new ones
Branding	+ Increased brand visibility, more people wear the shoes. + Strong branding possibility with own second hand shop + Stronger connection to customer, strengthen the brand and gives customer loyalty	+ Increased brand visibility, more people wear the shoes.	+ Show people that Icebug want to strive forward for innovative new solutions + Exposure on PLUSfoam's website + Stand out on the market compared to "normal" take-back schemes	+ Increased brand visibility, more people wear the shoes. + Infographics on box reach everyone - Limited drive → faded interest?	+ Increased brand visibility, more people wear the shoes. + Infographics on box reach everyone + Shoe sole reach everyone, never lose the info	+ Increased brand visibility, more people wear the shoes. + Double exposure and brand visibility + Front page visibility - easy to find for customers even on Sellpy	+ Increased brand visibility, more people wear the shoes. + Double exposure on Tradera and Icebug
Other	+ Attract another costumer range		+ International, ship to PLUSfoam's nearest recycling centre, short distances	+ Helps R&D for recycling of shoes (help SOEX pilot programme) - No control whether or not Red Cross choose to change their recycle partner	+ Helps R&D for recycling of shoes (help SOEX pilot programme)	+ Attract another costumer range + Catches the lazy people - Folder - extra paper → could end up in the trash quite fast	+ Attract another costumer range + Could bring a faster sell opportunity for the user, more people see the ad.

APPENDIX IV: EVALUATION MATRIX - REUSE & RECYCLE

	SECOND HAND STORE	MYROR-NA	PLUS-FOAM	RED CROSS & SOEX	SOEX & I:CO	SELLPY	TRADERA
Incentives	+ Customer gets voucher as an incentive		+ Because of the material recycling more people might be given an incentive to hand in + Customer gets voucher as an incentive and makes up for postage costs	+ Because of the material recycling more people might be given an incentive to hand in	+ Because of the material recycling more people might be given an incentive to hand in	+ Customer get rid of old shoes and gain money to buy new ones	+ Customer get rid of old shoes and gain money to buy new ones
Branding	+ Increased brand visibility, more people wear the shoes. + Strong branding possibility with own second hand shop + Stronger connection to customer, strengthen the brand and gives customer loyalty	+ Increased brand visibility, more people wear the shoes.	+ Show people that Icebug want to strive forward for innovative new solutions + Exposure on PLUSfoam's website + Stand out on the market compared to "normal" take-back schemes	+ Increased brand visibility, more people wear the shoes. + Infographics on box reach everyone - Limited drive → faded interest?	+ Increased brand visibility, more people wear the shoes. + Infographics on box reach everyone + Shoe sole reach everyone, never lose the info	+ Increased brand visibility, more people wear the shoes. + Double exposure and brand visibility + Front page visibility - easy to find for customers even on Sellpy	+ Increased brand visibility, more people wear the shoes. + Double exposure on Tradera and Icebug
Other	+ Attract another costumer range		+ International, ship to PLUSfoam's nearest recycling centre, short distances	+ Helps R&D for recycling of shoes (help SOEX pilot programme) - No control whether or not Red Cross choose to change their recycle partner	+ Helps R&D for recycling of shoes (help SOEX pilot programme)	+ Attract another costumer range + Catches the lazy people - Folder - extra paper → could end up in the trash quite fast	+ Attract another costumer range + Could bring a faster sell opportunity for the user, more people see the ad.

APPENDIX IV: EVALUATION MATRIX - CARE & REPAIR

Shoe Care	FOLDER IN SHOEBOX	INFO ON WEBPAGE
Accessibility	+ Information folder reaches every on - Information can get lost	+ Information available at all time - Some might not visit the webpage

Shoe Care	FOLDER IN SHOEBOX	INFO ON WEBPAGE
Total	0	0

Why repair and care	INFOGRAPHIC - ON HOME-PAGE	INSPIRATIONAL MOVIE ON HOMEPAGE	INFOGRAPHIC PRINT-ED (STITCHED) ON TOTE BAG
Availability	+ Available at all time	+ Available at all time	+ Reaches the ones who are not that active on internet + People hopefully keep the bag
Easy to process info	+ Get the full holistic view directly at one glance, understand why	- People might not have time to sit and see the entire movie - Movie does not give a full over-view at first glance	+ Customer continuously see the information, stays with them
Content		+ Movie can bring more of an in-formation than flat infographic	- Might be limited space to include all necessary content
Capture interest		+ Easy to convey the right feeling and message	+ Free branding possibility for Icebug, walking around town

Why repair and care	INFOGRAPHIC - ON HOME-PAGE	INSPIRATIONAL MOVIE ON HOMEPAGE	INFOGRAPHIC PRINT-ED (STITCHED) ON TOTE BAG
Total	2	1	3

APPENDIX IV: EVALUATION MATRIX - CARE & REPAIR

How to get repair parts	ORDER REPAIR-PARTS ONLINE, PICK THE ONES YOU NEED + BUY REPAIR-KIT IN STORES	ORDER REPAIR-PARTS ONLINE + RETAILERS HAVE SPARE STUDS	ORDER PRE-FILLED REPAIR-KIT ONLINE + BUY IN STORE + CAN MAKE A CLAIM FOR SPECIFIC PARTS.
Availability	+ Having both repair kits online and in-stores reaches everyone	+ Retailers having spare parts, easy for the customer to go to any store which have Icebug shoes - Customers have to actively ask for spare parts	+ Having both repair kits online and in-stores reaches everyone
Effort	- Not Pre-filled repair kits more effort for customers to order - Not pre-filled repair kits more effort for Icebug to send	- Retailers have to store spare parts in the back, keep track of	+ Only Pre-filled repair kits, easy for customers to order or buy in store, don't need to decide + Pre-filled repair kits easy for Icebug to send
Other	+ In-store repair-kit extra sales + Repair-kit works as a branding symbol + Ordering exactly the parts that the user need, do not send spare parts that will not be used	- Info about where to find spare parts is not readily informed except from the homepage	+ In-store repair-kit extra sales + Repair-kit works as a branding symbol - Pre-filled repair kits customer might get items that they don't need - Pre-filled repair kits Icebug send unnecessary parts

How to get repair parts	ORDER REPAIR-PARTS ONLINE, PICK THE ONES YOU NEED + BUY REPAIR-KIT IN STORES	ORDER REPAIR-PARTS ONLINE + RETAILERS HAVE SPARE STUDS	ORDER PRE-FILLED REPAIR-KIT ONLINE + BUY IN STORE + CAN MAKE A CLAIM FOR SPECIFIC PARTS.
Total	2	-2	3

APPENDIX IV: EVALUATION MATRIX - CARE & REPAIR

Information how to repair	REPAIR VIDEOS ON HOMEPAGE	REPAIR EXPLANATIONS AND IMAGES ON HOMEPAGE	LINK TO DIY WEB-PAGES	COMMUNITY - DIY, POST REPAIR TIPS	INSTRUCTION FOLDER IN REPAIR KIT + INSPIRATIONAL STORY ON THE BACK-SIDE
Availability	- Might not reach the ones who are not active on internet	- Might not reach the ones who are not active on internet	- Might not reach the ones who are not active on internet	- Might not reach the ones who are not active on internet	+ Reaches the ones who are not that active on internet - Easy to lose instructions
Easy to process info	+ Repair videos - can follow closely step by step - Have to stop and pause, can be disturbing	+ Easy to follow and understand - People might get tired of reading instructions			+ Step-by-step instructions easy to follow - People might get tired of reading instructions
Capture interest	+ Movie can create the right feeling		+ Get innovative instructions and fixings	+ Engages customers	
Effort	- Constructing repair videos requires a bit of effort from Icebug	+ Constructing of text and pictures, less effort than repair videos	+ Possible to get a lot of materials without much effort needed from Icebug	+ Icebug can get many smart ideas and get insight in the customer behaviour, without much effort	
Other			- Might not be in line with how Icebug consider good repair	- Will people actually do it? - Might not be in line with how Icebug consider good repair	+ Very relevant if using a repair-kit concept

Information how to repair	REPAIR VIDEOS ON HOMEPAGE	REPAIR EXPLANATIONS AND IMAGES ON HOMEPAGE	LINK TO DIY WEB-PAGES	COMMUNITY - DIY, POST REPAIR TIPS	INSTRUCTION FOLDER IN REPAIR KIT + INSPIRATIONAL STORY ON THE BACK-SIDE
Total	-1	0	0	-1	1

APPENDIX IV: EVALUATION MATRIX - CARE & REPAIR

Upcycling tips	ICEBUG SUGGESTIONS + CUSTOMERS UP-LOAD OWN	ONLY ICEBUG SUGGESTIONS
Capture interest	+ Possibility to upload own tips'n'tricks creates a belonging and community, boost to share your own smart ideas	
Effort	+ Icebug can get many smart ideas and get insight in the customer behaviour - Work for Icebug to sort out acceptable suggestion	+ Less work for Icebug in order to have control over what is posted - More work for icebug to do their own movies and ideas
Other		- Loose smart ideas from customers

Upcycling tips	ICEBUG SUGGESTIONS + CUSTOMERS UP-LOAD OWN	ONLY ICEBUG SUGGESTIONS
Total	1	-1