

Feasibility study of product-service system model for cradle-to-cradle products

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Gaurav Soni

Student number: 4743334

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Graduation committee

Chairperson: Dr. R.M. (Robert) Verburg, Economics of Technology and Innovation

First Supervisor: Dr.ing. V.E. (Victor) Scholten, Economics of Technology and Innovation

Second Supervisor: Dr.ir. J.N. (Jaco) Quist, Energy and Industry

External Supervisor: Mr. Wouter Beck, Business Development Manager, Hunter Douglas Europe

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Summary

This thesis report is based on the feasibility study of two concepts combined together. The first is the concept of cradle-to-cradle (C2C) certification, a product certificate that proves the material reutilization and safety of any product. Cradle-to-cradle certificate is based on five independent criteria: material health, how healthy the materials in a product are; material reutilization, how much materials from old products can be used again; renewable energy, how much of the energy used is from renewable sources; water stewardship, what is the quality of water after use in production; social fairness, what is the social impact of the company or their product. The final cradle-to-cradle certification is based on the individual levels in these five criteria. There are three cradle-to-cradle product lines at Hunter Douglas, and these three are bronze level certified, which would be the focus of our project.

The second concept under focus, is the product-service system (PSS) model. This business model is an innovative model adopted by radical start-ups like Airbnb and Uber. This model persists on the provision of additional services along with the products that are sold, to ensure that the product manufacturing companies are still responsible of the product during use, and also at end-of life. For the cradle-to-cradle products in our focus, we have arrived on using a type of PSS, a 'product-based service contract', along with selling the products themselves. These contracts ensure that Hunter Douglas would be able to bring the old products back, and can invest in product recycling.

For the implementation of 'product-based service contracts' for our cradle-to-cradle products at Hunter Douglas, we decided to investigate what the company and the retailers, feel about these two concepts, and decided to prepare business strategies for Hunter Douglas, based on the data provided in interviews. The following strategies are recommended:

- a. Conducting a customer survey to understand various preferences
- b. Increasing clear communication down the value chain
- c. A product-based service contract for product take-back
- d. Increasing contracts business directly with building owners
- e. Increasing global awareness among competitors, industries and countries
- f. Product innovation
- g. Online selling
- h. Pilot project: Venetian Blinds

The report provides more detail on each of these individual strategies and how they were developed.

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Abbreviations

C2C- Cradle-to-Cradle

CE- Circular Economy

PSS- Product-Service System

OST- Optimal Strategy Triad

B2B- Business-to-Business

B2C- Business-to-Consumer

OST- Optimal Strategy Triad

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Chapter 1: Introduction

1.1. Introduction

The world population has been increasing exponentially in the past few decades and is expected to cross more than 9.8 billion by the year 2050 (“World population projected to reach” 2017). In addition to growing population, there has been economic development, globalization and technological progress in all major developed and developing countries. These trends have set out an uncontrollable generation of huge amounts of wastes. The world bank has reported that in 2012, the amount of Municipal Solid Waste (MSW) generated globally was around 1.3 billion tonnes annually. This is projected to increase to an alarming 2.2 billion tonnes annually by the year 2025 (Hoornweg & Bhada-Tata, 2012).

The huge amount of wastes generated each year, make us realize the extent to which we are welcoming drastic environmental changes, pollution and constant rise in global warming. We have to come up with measures to ensure the reduction of these wastes and a sustainable way of living. This is where the concept of circular economy plays an important role. Circular economy (CE) is a term that has been trending among corporate agendas, when they are aiming to target sustainability as a core value. CE is the opposite of linear economy (where products follow the path of production-consumption-disposal). CE tries to find different ways in which the product can be brought back into the cycle of production and have a longer ‘life’ (Senthil Kumar & Femina Carolin, 2019). As the products are being used for a longer time it reduces the demand for new products and thus reduces demand for virgin materials and energy, reduces wastage and increases the ‘use value’ of the products. According to Ritzen (2017), CE is pushing for more sustainability-driven business models and is helping to tackle three fundamental and global challenges: environment changes, resource scarcity, and economic growth (Ritzén & Sandström, 2017).

The latest innovation in CE, for finding sustainable solutions, is the concept of Cradle-to-Cradle (C2C) certification. C2C is primarily focused on resource reutilization and material conservation. The basic requirement is that any product, that aims for a C2C certification, must ensure that the materials used for the product is either a part of a biological cycle (the ones which are safe for bio-degradation) or the technical cycle (the ones where the materials are circulated in infinite life-cycles) (Toxopeus, De Koeijer, & Meijer, 2015). Additional information about the materials classification and the certification process would be discussed in [C2C Certification process](#).

Various industries are trying to find solutions where companies can incorporate CE/C2C into their business models to ensure sustainability and economic progress. In return they are getting additional value from products that would have gone to waste, as it has been reported that recycling requires

less energy and resources than producing new products. Some of the strategies for CE corresponds with the famous '4 R's, repair, reuse, recondition and recycle' (Ritzén & Sandström, 2017). The major challenge that remains is to establish the system of CE into the traditional business models of major companies. The transition from linear to CE would be serious disruption for various companies and thus they avoid this major leap (Ritzén & Sandström, 2017). There are several barriers to the establishment of sustainability practices in any organization's production process and business model, which can vary from industry-to-industry.

Thus, we see that it is an important objective for companies globally, to reduce the overflowing amount of waste products all around the world. The point of target for tackling this problem, is the birthplace of products, the organizations themselves. If the organizations start to incorporate sustainability in the form of CE/C2C into their business practices, then the customers would find a lot of options available for their demands, and would prefer to reuse products which in turn would reduce both the demand for new materials and amount of wastes for disposal. [Figure 1](#) indicates how we need a switch from a linear model, to a circular model, and for that, not only the customers must be aware about this global issue, but companies must also incorporate sustainable principles in their organizational practices. The only major challenge now would be to overcome the barriers that firms face to include these principles in their business model. That would surely help make the world a better place.

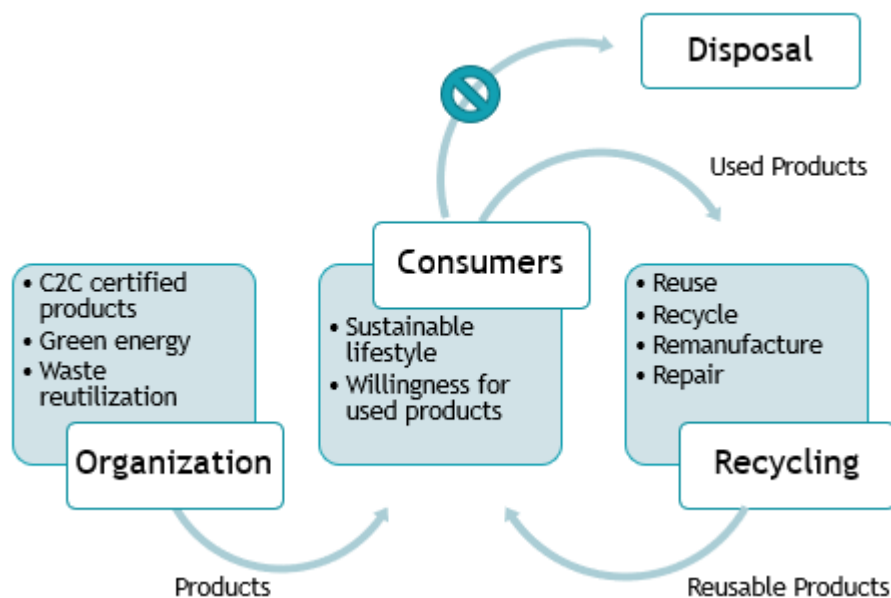


Figure 1: The need for the future

1.2. Company and product information

For our report, we would be focusing on the products sold by Hunter Douglas Europe. Hunter Douglas is the leading manufacturer of window covering products, based in Rotterdam, but has offices all around the world. The brand name associated with Hunter Douglas, in Europe, is Luxaflex. There are three products in the Luxaflex portfolio, Venetian Blinds, Roller shades system, and Fabrics. We would be focusing on these three products specifically, when talking about C2C products. [Figure 2](#) shows the products under our scope.

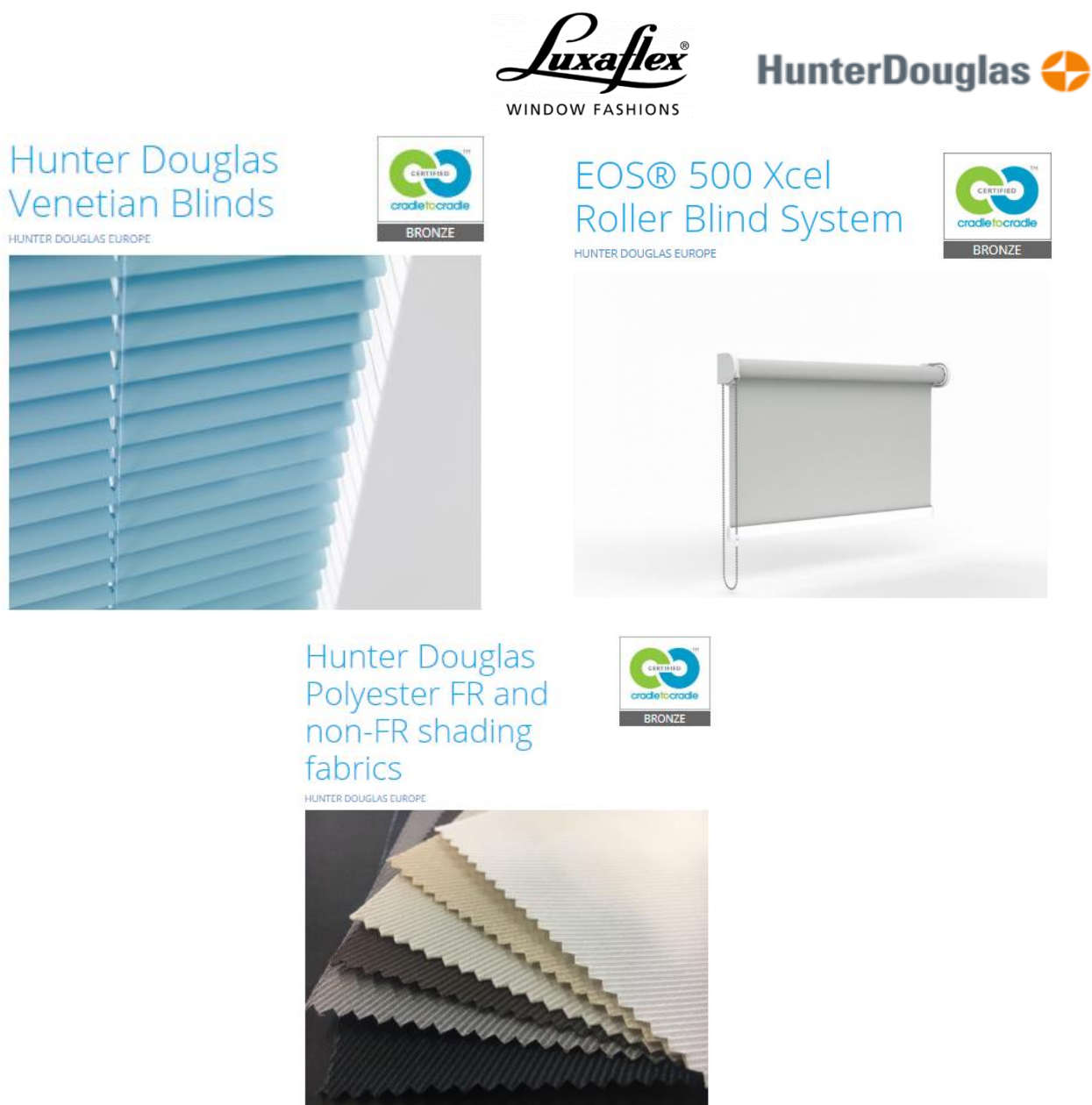


Figure 2: Hunter Douglas products ("Product Registry - Cradle to Cradle Products Innovation Institute," n.d.)

The detailed information about the company, and the descriptions of the products in focus, is mentioned in [Appendix-1](#).

1.3. Research Problem

In this sub-section, we will discuss the practical problems faced by various organizations in recent times. We see a lot of companies have already taken huge initiatives towards global sustainability, due to a number of reasons like globalization, increased competition, increased governmental regulations, and environmental concerns (Xing & Ness, 2016). In order to adopt a circular model, the companies would face a drastic, radical change from their much traditional linear model, which can affect the organization structure, supplier and retailer networks, distribution channels and revenue sources. Another issue that is rising, is that the parent company hopes that these circular initiatives are taken up by the distribution channel, or the entire value network of firms involved with the main organization, as well. These firms, on the other hand, generally tend to avoid changes that are not primarily required by them. But these firms are an important part of the company's working and thus, this becomes a dilemma, for which organizations need a crucial solution.

Accordingly, to look into these challenges, we have decided to focus our report on companies that have already adopted cradle-to-cradle certification for their product line, in our case, Hunter Douglas. According to Kowszyk et. al. (2018), companies can incorporate CE in their organization, by product, process and business model innovations (Kowszyk & Maher, 2018). With C2C certified products, these companies have successfully found a product innovation. Next, they would want to focus on the feasibility of a process and/or business model innovation, which must also be reflected by the value chain, because only until the stakeholders support the change, the company can be successful. It is important to understand if these C2C products can be actively taken up in the market. Also, we would be focusing on product-service system (PSS) business model, or a 'service-based model' for these products, where the company doesn't only sell the products but also provide services. We try to understand how this business model innovation would affect the organization and the retailers. Finally, by incorporating all the stakeholder's opinions about the changes being made by the company, we can ensure a smooth transition for these new practices.

1.4. Research Objective

The concepts of CE and C2C are difficult to be implemented by already well-established firms due to their resistance to change and lack of knowledge on the topic. The introduction of CE in the company cannot be totally successful unless these initiatives are taken up throughout the value chain, including suppliers, the company itself, and the retailers (mentioned henceforth in the report as dealers). This would form the base for our main research question. Thus, the main research objective here would then be to *identify factors to ensure successful commercialization of cradle-to-cradle initiatives in the market*. The main organization and the dealers would be the focus of our research, as these hold a high priority when radical changes are to be made, in order to ensure smooth flow of the product cycle. Also, they are the only two direct point of contact with the customers, and so, the main barriers that they face to adopt C2C certified product would be the focus. Finally, we would also conduct research to see if the PSS business model would prove efficient to boost the company to the next level of C2C certification.

The outcome of the research would be the knowledge about successful strategies for large-scale commercialization of C2C products in the market, at the bronze level of certification, which the company has already achieved at the early stages of product innovation. Further, we would have a feasibility assessment of a PSS model, and see how it would help the company to jump to the next level of certification. Thus, we would be looking for horizontal integration of C2C products in the value chain, and also a vertical growth to higher levels of C2C certification explains these objectives. The final strategies recommended, would be valid for horizontal integration of bronze-level C2C products, or can be used for vertical integration towards next level of certification. [Figure 3](#) shows this integration.

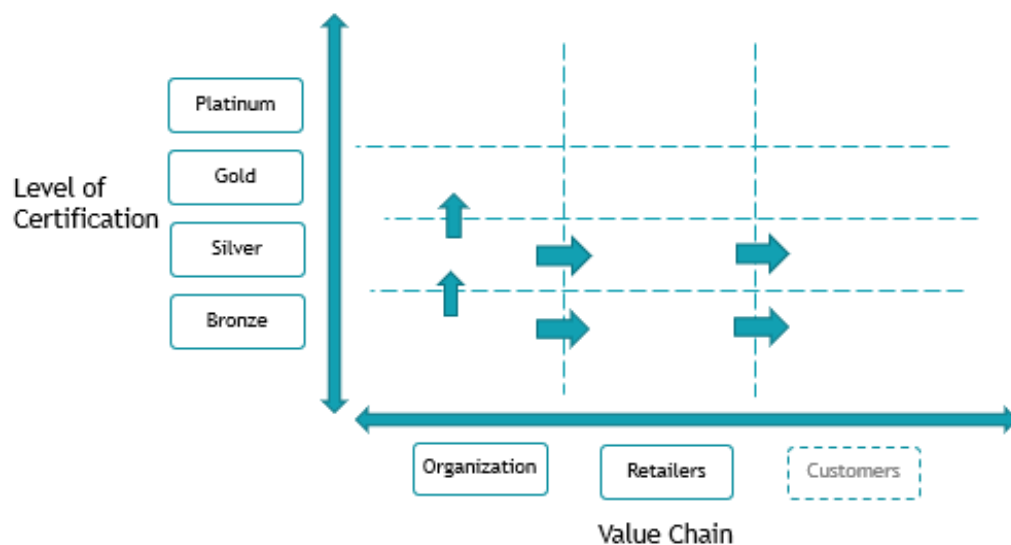


Figure 3: Research Objectives

1.5. Research Question

In order to achieve appropriate solutions for the challenges faced by the organization, we would formulate a precise research question, based on our research objective:

“How can a product-service system (PSS) model, be used with the combination of cradle-to-cradle certified products, to help increase the certification level?”

The focus for our research, by taking the particular company case of Hunter Douglas, would be the successful commercialization of circular product innovations (cradle-to-cradle products), in Hunter Douglas’ value chain (consisting of the main organization and the dealers), and assessing the changes that occur due to introduction of a business model innovation (product-service system). The following sub-questions are divided to incorporate the existing knowledge of both the PSS and C2C concepts, and also find the strategic changes required for such an innovation, and would help to collectively answer the main research question:

1. *“What is the current status of the C2C product certification process?”*

This part of the research would be done using extensive desk research on the concepts of circular economy and cradle-to-cradle. The certification process would be discussed in detail and the current level of certifications would be mentioned along with the requirements for next levels of certification.

2. *“What are the existing PSS models in practice?”*

This part of the research would be done using extensive desk research on the various types of sustainable business models that are available in the literature. Additionally, we will discuss in detail about the various types of PSS and leasing models available in the scientific literature as well.

3. *“What are the most optimal strategy recommendations for successful commercialization of C2C certified products, based on a PSS model?”*

This part of the research would be answered after data analysis of the interviews with the top-level executives of the company and the dealers. The analysis would be done to find qualitative results of the most optimal business strategies that would be based on the Optimal Strategy Triad, explained in later sections. The output would be the most feasible strategies for practical applications.

1.6. Research Outline

The report is divided into six chapters. In this chapter we introduced the topic and the research questions. The rest of the chapters are structured according to the research sub-questions. The first two sub-questions would be answered in chapter 2. This would be based on a literature review of the available knowledge on the concepts of C2C and PSS. In the next chapter we would discuss the methodology of data collection. The final sub-question, regarding the strategy recommendations, would be based on data presented in chapter 4, and would be presented in chapter 5. The final chapter would be the conclusions, including limitations and scope for future research. Finally, we have a reference section and the Appendixes. [Figure 4](#) shows the report structure in detail.

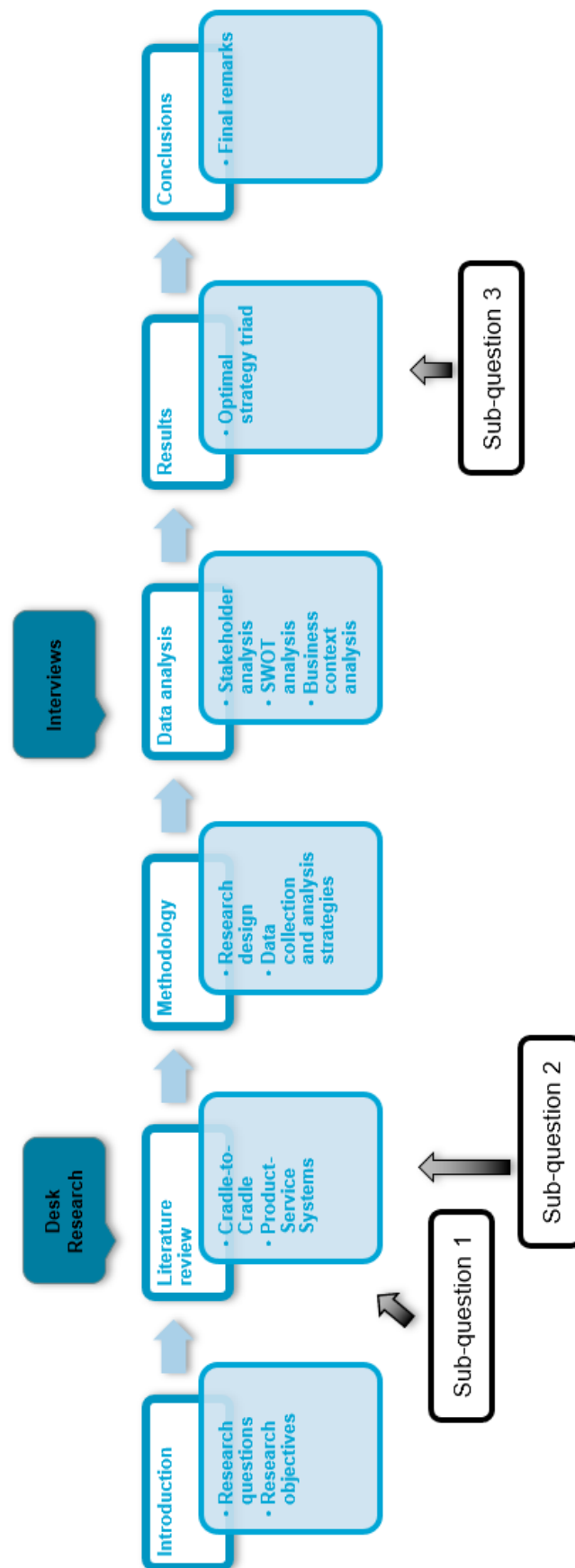


Figure 4: Report structure

Chapter 2: Literature Review

2.1. Search and selection criteria

The starting point for my literature survey was the report published by Ellen McArthur Foundation, about the opportunities of circular economy, and how the concept can help to have a positive impact on the world (Macarthur, 2012). The article introduced me to the various concepts related to circular economy, cradle-to-cradle, recycling and recovery systems. As the products at Hunter Douglas were already cradle-to-cradle certified, I decided to focus on C2C and search for articles on various scientific databases, such as Scopus, Wiley online library, and ScienceDirect. I used the software Mendeley to gather and document all the scientific materials that I gathered.

The set of keywords used were based on the author's keywords available throughout the initial set of research papers I read. When the keywords started becoming common, I decided to search articles with these keywords in their title. The following key words were used: 'circular economy', 'circular business models', 'circular implementations', 'cradle-to-cradle'. I found 98 papers with these keywords in the 'title', 'title and abstract' and 'abstract'. After initial scanning I decided to pursue with 35 papers for thorough scanning. An initial set of 18 articles were selected for the literature on circular economy and cradle-to-cradle. These articles would help me answer the first sub-question and is presented in part 1 of this chapter.

For the second part of our research, I am going to focus on the business models that support the development of circularity and sustainability in the company's practices. I looked up for 'circular business models', 'sustainable business models', 'product-service systems' and 'closed-loop business models'. I found 67 articles with these keywords in the 'title', 'title and abstract' and 'abstract'. After initial scan, 32 articles were selected for further reading. Finally, a set of 16 articles would help me answer the second sub-question, and would be presented in part 2 of this chapter.

There have been instances where my search resulted in a dead-end, or I could not gather relevant data from the articles I read. I kept trying to scan for new scientific papers, using the references that were presented at the end of important papers. Specifically, the book by Michael Braungart and William McDonough, titled 'Cradle-to-Cradle', and the paper by Tukker (2008), were the backbone of my research. These sources have been the most important reference point for all my queries and questions (McDonough & Braungart, 2002; Tukker, 2004).

Part 1

Answer to sub-question 1: *What is the current state of cradle-to-cradle product certification process?*

The first part of the chapter discusses the concepts of circular economy and cradle-to-cradle. The data available on these topics are gathered using extensive desk research of information available online, in books, and scientific papers. The data collection method is discussed in chapter 3.

Cradle-to-cradle is one of the various strategies under circular economy. The chapter begins with an introduction about the circular economy concept and moves on to the current developments in the cradle-to-cradle knowledge. The outcome of this part is the answer to our first sub-question, regarding the current state of cradle-to-cradle certification process.

2.2. Circular economy

2.2.1. Defining circular economy

The term Circular Economy (CE) was first introduced by David W. Pearce and R. Kerry Turner (1990), to encourage public to properly understand the effect that waste generation had on the environment. There have been various authors that have attempted to define CE in their own terms. We would discuss some of the basic definitions that are closely related to our research. Although simply put, CE is the process of keeping materials available in the environment for a long time, instead of simply disposing them. This process helps to close the loop of materials for a product lifecycle, and thus they can be used again for new products as well (Ritzén & Sandström, 2017). On the other hand we have a complex definition as well, “CE is a sustainable development initiative with the objective of reducing the societal production-consumption system’s linear material and energy throughput flows by applying material cycles, renewable and cascade-type energy flows to the linear system” (Korhonen, Nuur, Feldmann, & Birkie, 2018). [Figure 5](#) shows the difference between linear and circular economy.

Another simple explanation of CE is that, the strategies applied towards the adoption of CE by firms, have a basic goal of addressing the ever-increasing challenges of resource scarcity and waste disposal, and CE is the main solution to these problems. It can be considered as an objective, that helps a firm with the transition from a linear model of ‘*take, make, use, dispose*’ to the circular model, where old products and materials can still be kept in active use (Araujo Galvão, De Nadae, Clemente, Chinen, & De Carvalho, 2018). Although, there has not been a universal definition of the concept, many firms simply identify CE as a model that is “restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times. It is a positive development cycle that preserves and enhances natural capital, optimizes resource yields, and minimizes system risks” (Macarthur, 2012).

Various authors have associated CE with the concept of the 3Rs, *reduce, reuse and recycle*. According to Ranta et. al. (2018), the *reduce* strategy focuses on minimizing the use of virgin materials in the production process, along with a reduction in energy usage and amount of waste generated. *Reuse* strategy is used when the products can be directly used again by different customers in the same market. Finally, *recycle* is the strategy where the waste materials are modified to be part of the same or new product segments (Ranta, Aarikka-Stenroos, & Mäkinen, 2018). On these grounds, CE can also be identified as an economic system, that aims to design appropriate waste systems, maintains materials and the products in use for a longer time, regenerates the natural systems, and recovers economic value by extracting the maximum possible value of resources from the products with maximum efficiency. Thus, we see that reduced resource usage leads to higher productivity along with business growth (Kumar & Suganya, 2019). The European commission is actively promoting firms to push towards a more sustainable business, and in turn has put a lot of efforts to establish CE among its firms. They believe that CE initiates positive development such as “boosting recycling and preventing loss of valuable materials; creating jobs and economic growth; showing how new business models, eco-design and industrial symbiosis can move Europe towards zero-waste; and reducing greenhouse emissions and environmental impacts” (Nancy M. P. Bocken, Pauw, Bakker, & Grinten, 2015).

The most structured definition that incorporates a lot of important concepts in the definition of CE was proposed by Kirchherr et al (2017) in their study of around 114 definitions of CE. They said that “a circular economy describes an economic system that is based on business models which replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes, thus operating at the micro, meso and macro level, with the aim to accomplish sustainable development, which implies creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations” (Kirchherr, Reike, & Hekkert, 2017). All these various definitions help us understand the basic principles of CE and would help us understand the concept of cradle-to-cradle in detail. CE strategies have often been associated with the cradle-to-cradle strategy due to the similarities in their principle, i.e. *material reutilization*. The cradle-to-cradle concept would be discussed in detail in [Cradle-to-Cradle](#).

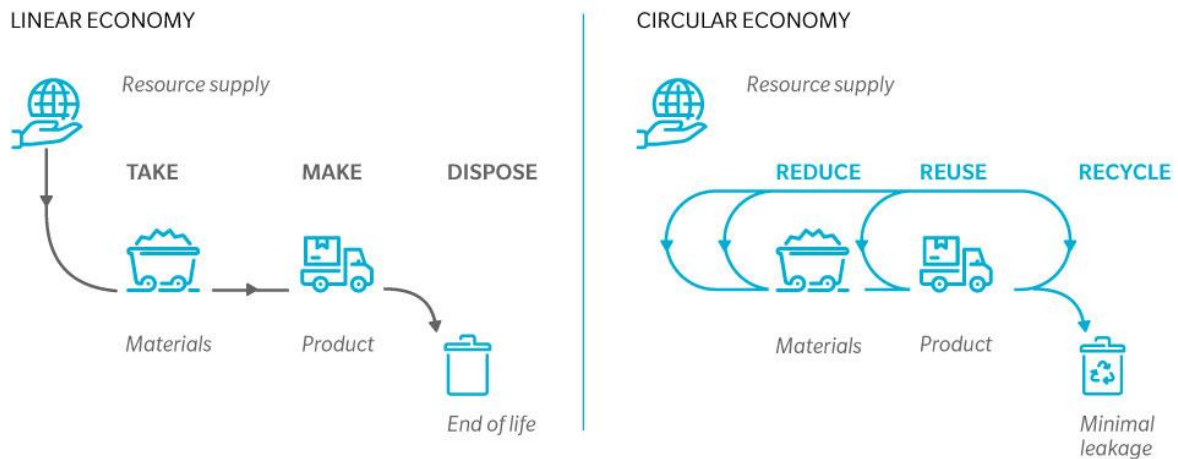


Figure 5: Linear vs. Circular Economy ("Supporting The Circular Economy Transition," n.d.)

2.2.2. Challenges and benefits of circular economy

In the last decade, there have been a lot of studies that have focused on finding the challenges that the organizations face, when they are aiming for incorporating CE in their business models. The presence of these barriers halts the transition from linear to circular economy, which in turn would be unprofitable for these firms, as CE has become part of the ever-changing trends in every industry. One of the recent studies identifies five barriers to CE. These include '*attitudes and knowledge*', where the lack of understanding over the concept of CE and its functions, make firms and the managers to resist a change from their traditional business structures. Next, we see that the '*integration between functions*' is a dominant barrier, as CE is too complex to be handled by a single department, and needs to be incorporated throughout the organization. Other barriers include '*value chain structures*', where we find that not all stakeholders in the value chain are involved in the CE strategy of the company. Finally, we have the '*values and finance*', and '*technology*' barriers (Ritzén & Sandström, 2017).

Other studies provide detailed analysis as to why firms resist a transition from linear to a circular economy. For example, Kumar and Suganya (2019) have mentioned financial expense and high complexity to be a major reason as to firm's neglect towards a CE-based business model. The practical approach to CE, including logistics of old material, storage and redesigning, always ends up being quite expensive for firms who would need to cut these expenses from their profits. Also, there is very few customers that would prefer to buy a recycled product than a new product, due to their perceived proportionality between new products and high quality. Finally, they also mention that innovative growth is hindered if a lot of resources are focused only on renewing the old (Kumar & Suganya, 2019). The authors have further classified these barriers into different sections based on the role they play

and their connection to the organization. There are 'internal barriers', which include 'technical, operational, financial, knowledge and information barriers'. Then there are 'external barriers' and 'societal barriers' as well.

The past decade has seen various changes around many industries, with the help of rules and regulations, regarding the environmental impact of the firm's businesses. But various barriers that are still hindering this move towards sustainability. These include inappropriate technology, low encouragement and support, lack of knowledge about design or products and processes, high capital and transaction costs, undesired loss of profits, and a lack of proper framework (Senthil Kumar & Femina Carolin, 2019). Another study by Veleva and Bodkin (2018) prove that a lot of challenges such as the complexity, measurement tools, and lack of coordination between various stakeholders, can be a reason why many firms don't support changing their business strategies. Also, the capital costs of the plants, personnel, equipments and resources, along with the huge responsibility of bringing all players in their supply chain are some of the dominant barriers. These complexities and financial burden can make them lose their customer base, have negative impacts on their prices, quality and market position (Veleva & Bodkin, 2018).

Finally, we find a lot of legal and regulatory difficulties that prevent firms to move towards CE practices. Small firms face a lot of pressure due to lack of funding, networks and government support. Most importantly, the lack of effective indicators to assess the sustainability of their companies and a lack of reliable information and research added with a lack of customer awareness about CE concepts, can some of the major obstacles faced by various companies (Veleva & Bodkin, 2018).

Despite all these challenges, there are also numerous benefits of adopting CE. Many firms have overcome many of the challenges presented above, and are now a front-runner in sustainability business strategies. One of the major advantages of a CE is waste reduction. As mentioned in the introduction chapter of this report, we have seen a huge rise in the amount of wastes generated by the world. This will only be increasing in the coming decades. CE is one of the strategies that would help the planet bear the pressure of the ever-increasing wastes, by investing in methods and practices that intend to increase the 'product-lifespan'. This would keep the products in the market for a longer time, and reduce direct disposal of 'usable' products.

According to the Ellen MacArthur Foundation (2015), there are three major benefits of CE: 1) there are opportunities for substantial material savings and companies would face reduced risk due to price fluctuations of raw materials in the market. 2) the potential for innovative ideas and entrepreneurial behaviour increases among the firms, thus allowing faster solutions to local and global problems. CE

also helps to boost the employment opportunities in the society. 3) there is an increase in the resilience of living systems and the economy in general (Ellen MacArthur Foundation, 2015). One of the major similarities between the principles of C2C and CE, is that both concepts believe that one system's waste should be utilized for production in another system, thus eliminating wastes and increasing the 'use-value' of materials.

Finally, we see positive effects on the environment when companies adopt circular strategies. The land productivity increases, the soil has better health, there is reduction in loss of flora and fauna, and the eco-system is balanced. From an economic perspective, we see huge savings for companies due to material reuse, and a better corporate social responsibility (CSR). From a social perspective we see higher community interactions, better customer relationships and higher satisfaction for users who demand sustainable products. To conclude, we see a high positive impact of CE from the social, economic and environmental aspects, although there are several challenges for firms to simply switch to a CE, but numerous solutions are being developed by some institutions, to overcome these challenges.

2.2.3. Institutions involved with circular economy

Various institutions are involved in the effort of bringing CE in the business practices of organizations around the world, in order to increase their involvement and also public awareness. One such institution is the Ellen MacArthur Foundation (EMF). EMF was founded by Ellen MacArthur in 2009, and is one of the major charity organization that is working towards research and development, implementations, guidance and financial aid for companies aiming to target CE. EMF has presented a number of reports on CE and has the parent institution, who has now brought together more than 100 big companies like Google, Unilever, Nike, Renault, along with leading technical institutions like TU Delft, Arizona State University, and many more, to work collectively towards a sustainable future. This group is collectively known as the CE100. EMF mentions that CE is based on 3 key principles: to preserve and enhance natural capital, to optimize resource yields and to foster system effectiveness (Ellen MacArthur Foundation, 2015). [Figure.6](#) depicts these principles in action, along with the various cycles of the 4Rs of *recycle, reuse, reduce and remanufacture*. The figure explains how, under CE, any product can be separated into *technical component* and *biological component*. Each of these cycles have different ways for closing the loop of materials. The cycle on the left represents the *biological cycle* and the one on the right is the *technical cycle*.

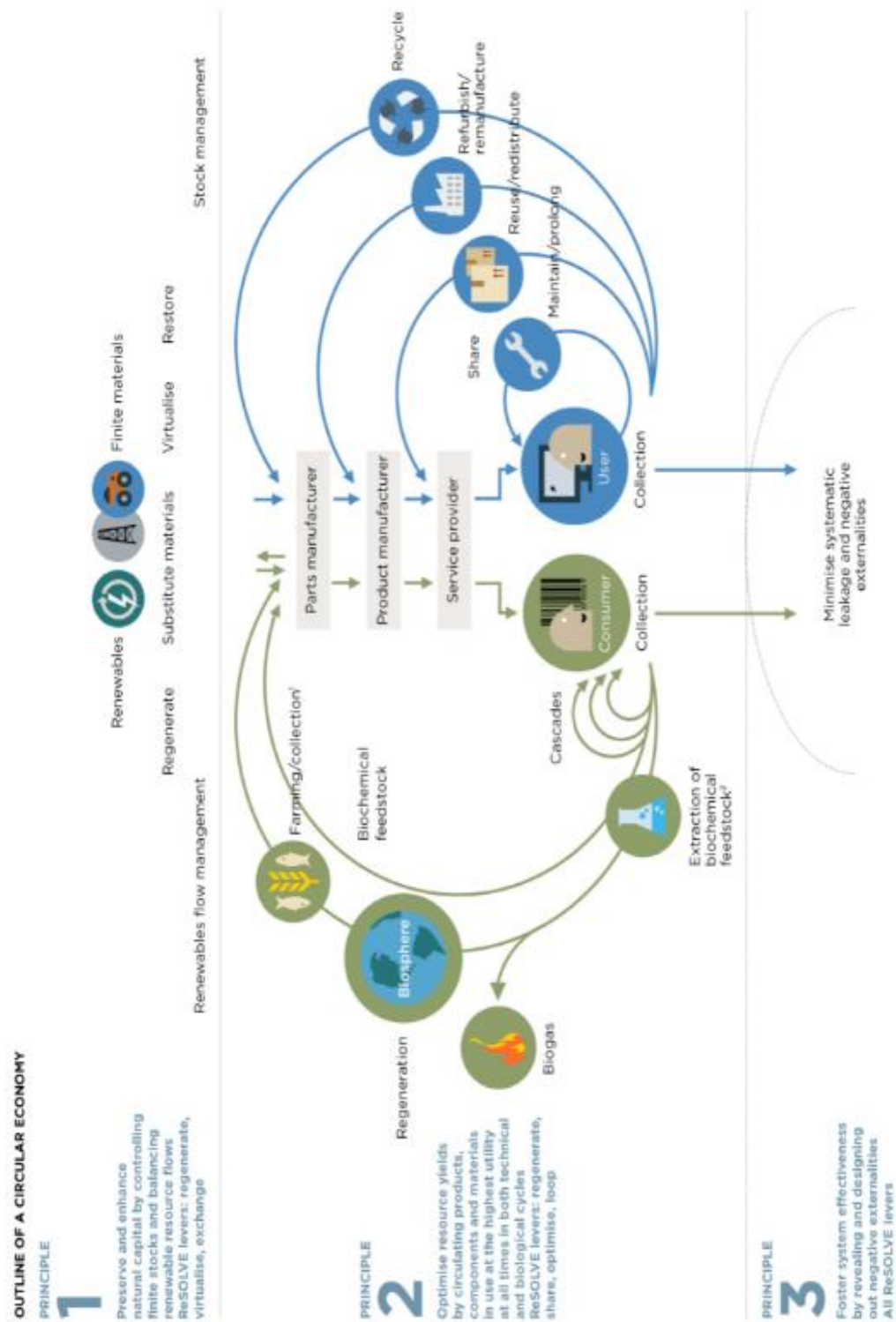


Figure 6: Circular economy system (Ellen MacArthur Foundation, 2015)

2.3. Cradle-to-Cradle

2.3.1. Explaining Cradle-to-Cradle

Cradle-to-Cradle (C2C) is a concept under the vast circular economy theory, which has its primary focus on maximum resource utilization. It is the positive transitional step from the more traditional '*cradle-to-grave*' material flow system that is the current economic model for many companies. The basic philosophy is to eliminate the preferred concept of doing '*less bad*', to doing '*more good*'. Thus, we see a transition from an '*eco-efficient*' business model of reducing the negative ecological footprints of a company's activities, to a more '*eco-effective*' model of increasing the company's positive footprint and doing things '*right*' instead of '*less bad*'. (Toxopeus et al., 2015). The concept was introduced by two authors, Michael Braungart and William McDonough, who defined C2C as "the design that defines a framework for designing products and industrial processes that turn materials into nutrients by enabling their perpetual flow within one of two distinct metabolisms: the biological metabolism and the technical metabolism" (Braungart, McDonough, & Bollinger, 2007) (Drabe & Herstatt, 2016).

Similar to the model for CE by EMF, shown in [Figure 7](#), there are two different metabolic cycles for materials under the C2C concept. Materials that are used in the products are classified into two categories: '*Biological nutrients*' and '*Technical nutrients*' (McDonough & Braungart, 2002). *Biological nutrients* are the materials that are so designed that they can be returned back to nature through soil, or air. These can also feed other environmental processes and are least harmful for the nature. (Bjørn & Strandesen, 2011) They can be returned to the biosphere by anaerobic digestion or composting. (Macarthur, 2012) Within the biological cycle, we see a wide variety of '*consumables*' such as paper, wooden furniture, etc. where we can see that the end of the use period for these products, would lead to the birth of a new product. *Technical nutrients*, on the other hand, comprise of materials that are finite in nature, and require intensive energy usage for extraction, processing and manufacturing. These are also very difficult to dispose and can really affect the environment. These nutrients are to be kept in endless product life-cycles, circulating in high quality loops without entering the biosphere, and can be continuously used for the next product. Some of these products are known as '*durables*', and include complex products such as computers and engines. (Macarthur, 2012) (McDonough, Braungart, Anastas, & Zimmerman, 2011)

A lot of studies have claimed that the concept of C2C is based on three principles that focus on the health, and environmental and economic impact of the products. These are 1) *Waste equals food*: this means that “all the materials should be seen as nutrients for the next product’s lifecycle, either as a biological nutrient or a technical nutrient” (Toxopeus et al., 2015). This means that all recyclable products must be designed with either technical or biological nutrients, as a mixture would make it really difficult for recycling companies to separate both nutrients and avoid wastes. 2) *Use current solar income*: this means that the energy that is required for any product must be from a renewable source known as ‘current solar income’, and which includes photovoltaic, geothermal, wind, hydro and biomass energy. 3) *Celebrate diversity*: this means that organizations must try to avoid a one-size-fits-all policy, and must cater to the diverse and specific demands of different individuals at different locations. This helps designers to increase focused positive effects rather than collectively reduce negative effects. (De Pauw, Karana, Kandachar, & Poppelaars, 2014) (McDonough et al., 2011) (McDonough & Braungart, 2002)

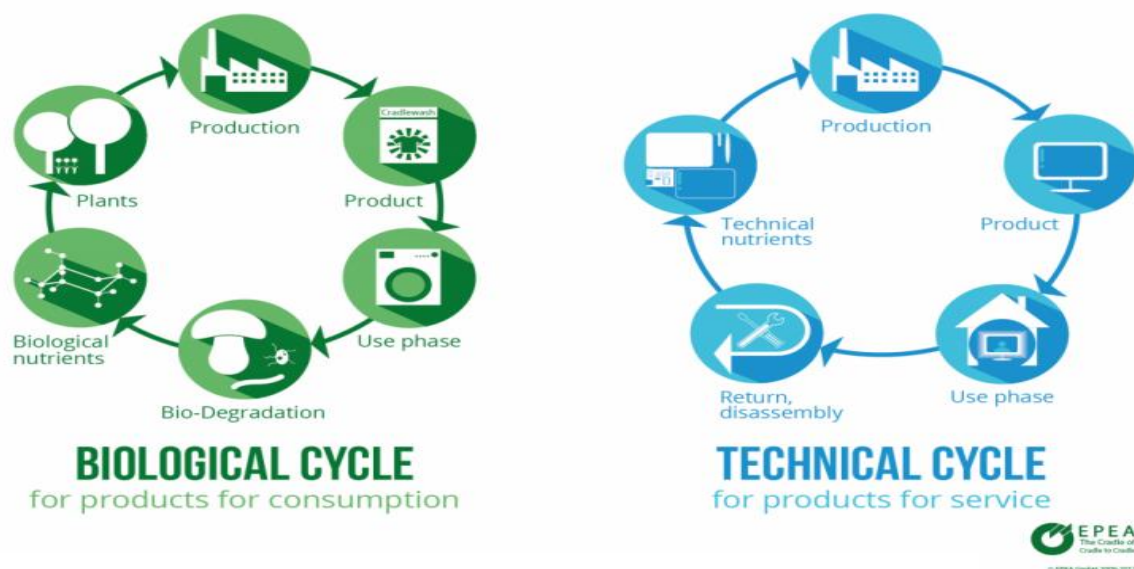


Figure 7: Biological vs Technical Material Cycles (“The Cradle to Cradle® design concept - EPEA,” n.d.)

The products must be designed in such a way that these nutrients can be separated and can join either of the two cycles, as shown in Figure 7. This would prevent wastes and also reduce dependencies on virgin raw materials in the manufacturing of new products. Although, today most of the products that are produced are termed as ‘*monstrous hybrids*’, which are the products that are made of a complex combination of biological and technical nutrients that are very difficult to separate (Helen, 2019). This makes the product useless after its use period as it can neither be recycled nor be reused. These products would be incinerated or sent to a landfill, which is one of the issues that the world is facing right now. C2C concept aims to avoid this waste by substituting harmful materials with the ones that

can be used endlessly in the product cycle. This is the reason why designing products according to either biological or technical nutrients, is one of main principles of C2C.

There are various objectives of the C2C concept that can be divided into three focus areas: *environmental, economic and socio-cultural*. From the *environmental* point of view, C2C primarily focuses on designing products for recycling, which means that the materials can be extracted from the wastes and be used in new products. Also, it necessitates the use of renewable sources of energy for the production process, which ensures that fossil fuels and other non-renewable sources of energy are preserved for future use. Secondly, from an *economic* perspective, we see that following the C2C guidelines will help the companies increase their profits and give them an edge over their competitors in the coming years. It increases the customer preference for their products and also helps to boost regional or local economic development. Finally, from the *socio-cultural* aspect, we see that these products increase the quality of life and the lifestyles of the customers, while promoting cultural diversity and facilitating the development needs of the community (Ankrah, Manu, & Booth, 2015). Thus, we find that there is obvious positive growth to the companies and the society by adopting C2C product cycles.

2.3.2. Standards and certification

Similar to the Ellen MacArthur Foundation (EMF) promoting circular economy among corporations and governments, the Cradle-to-Cradle Product Innovation Institution (C2CPII) is the institution that provides certification services for companies that wish to certify their products as C2C products. The certification process is explained in detail in the next sub-section. Apart from the certification institute, there are two other consultancy companies who can partner with the organizations that are in the process of certification. These two companies, which were founded by the founding fathers of the C2C concept, William McDonough and Michael Braungart, are Environmental Protection and Encouragement Agency (EPEA) and McDonough Braungart Design Chemistry (MBDC). These companies help any firm, from start-ups to incumbent firms, to prepare for the certification process, by getting all the paperwork ready. All the details and proprietary knowledge about the production processes of these firms are bound in individual non-disclosure agreements (NDAs), which allows for more transparency and information flow.

2.3.3. C2C Certification process

The certification process is a long and tedious process where the companies have to explain the detailed composition of the various materials that are part of their components or products to the C2CPH. Thus, we need proper documentations regarding the materials and the composition of the products from external suppliers as well, if necessary. The certification process evaluates a product in five different segments: *material health*, *material reutilization*, *renewable energy*, *water stewardship*, and *social fairness*. We will now discuss these segments in more detail.

The *material health* describes the exact chemical composition of the product, in order to classify them into biological or technical nutrients. This also helps to qualify the materials according to the harmful effects they might have on humans and the environment, during the use-period and after end-of-life. Next, we see *material reutilization* ensuring that the materials used to design the products are 'designed for recycling'. This means that there should be a large amount of safely renewable or reusable materials, in the manufacturing of the products. Third, we see that the production processes only use *renewable energy* sources such as solar, biogas, and wind energy, which ensure there is less wastage of non-renewable energy sources such as fuel, and also means a reduction in the carbon footprint of the product. After this, we have *water stewardship*, which tries to ensure that water is only used from locally available water sources and ensure that no harmful chemicals are added during the use of water. This ensures that the quality of water remains harmless even after use in the production process. Finally, we see *social fairness* of a product, which means that there is a positive impact on everyone involved with the manufacturing of a product, including the employees, stakeholders, partners and customers.



Figure 8: The 5 factors for C2C certification ("About the Institute - Cradle to Cradle Products Innovation Institute," n.d.)

The overall level of certification is provided based on the individual performance of the product in each of the five segments. The lowest level to be assigned is the *basic* level, which means that the product has just managed to reach the minimum required conditions in the specific segment. The next is *bronze*, *silver*, *gold* and finally the *platinum* level, which are assigned accordingly for reaching a specific level of achievement. The lowest level assigned in any of the 5 segments would be the overall certification level. As the process involves continuous improvement of material performance, the assessment urges companies to keep upgrading their level of certification to the next level. [Figure 8](#) shows an example of a product certification.

2.3.4. Challenges and benefits of C2C

Although the concept of C2C would surely bring about positive improvements to the companies, society and the environment, there are a few critics that believe the concept has to develop more to reach a mature stage of global application and large-scale adoption. One of the major issues with C2C is that it does not consider energy efficiency to be a factor under consideration, as the primary goal for C2C products is effectiveness. So, as long as the production process uses renewable sources of energy such as solar or biomass, the process would be C2C certified, no matter what amount of energy is consumed. This is a serious problem, as even with renewable energy sources, large amount of usage would be a loss to the firm and the planet. The other issue with C2C is the scale of the reverse loop. The products could be designed to either fall in the technical or the biological cycle but the volume of products that are recovered is always too small for large scale companies to implement and it might not be totally practical for them to adopt C2C. There can be various reasons why these companies are unable to recover the products that they have sold, as the products use period varies with different customers, the products might be sold back to other recycling companies, or customers might find it inconvenient to return the individual products to the collection points and would much better prefer throwing it in the waste (Bjørn & Strandesen, 2011).

Bjorn et. al. (2011) further go on to explain these limitations of the C2C concept. Firstly, it is thermodynamically impossible to recycle and separate 100% of the technical and biological nutrients. Life-cycle Assessment (LCA) of these products would show that a large amount of energy would be required to separate these nutrients and some of the materials would always be unrecovered. They also point out the fact that, according to the C2C concept it is important that the biological nutrients be returned back to the nature, but they do not always add nutrient value to the environment. They say, “any manipulation of natural systems would result in a changed species composition, a decrease

in species numbers, and in the worst case, a loss in biodiversity” (Bjørn & Strandesen, 2011). Finally, they suggest that it is not practically and economically possible to completely eliminate the need for virgin resources in the manufacturing process, as the quality of recycled materials keeps decreasing with every use (Bjørn & Strandesen, 2011).

Other challenges related to C2C is the lack of methodological implementation strategies for large-scale commercialization. As the concept is a fairly new concept, many companies have developed firm-level strategies for their companies and there is still little knowledge for entire industry-level application. Also, there are no measurability standards for checking the effects of C2C implementation on the business model and company’s profits. Finally, we find that not all companies have direct knowledge of the exact constituent materials in their products, which necessitates the need for intermediate consulting agencies like EPEA and MBDC (Drabe & Herstatt, 2016).. Other major challenge with C2C is that many companies don’t fully understand the practicability of the rules and regulations set by the assessment institutes, and are mostly unwilling to disclose proprietary knowledge to third party institutions, who might also be consulting their market competitors. (Toxopeus et al., 2015).

The introduction of C2C in the market has opened up various new opportunities for the companies that are interested to adopt sustainability. One of the advantages of C2C is that it gives the companies a new perspective for product development, that can help them get an additional advantage over their competitors, and increased customer attraction. It forces firms to think outside the box for strategies, and go beyond existing standards, that can help them bring back their products and help them design them in a way that is recyclable. This helps to set new industry standards for innovation, production, usage and disposal strategies. Also, we see that the guidelines to use alternative and less harmful materials to replace the hazardous ones, contributes towards setting out a positive ecological and environmental footprint for the company. When the design of the product considers disposal and recycling in the early stages itself, it reduces the complexity of product development and can help increase company profits (Drabe & Herstatt, 2016). Finally, we also see that C2C has become an inspiration for various companies that are *‘going green’*, as the principle value of the concept is material reutilization. Resource dependencies and energy usage would reduce dramatically, and the C2C also provides an actionable framework for positive and eco-friendly development (Bakker, Wever, Teoh, & de Clercq, 2010).

Part 2

Answer to sub-question 2: *What are the existing PSS models in practice?*

The second part of the chapter will focus on the current business model structures and the product-service systems that are in practice around the world. We initially start with various types of the business model structures that are available in the scientific literature and are in practice among businesses around the world. These are divided into circular business models and sustainable business models. These frameworks present the existing knowledge about the various strategies that companies can adopt, to incorporate circular or sustainable strategies in their business models. The Triple Layered Business Model Canvas (TLBMC), which is one of the important concepts in our research, is also explained in detail in this part. Finally, we would discuss the existing knowledge on the product-service systems.

2.4. Recommended business model structures

According to Valkokari et. al. (2018), there can be two differing types of business model when sustainability is a factor. These are circular business models and sustainable business models. Thus, we would also divide the available literature on business models into these two classifications (Antikainen & Valkokari, 2018) (Geissdoerfer, Vladimirova, & Evans, 2018).

2.4.1. Circular Business Models (CBM)

Various authors have tried to suggest new business processes and structures that can help to incorporate CE in the company's business model. One of the authors has suggested the concept of '*Product Stewardship*' (PS), where they try to promote resource conservation through initiatives mandated by the government or the industry, where they make agreements between two parties to work sustainably (Jensen & Remmen, 2017). The authors further go on to suggest three different manufacturing industries where the concept of PS has been successfully implemented. In the automobile industry they put regulations on the manufacturing companies to provide environmentally friendly procedures for dismantling and recycling. This ensures that the industry maintains a 'closed-loop-recycling', where the materials go back into the company after use, to support production. (Jensen & Remmen, 2017)

Jensen (2017) also recommends the use of management information systems such as '*Product Life Cycle Management*' (PLM) or '*Enterprise Information System*' (EIS), where the manufacturers can share information on product and the materials that are used manufacturing of the product, with the recyclers to improve the management of products and resources after their end-of-life. "Digitalization

in the form of EIS can potentially support the integration of PLM to share information such as the material composition of products to stimulate high-quality recycling or better reuse of components or products” (Jensen & Remmen, 2017).

Another alternative to the conventional business model structure is the involvement of small entrepreneurial companies in maintaining the sustainability value of their business. These corporate-entrepreneur collaborations help the big companies to not face a disruptive change in their business model, but still maintain a relationship with nature. These entrepreneurs are partnering with corporations to increase product life and reduce waste (Veleva & Bodkin, 2018). The authors believe that introducing CE is a major challenge for well-established companies and thus, the task must be out-sourced to the entrepreneurial firms that can afford to take big risks and high uncertainty. The barriers to CE, mentioned previously can be overcome by the entrepreneurial firms as they are more dynamic and autonomous. In return, the big corporations can provide funding, equipment and resources to these small firms. This partnership can help the business move towards higher sustainability.

Finally, we find the structure that provides the exact procedure that an organization has to take in order to move towards a more circular business model. The procedure is divided into five steps: preliminary identification of available options for circular economy; further in-depth research into these options; exploring the possibilities of changes to be made in the product or service; redesigning the product or service; implementing these changes in business model and entire organization (Jørgensen & Remmen, 2018). These steps help to prepare a pathway for any organization to enter the world of CE. There are three different types of redesign strategies suggested by the study: redesign of services, value chain relations or the internal business organization. Using these strategies, an organization can build their CE measures, based on the clear idea about their organization and considering multiple stakeholder’s values. This phenomenon, also considered as ‘circular economy journey’ of an organization, would be the base for our study and we will build our measures accordingly for our firm in focus.

2.4.2. Sustainable Business Models (SBM)

In contrast to the available literature on circular business models, we find a lot of authors that suggest a systematic approach towards incorporating sustainable strategies into the company's business model. One of the most appreciated works in sustainable business model is by Schuit et. al. (2018), where they suggest the framework for an SBM canvas. They divide the business model into five parts: Purpose, Value proposition, Value creation and delivery, Value capture and Field test (N. M.P. Bocken, Schuit, & Kraaijenhagen, 2018). Various other authors have also suggested this segmentation of a company's business model (Tunn, Bocken, van den Hende, & Schoormans, 2018), (Ranta et al., 2018), (Geissdoerfer, Morioka, de Carvalho, & Evans, 2018), (Sousa-Zomer, Magalhães, Zancul, & Cauchick-Miguel, 2018), (Richardson, 2007). The framework is shown in [Figure 9](#) and we would also explain each part of this framework separately:

- Purpose: This defines why the organization is considering the strategy and measuring the progress in terms of business, environmental and societal goals.
- Value proposition: Theoretical representation of what the company aims to do, the product or service that they are going to provide, that will give them competitive advantage over other companies in their market. This also includes environmental and societal impact.
- Value creation and delivery: This describes how the company is going to turn theoretical claims to practical application. This involves the consideration and the impacts on all the stakeholders in the company's activities. It also describes the firm's resources and capabilities along with the organization and structure of the company.
- Value capture: This part is related to the firm's revenue model. It specifically defines how the company is going to generate profits from the products or services that it is selling. The company must be able to capture value for all the stakeholders, in order to satisfy everyone, or else it might have a negative impact on the firm's performance due to neglected collaboration. The sources of revenue can include providing customers with products, services and information, or exchanging resources and capabilities with other firms.
- Field tests: The strategy is implemented on real customers and feedbacks are used to improve the quality of products and services.

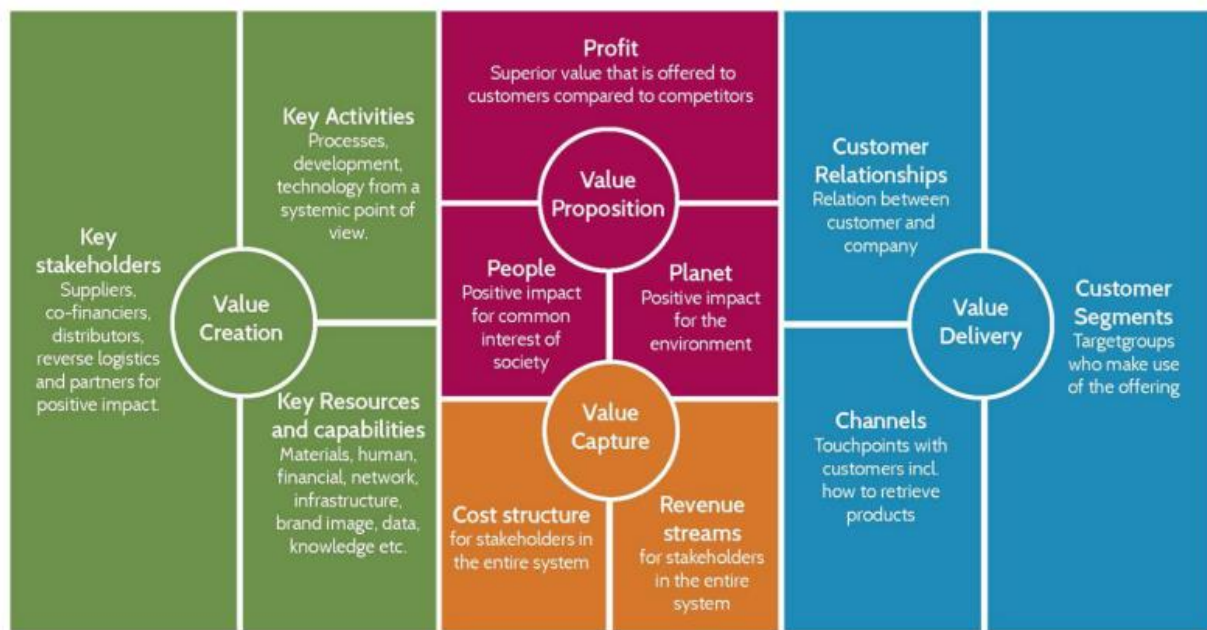


Figure 9: Sustainable business model framework (N. M.P. Bocken et al., 2018)

The other sustainable business models that are available in the literature also follow similar principles of defining a methodological approach towards adopting successful SBMs. According to Valkokari et. al. (2018), the SBM framework must include several important perspectives: it must understand the drivers and barriers associated with the adoption of the company's strategy at the eco-system level, including the stakeholders and value chain partners. This is part of the research that would be conducted in this paper. Secondly, the model should understand what value it is creating for these stakeholders and partners and how can it help increase it with their strategies. Finally, the framework must also be able to measure the impact of sustainability and circularity that the new strategies would be creating for the company, in order to measure the progress of the company towards achieving an SBM (Antikainen & Valkokari, 2018).

There are eleven elements that are identified among the three sections of the SBM framework: value proposition, value creation and delivery, and value capture. These are shown in Figure 10. The business elements can be used to develop the sustainable framework that the company aims to build.



Figure 10: Business elements for SBM framework (Tunn et al., 2018)

2.4.3. Triple Layered Business Model Canvas (TLBMC)

A recent study in the development of sustainability driven business models, we find the triple layer business model canvas (TLBMC). While most of the traditional business model frameworks are focused mainly on the economic impacts of an organization's business model, the TLBMC adds two additional layers to the framework, to incorporate the triple bottom line concept mentioned in many of the scientific literature. The triple bottom line means that impact of an organization is not only looked from an economic perspective, but also from a social and environmental perspective (Braungart et al., 2007). Thus, we now have a social and environmental layer for the business model framework. The TLBMC helps to overcome challenges faced by organization's trying to develop sustainable innovations, by being a visual representation of the organization's business model, by being a creation tool for development of potential sustainability-driven innovations, and by being a validation tool to find relevance with the organization's traditional values (Joyce & Paquin, 2016).

The environmental layer was developed by incorporating components of Life-Cycle Assessment (LCA) into the framework, as LCA gives the most appropriate indication of the organization's environmental impact, based on different factors. The social layer on the other hand was developed to involve Stakeholder Management (SM) practices into the business model framework, to "balance the interests of the organization's framework" (Joyce & Paquin, 2016). Thus, this framework helps the users to first analyse the current business model and understand the organization's impact in the social, economic and environmental perspectives, and secondly to explore how various possible innovations can help develop the existing business model, to improve these impacts. The TLBMC would be part of our results, showing how the current business model looks like, and how the business model would look if there is a PSS model introduced by the organization.

The three layers of the TLBMC is shown in detail in [Figure 11](#). The individual elements of the TLBMC are explained in detail, in [Appendix- 2](#).

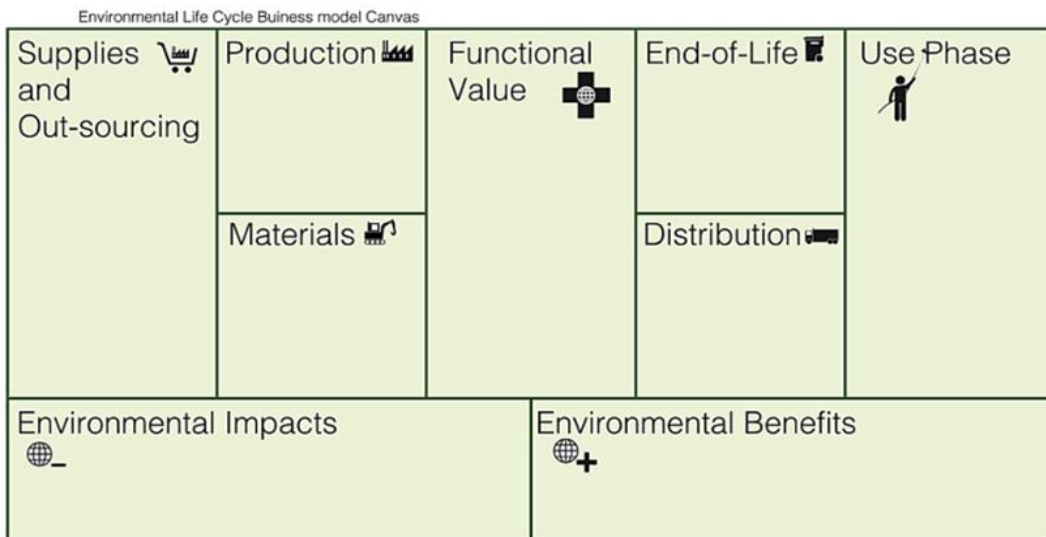
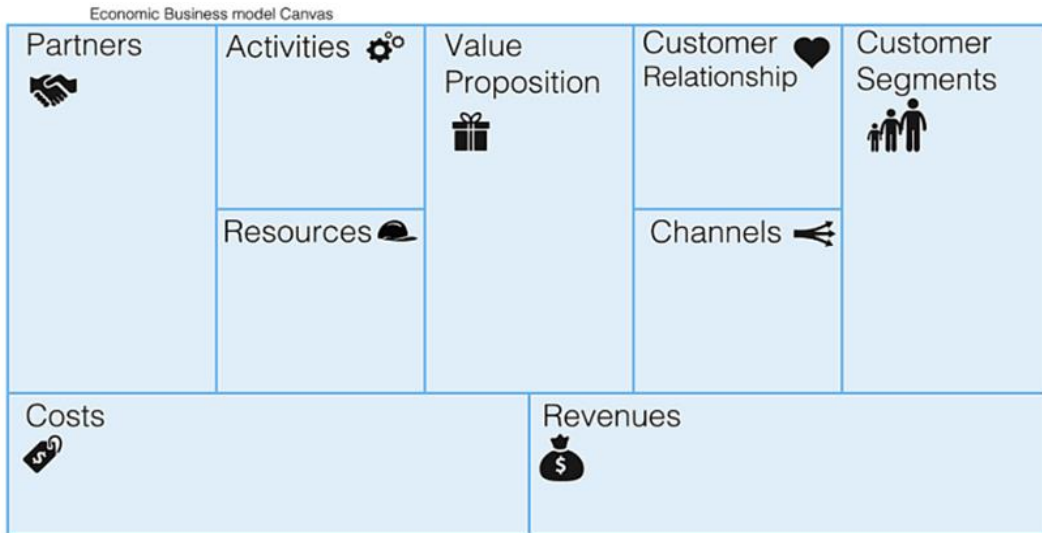


Figure 11: The three layers of TLBMC (Joyce & Paquin, 2016)

2.5. Product-Service Systems (PSS)

2.5.1. Explaining PSS

The business model that involves a systematic combination of selling both products as well as a service, are known as Product-Service Systems (PSS). This type of models require intensive collaboration between suppliers, manufacturers, distributors and service providers, to provide maximum customer satisfaction (Kuo, Chiu, Hsu, & Tseng, 2019). It is a shift from the more traditional '*selling model*' to the modern '*leasing model*'. Products are provided to the customer and are valued for their performance and functionality, rather than upfront manufacturer's cost. Basically, customers pay for the functional use of the product, while the manufacturer retains the ownership of that said product. These types of business models have their own barriers and drivers for both parties involved.

Product-service systems (PSS) are an integrated system of products, services and infrastructure, with the involvement of all the stakeholders, along with addition of business units and activities. This entire system constitutes of various units that are an important part of the product's value chain. It is an offer, provided by the company, that includes services such as insurance, maintenance, repair and end-of-use take-back (Ceschin, 2013; De Pádua Pieroni, Blomsma, McAloone, & Pigosso, 2018; Romero & Rossi, 2017; Tran & Park, 2014). One of the main advantages of the PSS is that companies can provide customer-specific services, catering to the specific needs of each customer, rather than a generic, one-size-fits-all solution with the traditional 'product' system (Raihanian Mashhadi, Vedantam, & Behdad, 2019).

There are various opportunities for the company that incorporate a PSS model. Firstly, they have a reduction in the amount of resources that they consume, as the product's ownership is retained by the manufacturer, and thus they have an incentive to extend the product's lifecycle as much as possible. They have new economic possibilities to extend their end-of-life solutions to recycling or reusing, as they have better track of the products that they sell. This also gives them a strategic advantage in the market, over their competitors (Vezzoli, Ceschin, Diehl, & Kohtala, 2015). On the other hand, the customers find this model to provide them relief from high upfront investment costs for product ownership and they don't have to face maintenance costs. This opens up a whole new market segment of the lower income strata, that can now afford the services of the products at a monthly rent. The increased importance of customers also helps to boost local economy, as this model is both labour intensive and resource efficient (Vezzoli et al., 2015). [Figure 12](#) shows the difference between a selling and a leasing model.

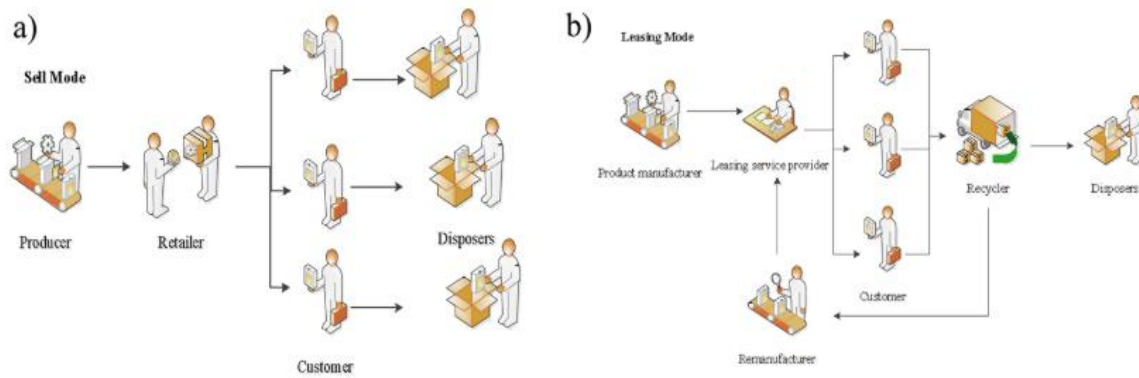


Figure 12: a) Selling model b) Leasing model (Kuo et al., 2019)

Apart from the opportunities, we also find a lot of barriers associated with the PSS model. Firstly, the model is too complex and expensive to be implemented by small and medium sized enterprises (SME), as it requires additional resources, competencies, etc. we see internal conflicts in the business functions regarding selling or leasing the products, as the leasing model clearly requires huge upfront costs for the manufacturing of products, and low profit margin in the beginning. This also creates conflict amongst stakeholder and shareholder, who see profits as the top priority. Similarly, for customers we see various barriers in the application of PSS. Firstly, we see that the majority of customers lack knowledge about the advantages of the leasing model. Many of them find ownership as a sense of satisfaction for their quality of life. Other barriers include privacy issues and a sense of invasion into the lives for various customers, when they allow for companies to track the exact usage data of their products. Further studies have also shown a great sense of acceptability by various business-to-business (B2B) customers, as it transfer responsibility of the products from them to the manufacturers (Vezzoli et al., 2015).

There are a number of complexities that are generated when a manufacturing company prepares for a shift from the traditional ‘selling’ model to a ‘leasing’ model. These can be categorized into four major types. 1) *Multiplicity*: the number of units, activities and actors required in the system would increase. 2) *Diversity*: the increasing number of these components, increases the variety involved. 3) *Interdependence*: there is an increase in inter-relationships between these units. 4) *Variability*: the units, activities and actors are all subject to change over the life-cycle of the product (Zou, Brax, & Rajala, 2018). These complexities would also be the focus during discussions with the experts, in order to find appropriate solutions, to avoid becoming unnecessarily complex.

2.5.2. Types of PSS

Tukker (2004) has identified 3 different classifications of PSS. These are further divided into 8 different types of PSSs, as shown in [Figure 13](#) (Tukker, 2004):

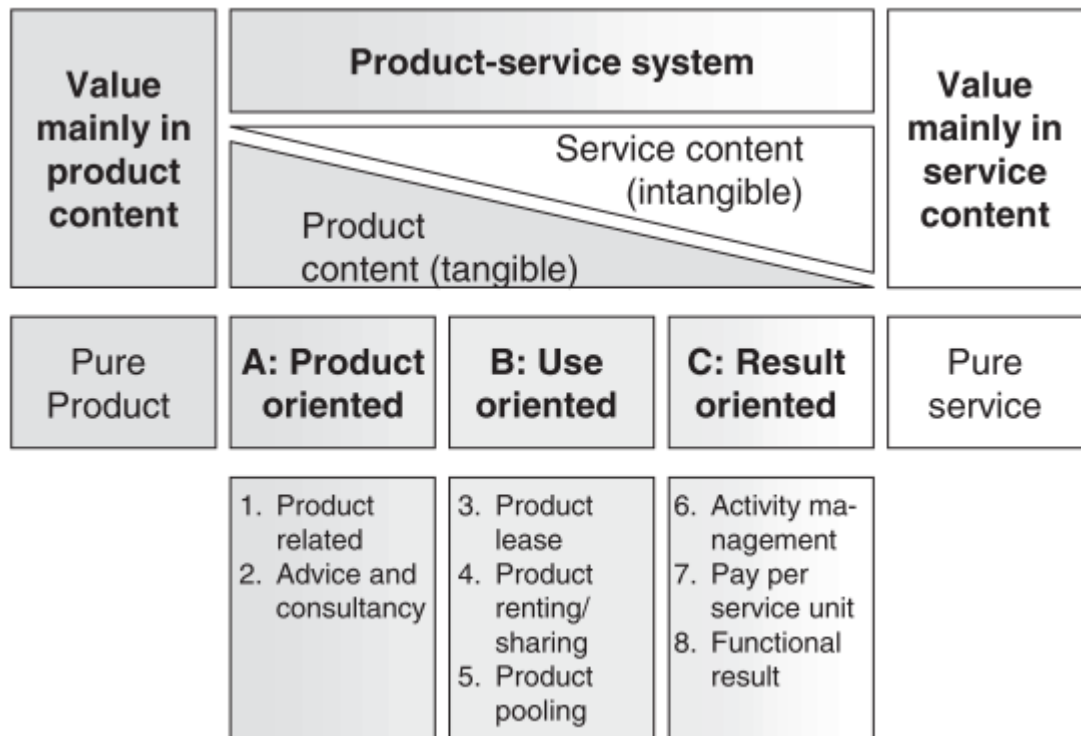


Figure 13: Types of PSS (Tukker, 2004)

The various types of PSS are explained in detail:

1. Product-oriented PSS

- 1.1. Product-related service:** The provider offers additional services along with the products, such as a maintenance contract, financing schemes, and take -back programs.
- 1.2. Advice and consultancy:** The provider would give advice on the most efficient use along with selling the product, like advice on organizational structure of the team using product, or optimizing the logistics in the factory where the product is being used.

2. Use-oriented PSS

- 2.1. Product lease:** The provider keeps ownership of the product and is also responsible for maintenance, repair and control. The lessee pays a regular fee for the use of the product. They have unlimited and individual access to the product.
- 2.2. Product renting/ sharing:** The provider keeps the ownership of the product and is also responsible for maintenance, repair and control. User pays monthly rent for the use of

product. No unlimited and individual access, other users can sequentially use the product at other times.

2.3. Product pooling: It is same as product renting/sharing, but products are simultaneously used by various users.

3. Result-oriented PSS

3.1. Activity management/ outsourcing: A part of an activity of the company is outsourced to third-party. For e.g. the outsourcing of catering and cleaning services to other companies.

3.2. Pay per service unit: User doesn't buy the product, but instead the output of the product according to the level of use. For e.g. pay-per-print model for copiers. The provider takes responsibility of the efficient working of the product and the user pays for the use rather than the product.

3.3. Functional result: The provider agrees with the client about the delivery of a result. The functional result is rather an abstract term and the provider is free to do anything for the result. For e.g. company promising a 'pleasant climate' instead of gas or cooling equipment. Here the company would be free to provide a pleasant climate by any means, regardless of winter or summer. This saves the users money to invest in heating and cooling equipment separately each year. Also, it saves provider money as they can find innovative and long-term solutions for the companies.

It has been found that product lease, product renting/sharing and product related services have been most recurrent when companies were trying to adopt circular strategies with a business model innovation. Also, it has been proved that result-oriented PSS, specially functional result type has highest capacity to decouple economic growth with resource consumption (De Pádua Pieroni et al., 2018).

Despite being a challenge to well-established manufacturing companies, a lot of studies have shown that PSS is one of most appropriate solution to overcome the barriers related to CE and towards a more sustainable world (De Pádua Pieroni et al., 2018; Raihanian Mashhadi et al., 2019; Romero & Rossi, 2017). Thus, a PSS model for cradle-to-cradle certified products is an appropriate alternative to the much traditional linear model, and would be the focus of our research.

2.6. Summary of Literature Review

Answer to sub-question 1: *What is the current state of cradle-to-cradle product certification process?*

Currently, the certification for cradle-to-cradle is provided by Cradle-to-Cradle Product Innovation Institute, for any products, across any industry. The manufacturing companies need to submit the required documents to the institute, and they can get their product certified. The certification is based on five criteria: material health, material reutilization, renewable energy, water stewardship and social fairness. Based on the individual levels achieved in each of these criteria, we get the overall certification level. These are: basic, bronze, silver, gold and platinum. Once the certification is done, the certificate would be valid for a maximum period of two years, after which, the company can reapply for a new certificate. Depending on the developments and innovation by the company about its products or processes, the company can get the same level of certification, or probably an upgrade.

Answer to sub-question 2: *What are the existing PSS models in practice?*

In order to adopt to sustainable practices and circular strategies, companies need to get rid of the linear business model and try to look for alternative circular business model. We found various types of circular and sustainable business models explained in the literature. One of the most recent types is the product-service systems, or the provision of services along with sale of products. these strategies help companies to maintain constant contact with the customers, and also try to improve their sustainability impact. After looking at the importance of product-service systems, we see the different types of PSS models that are in practice currently. These were explained in detail, and we have found from previous research, that a 'product-based service contract' fits best with the product characteristics similar to Hunter Douglas products, made-to-measure designer products.

Based on the literature available on the concepts of C2C and PSS, we see how the literature shows a research gap, and we discuss that in the next section.

2.7. Research Gap

We have seen that there have been various studies regarding CE and its implementation in different companies across various industries. C2C is a fairly new concept and there is very little research done on the topic. There are a number of institutions that are working actively towards promoting C2C in a number of companies. The knowledge gap is presented when companies do get their C2C products certified, but then are unable to commercialize it to a large scale, across various subsidiary firms and supplier. This is probably due to lack of opportunities and lack of knowledge in the market. There are numerous other barriers to such a change, which is still a valuable area of research for the manufacturing companies. These barriers can be found mostly in the extended value chain of a manufacturing company, that might include the suppliers, wholesalers, retailers and dealers. In order to overcome these barriers, it is necessary to have incentives in place, that can compensate for the resources and efforts needed for a change. All this knowledge will be gathered by directly interacting with all the stakeholders in an organization's value chain. This exactly would be the backbone of our research at Hunter Douglas.

Also, the second part of the report that would focus on the feasibility of a PSS for the cradle-to-cradle products, we see that there is a lot of research done on the PSS concept, but there is very less attention to the application of the concept, with the combination of C2C products. The process of introduction and diffusion of both these concepts together still needs to be studied (Ceschin, 2013). Thus, applying PSS principles to C2C products would be an interesting approach for our research.

The scientific contribution to the literature base, and the research gap we are trying to fill, is "The possible business strategies for large-scale commercialization of cradle-to-cradle products". There is enough knowledge on getting a C2C certification, and also firm-specific cases about their commercialization, but no industry-wide sustainable business strategy is available for new firms trying to adopt the C2C concept. In this study, we would be assessing the acceptability of a PSS business model instead of the much traditional linear model, specifically for the C2C certified products. The combination of C2C products with a PSS business model is an interesting approach and a major contribution to the literature available on both the topics.

The current status of the project at Hunter Douglas and the requirements for further development would be discussed below:

2.8. Project status quo

1. The focus of our report would only be on the European division of the Hunter Douglas company. As the brand name identified in Europe is Luxaflex, the company would henceforth be mentioned as '*Luxaflex*' in the report
2. Currently, the three products mentioned before are all cradle-to-cradle bronze level certified.
3. Only the product management and purchasing department are well aware of the cradle-to-cradle certification and the process.
4. Sales and marketing are still unsettled to adopt these cradle-to-cradle products.
5. There is little information about customer acceptance and demands for these certified products.
6. The current business model is based on the traditional linear model of take-make-dispose. This is against the definitions of circular economy or cradle-to-cradle concepts.

2.9. Project requirements

1. Luxaflex is hoping to achieve higher levels of certification for the products (like silver and gold).
2. Luxaflex wants the entire organization to be aware of the cradle-to-cradle certification and the processes, to ensure its application on other products in the portfolio as well.
3. Luxaflex needs strategies, to be adopted by the sales and marketing department, for large-scale commercialization and high marketability of these products.
4. They need information about customer acceptance, by involving the dealers in the research, as they are the point of contact with the customers of these products.
5. Various studies suggest a shift to the radical business model innovation of a service model, in order to shift to a circular economy of take-make-use-reuse. Luxaflex wants to understand the feasibility of a service-based business model, or a product-service system (PSS).

2.10. Foundations of the project

Now that we have seen the requirements of the company, we would discuss how we would lay the foundation of the project. In order to reach the company requirements of moving higher in the levels of certification of C2C, we have to first see which of the five criteria of C2C certification, mentioned earlier, we can focus on. We select 'material reutilization' as the criterion of focus. Material reutilization means "how much of the materials used in a product, can be used again for a new product?". It means elimination of wastes and finding solutions for disassembly and reuse of materials in the product. We need product innovation like Design for Recycling (DfR) for achieving higher certification here. But, before we invest our resources and energy in product innovation, we need to first see if we would be able to take-back the products that we sell. We can always invest directly in increasing the reusability of the materials, but there would be no benefits if the products still keep going in a linear path of use and disposal, and we don't extract value from our efforts. So, first, we look for strategies to actually bring the product back to us. We must check the feasibility of such a strategy with our entire value chain to come up with a successful solution. While researching for this feasibility, we would come across several barriers or issues faced by the various stakeholders involved, which would help us build strategies. Also, take-back of the products is difficult unless you have a product-service system (PSS) in place with the consumers, because unless we have provision of services along with the product we sell, it would be really difficult to keep track of our products, and also convince the customers to send the product back to us. Thus, we would also look which of the PSS would suit best for initiating successful take-back and recycling of old products. We would concentrate on the initial steps, to move patiently towards achieving the company's desire to achieve gold level certification. This process is shown in [Figure 14](#):

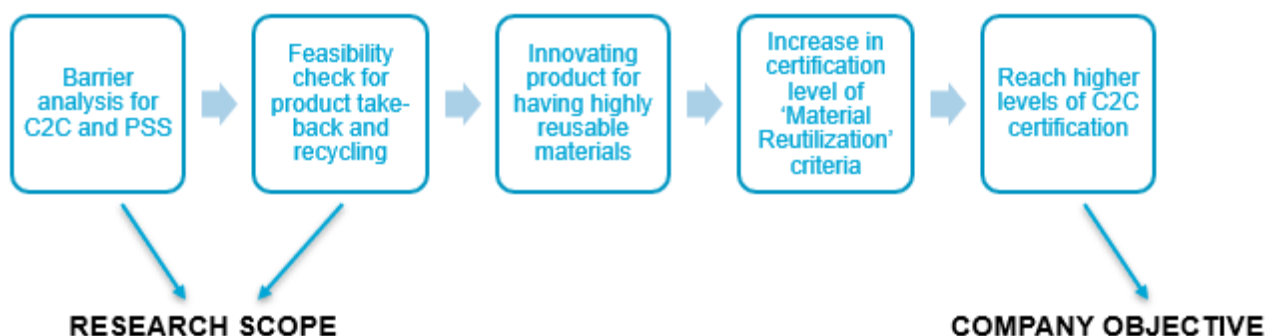


Figure 14: Project foundation

Chapter 3: Methodology

The following chapter would discuss extensively on the methods that would be used to answer the research sub-questions. The figure above shows the process diagram that would link the research sub-questions with the methodologies used for finding data. Furthermore, the chapters would be decided for each sub-research questions, and that would finally build-up to the results of the research.

3.1. Research Design

The research design is discussed in this section of the report. It is important to prepare the reader of the report with the description of the research design, to explain about what can be expected from the results of the research. There are several elements of a research design, based on the book by Uma Sekaran and Roger Bougie (2016), that would be explained here (Sekaran & Bougie, 2016):

- Research strategies: The research strategy is the organized strategy that would help us to answer the research question and the sub-questions. Our research strategy here would be a *'Survey Research'*, where we will collect the opinions of the respondents, to gather information about various concepts in the study.
- Purpose of study: In our research, we are trying to understand various ideas that have not been researched yet. We are trying to understand how various concepts can co-exist to provide positive boost to a company's business model. We would have extensive preliminary research into the topics, to understand the recent developments in the field of these business strategies. Our research would be a *'Qualitative research'*, as we would be conducting interviews for data collection. For the reasons mentioned above, we understand that our study would be an *'Exploratory study'*.
- Type of investigation: The study here would be a *'Correlational study'*, as we are just identifying the description of important factors, with respect to certain modern technological developments.
- Extent of researcher interference with the study: The extent to which the researcher is interfering with the natural working flow of the system is important to understand how much influence will the research process have on the environment of the setting. In our case, the extent of researcher interference would be *'Minimal'*, as the study to be conducted is a Correlational study, i.e. conducted in the natural environment, with nominal interference with the flow of events of the system.
- Study setting: As mentioned above, the study would be done with minimal interference, and thus the study setting would be in a *'Non-contrived setting'*, where the events proceed

normally without disturbance. As our study would be in a non-contrived setting with minimal interference, it can be called a '*Field study*'.

- Unit of analysis: in our research, we would be collecting data from individual respondents in various companies, and analysing their responses as individual data sources. Thus, the unit of analysis would be, '*Individuals*'.
- Time horizon of study: Our study would be conducted over a period of six months. The data would be collected over a period of four weeks, and would be gathered only once for each respondent. Thus, this would be a '*Cross-sectional study*'.

Figure 15 shows the research design in detail.

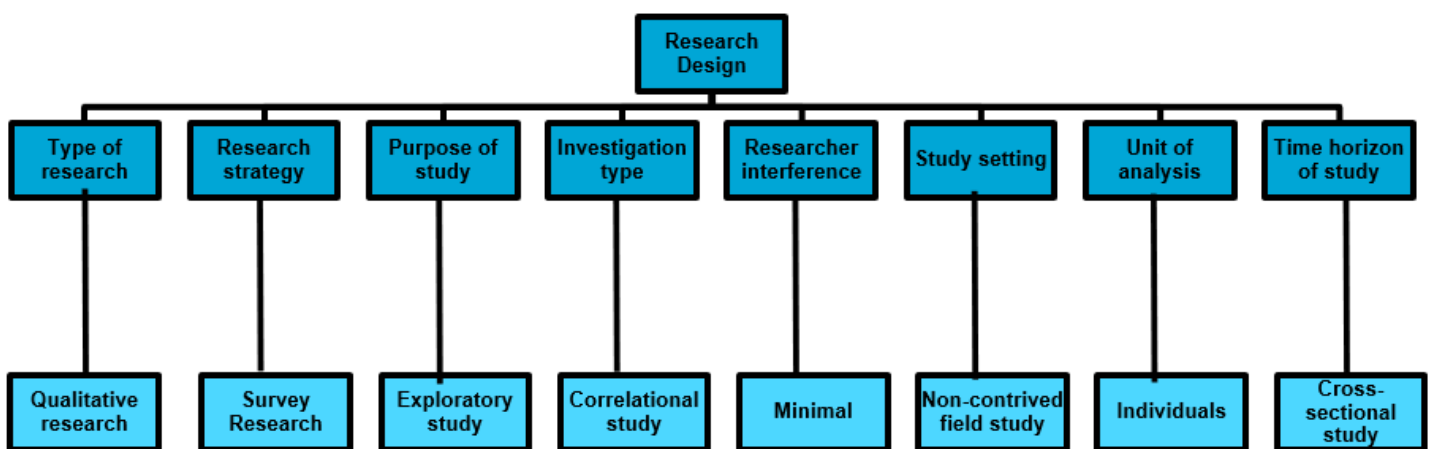


Figure 15: Research design

3.2. Data collection methods

Data collection is the most important part of any research. It is critical to have appropriate and unbiased data for accurate results. As our method of research is qualitative, the data that would be gathered would be open, accurate and honest, as they would be based on the opinions of the respondents, and no modifications would be made to these opinions. It is important to interpret these opinions accurately to avoid errors in the results.

In our research, we would be using two types of data collection methods, as shown in [Figure 16](#):

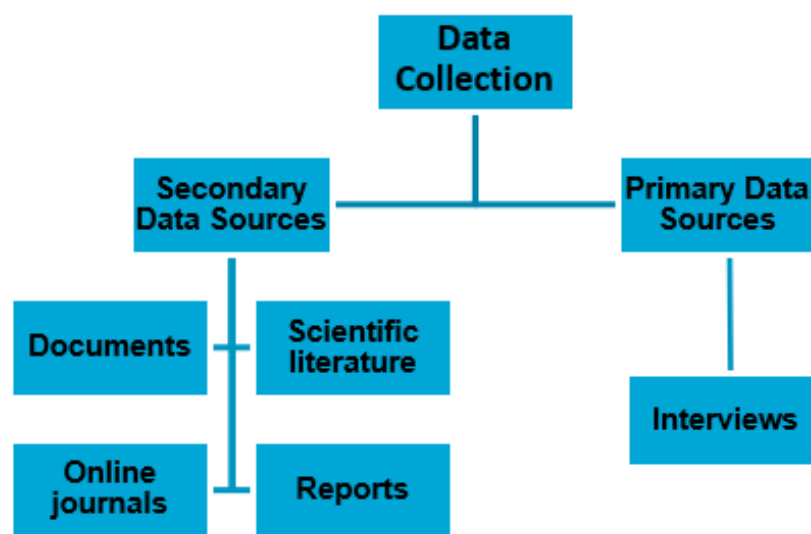


Figure 16: Data collection methods

3.2.1. Secondary data collection

Secondary data are the data, that are gathered for some other purpose than the current research. These sources include data from scientific papers, documents, graphs, government publications, interview records, etc. The information available on these data sources have been collected for other research purposes and are not directly related to our research. But they have the information available, that forms the base for our research.

For our research, we would be conducting an extensive '*literature review*' of scientific papers, documents and online data, on the current developments around the concepts of circular economy, cradle-to-cradle, sustainable business models and product-service system. We would be documenting all the available data that can help us build a knowledge base required for our research, and also answers the first two research sub-questions.

3.2.2. Primary data collection

The most practical way to gather data for a research is through primary data collection methods. As our study setting is in a business environment, the information to be gathered has to be directly from people working in organization under focus. The selected primary data collection method for our research would be '*Semi-structured Interviews*'. According to Sekaran and Bougie (2016), Interviews are guided purposeful conversations between two or more people, as a way of collecting data for business research (Sekaran & Bougie, 2016). As we have a documented version of the questions to be asked in the interview, our interview would be a structured interview. A logical order of the set of topics that would be discussed is prepared, with the option to probe on some answers with probing tactics, to get deeper knowledge about the specific topic. This freedom to change the course of interview, during the interviewing process, makes it a semi-structured interview.

We would be conducting personalized interviews with people working in the top management of Luxaflex, as well as several dealer companies. The number of interviews would be set to 15, due to limitations in time available for the research. The distribution of respondents for the interview is shown in the figure below. The respondents were selected based on the stakeholders involved. As our focus is on cradle-to-cradle certified products, we decided to interview the product manager of each of the products. Next, as business decisions are made by the upper management, we included three individuals from the top-level management of the company. Finally, as per company requirements, we decided to include the sales and marketing team in the interviews, as they were the department with the most resistance to sustainable practices. Finally, to include the dealers in the interview, we decided to interview three dealers from two sides of the market, business-to-business and business-to-consumers. [Figure 17](#) mentions the list of respondents for interview.

These interviews would help us to understand complicated issues in business environment, and also gather rich, personalized and practically applicable solutions from various top-level executives with industry experience. This rich data-set, based on years of experience, would help us decide the most appropriate business strategy, that is practical, as well as, has the stakeholder's approval.

Sr. No.	Individual role	Description
1	Technical manager- Venetian Blinds	Product expert
2	Technical manager- EOS 500 Roller systems	Product expert
3	Technical manager- Fabrics	Product expert
4	Business unit manager- Luxaflex	Upper management
5	Chief financing officer- Hunter Douglas Europe	Upper management
6	Manager- Luxaflex Scandinavia	Upper management
7	Marketing manager- Luxaflex projects	Sales and marketing
8	Account manager- Luxaflex projects	Sales and marketing
9	Sales manager- Luxaflex projects	Sales and marketing
10	Business-to-Business dealer	External partner
11	Business-to-Business dealer	External partner
12	Business-to-Business dealer	External partner
13	Business-to-Consumer dealer	External partner
14	Business-to-Consumer dealer	External partner
15	Business-to-Consumer dealer	External partner

Figure 17: List of respondents for interviews

Despite having great advantages, we still face some limitations due to interviewing technique, which are known as interview biases, which include geographical limitations, language barriers, and issues relating to privacy. We have tried to reduce these limitations by adjusting to reach the dealers location physically, by meeting executives who are fluent in English, and keeping the names of the respondents anonymous in the report. Also, as we cannot include end-customers in the interviews due to limitations of product scope, it proves a barrier to completely understand how we can successfully implement sustainable strategies. Probably with the customers included in the interviews, we could better understand the market, and recommend business strategies appropriately.

3.3. Interview strategy

The interview document would consist of the organized set of questions to be asked for the research. The sections would be divided to gather information on the topics under discussion in a structured manner, with some room to probe on follow-up questions during the interview. As mentioned in the summary of the literature review chapter, we see that a lot of research has been done on the concepts of C2C and PSS. In our interviews, we would try to identify public awareness about these concepts, and also try to understand what they feel are the strengths, weaknesses, opportunities and threats of each of these concepts. The interview would be structured to ask various additional questions, to provide a smooth flow of conversation.

The interview protocol would be prepared as follows,

1. Introduction: Introducing the interviewer and explaining why we are conducting the research. The respondents introduce themselves as well.
2. Circular economy and Cradle-to-Cradle: After gathering data on the current developments in the circular economy field and the cradle-to-cradle certification process, we would be asking respondents to mention the barriers they face towards adopting cradle-to-cradle products and what are the enablers for the same. We would also ask what they feel are the strengths, weaknesses, opportunities and threats for the cradle-to-cradle concept in the business setting. Their answers, based on years of experience would help us build deeper knowledge about what are the practical implications of such disruptive concepts on the business world.
3. Product-service system: Similar to the previous section, we would gather available data on the concept of sustainable business models and types of product-service systems. We would then be asking the respondents, what they feel about Luxaflex products to be sold along with provision of services. We would ask them what is their opinion on selling functionality, i.e. daylight shading and privacy, instead of the products, i.e. roller shades and blinds. We would be asking respondents to mention the barriers they face towards adopting a product-service system business model and what are the enablers for the same. We would also ask what they feel are the strengths, weaknesses, opportunities and threats for this 'service-based model' in the business setting.
4. Company's value network: The respondents would explain what they feel should be the value network diagram in case they adopt as product-service model for the cradle-to-cradle products. The current value chain would be shown to them, and they will add the units that they feel would be needed in order to adopt the 'service-based model', like the recycling companies, service provider, and reverse logistics services.

5. Product recovery strategies: We would also be asking the respondents what they feel are the best strategies for product take-back according to them. We would discuss the issues and try to find solutions for these issues during the conversation.
6. Conclusion: Final remarks and suggestions.

A copy of the interview protocol is in [Appendix-4](#).

3.4. Data analysis

After collecting all the required data during the interviews, it is important to analyse and correlate various independent variables, to get the required results. In our research, we are trying to identify business strategies that can successfully commercialize cradle-to-cradle products using a product-service system business model. Once all the interviews are completed, we would perform content analysis, based on the book 'Research methods for business', to identify various data points, themes, words and sentences in the interview transcripts, which can be an input to three data analysis tools to be discussed next (Sekaran & Bougie, 2016):

3.4.1. Stakeholder analysis

Stakeholder analysis is the type of data analysis tool, that tries to identify the needs of all the stakeholders that are involved with a particular project. In our case, we would be looking at the requirements and needs of the various stakeholders involved with the company's strategy of a PSS for C2C products. These stakeholders include the main organization, dealers, customers, recycling companies, etc and they can be arranged on the stakeholder matrix, based on their influence on the decision and the impact they would feel. The needs and desires of each of these stakeholders would be gathered during interviews, and would form the base of our research to look for successful strategies for product recovery of C2C products. As every stakeholder's opinion is taken into consideration, the chances of success increases.

During the interview with various stakeholders, we would identify what they actually want from Luxaflex and its products and business plans. Although it is important to incorporate every stakeholder's opinions, it is not feasible to accommodate all of them. There are conflicts among different stakeholders regarding their needs. We would find appropriate strategies to accommodate all the stakeholders needs in the best possible way. We would be using concepts like stakeholder management and decision-making in networks, from the book 'Management in Networks', by Hans

de Bruijn and Ernst ten Heuvelhof, in our course Inter and Intra decision making (de Bruijn & ten Heuvelhof, 2014).

3.4.2. Business Context Analysis

Business context analysis is the analysis of the external environment of the business setting. It determines how the surrounding elements of a company affects their business. In our interviews, we would gather data regarding the barriers and enablers of cradle-to-cradle and product-service systems. The various barriers and enablers would be listed into a matrix according to 'highest to least' influential in the decision making of the company. This list of barriers and enablers would also be an important input to the SWOT analysis of the research.

The list of barriers and drivers/ enablers, is important to understand what are the factors that are causing an inertia for firms and individual dealers to successfully and positively adopt sustainable practices like C2C products and PSS models.

3.4.3. SWOT Analysis

According to Groenendijk and Dophiede (2003), SWOT analysis is a business tool that helps with the initial stages of the decision-making, being a predecessor to strategy planning. It is an important tool for analysis of the performance of new concepts in the business field. It allows us to see whether a strategy would be successful, by including the external and internal factors affecting the strategy. We would be conducting a SWOT analysis for both the strategies of the research: cradle-to-cradle products and product-service systems (Groenendijk & Dopheide, 2003). There are four elements of a SWOT analysis:

1. **Strengths:** A strength for a company is the characteristic of the strategy under consideration, that would help boost the realization and practical application of the strategy. It can be an asset for the company, which they need to exploit more, in order to tackle threats and create more opportunities. In our research, we would try to identify the strengths of C2C and PSS, which would help us formulate efficient strategies for successful implementation.
2. **Weaknesses:** A weakness for the company is the characteristic of the strategy under consideration, that threatens successful implementation of the strategy. The weaknesses need to be avoided, in order to reduce negative impact of the strategy on the company. In our research, we would try and look out for weaknesses of C2C and PSS, and try to find strategies that would reduce the negative impact of these weaknesses.

Both strength and weaknesses are considered to be part of the '*Internal analysis*'.

3. Opportunities: Opportunities are the potential positive development for the strategy under consideration, that would be complimentary towards our strategy. It will substantially contribute towards the realization of our final goal. In our research, we would identify the opportunities for further potential for growth of our C2C products with a PSS business model. We would work to make the best use of these opportunities for generating the optimal strategies.
4. Threats: Threats are the potential negative development due to the strategy under consideration, that would have damaging effects on the company's business. These are the challenges developed due to the environment of the business setting, that would have a negative impact on successful implementation of the strategy. In our research we would focus to identify the threats to the concepts of C2C and PSS, present in the environment.

Both opportunities and threats are considered to be part of the '*External analysis*'.

A SWOT matrix is generated to incorporate various strategies that can be combined together as shown in [Figure 18](#)

<div>Internal Factors</div> <div>External Factors</div>	<div>Strengths (S)</div> <div>List 5 to 10 internal strengths here</div>	<div>Weaknesses (W)</div> <div>List 5 to 10 internal weaknesses here</div>
<div>Opportunities (O)</div> <div>List 5 to 10 external opportunities here</div>	<div>SO Strategies</div> <div>Generate strategies here that use strengths to take advantage of opportunities</div>	<div>WO Strategies</div> <div>Generate strategies that take advantage of opportunities by overcoming weaknesses</div>
<div>Threats (T)</div> <div>List 5 to 10 external threats here</div>	<div>ST Strategies</div> <div>Generate strategies here that use strengths to avoid threats</div>	<div>WT Strategies</div> <div>Generate strategies here that minimise weaknesses and avoid threats</div>

Figure 18 SWOT matrix (Groenendijk & Dopheide, 2003)

3.5. Theoretical framework: Optimal Strategy Triad

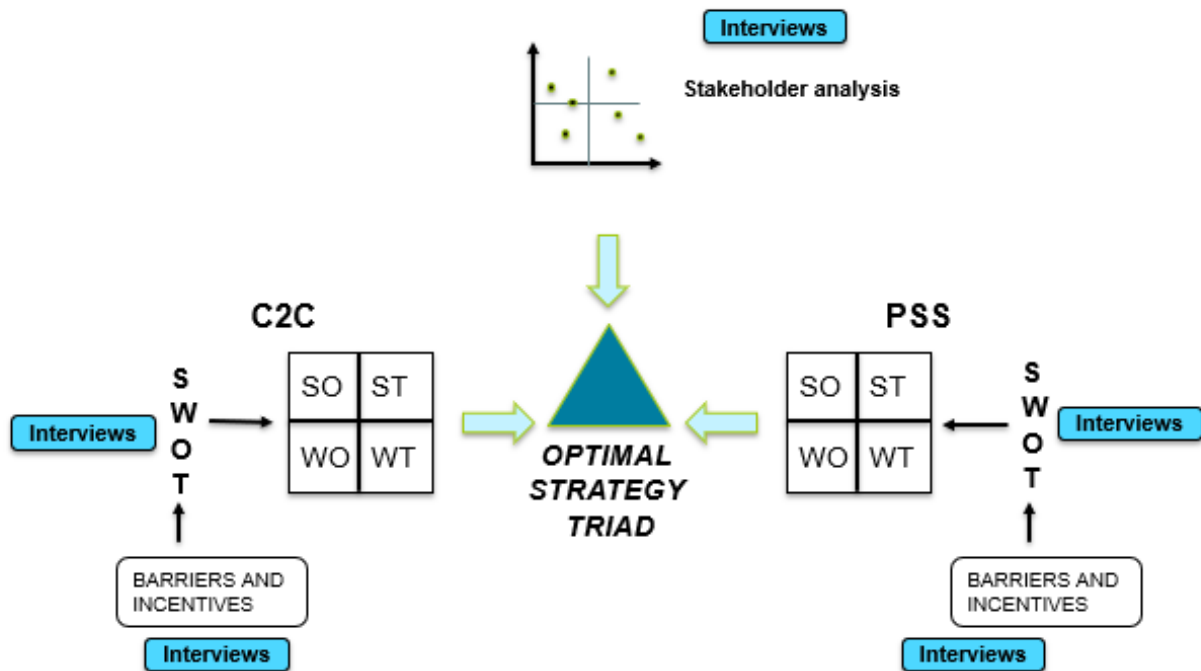


Figure 19: The theoretical framework

Figure 19 above shows the theoretical model, that we would be using for our research. This optimal strategy triad is based on a similar descriptive triad model in a previous master thesis from the TU Delft repository (Peters, 2009). The theoretical model is modified to incorporate two different SWOT matrix, and a stakeholder analysis, together to formulate various strategies that can overcome various threats and weaknesses, and also build upon the strengths and opportunities. The theoretical model would be discussed in detail below:

1. A stakeholder analysis, would take into consideration, all the stakeholder's opinions. In this way, we would be able to capture every possible requirement of each and every player involved. This would form the base of our strategies in the optimal strategy triad. The strategies would be developed on the basis of what and how each stakeholder wants the final strategies to be. These opinion and requirements would be gathered during the interviews.
2. The barriers and enablers/incentives generated during business context analysis would be used as an input to the four elements of the SWOT analysis: Strengths, Weaknesses, Opportunities and Threats. The barriers would form a base for threats and weaknesses, (if the barrier is an internal effect, it will form a weakness, and if it is an external effect, it will be a threat). On the other hand, the enablers would form the base for strengths and opportunities, (if it is an internal effect, it will be a strength, if it is an external effect, opportunity). Also, some

basic tactics can be used in SWOT analysis. Matching is where we try to match the strategies in strengths and opportunities. Converting is where we try to change threats and weaknesses to strengths and opportunities. After all the data analysis using this approach, the result would be the most appropriate strategies for C2C and PSS.

3. The list of strength, weaknesses, threats and opportunities would be used to generate strategies for the SWOT matrix, which is shown in figure above. This matrix would consist of all appropriate strategies for both C2C and PSS. These strategies would help us understand how can the strategy under consideration can be successfully implemented by boosting strengths and opportunities and reducing the impact due to weaknesses and threats.
4. Finally, we see the Optimal Strategy Triad (OST), which takes input from the two SWOT analysis on C2C and PSS, along with the input from the stakeholder analysis, to generate the most optimal strategies for efficient and successful implementation of a product-service system business model for cradle-to-cradle certified products. The OST is a modified strategic planning tool. It incorporates the famous SWOT matrix analysis technique of generating SO, ST, WO and WT strategies. But for our research, we would have two SWOT matrix and the combined strategies would be developed from both. The strategy building would follow the procedure for SWOT analysis from the book 'Planning and Management Tool' by Liza Groenendijk and Emile Dopheide. The guidelines, from the book, regarding single SWOT matrix would be used to combine the SWOT of C2C and PSS both, while also keeping in mind individual stakeholder's needs from the stakeholder analysis. This framework is something that is clearly unique to this research and is open to criticism (Groenendijk & Dopheide, 2003).
5. A modified value network diagram would also be one of the outputs of the OST. Also, a business model assessment of how the business model of Luxaflex would look after adopting a PSS model would be part of the results, and is presented in [Appendix-4](#).

Chapter 4: Data Analysis

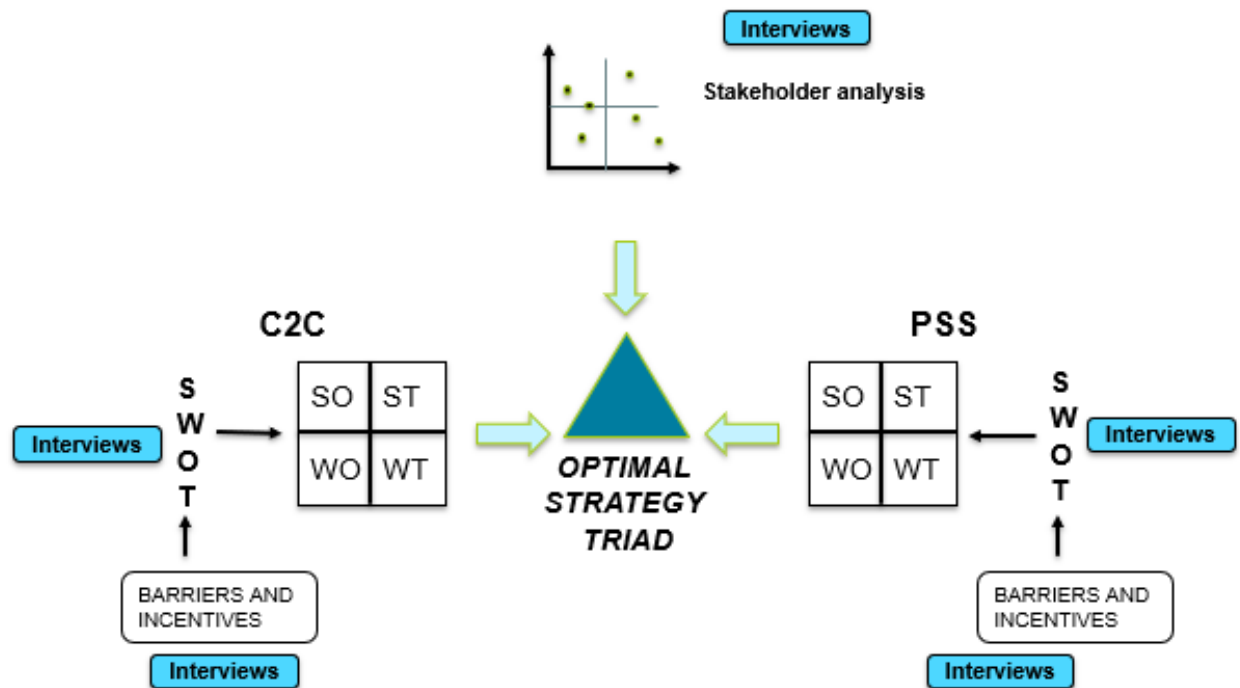


Figure 20: Optimal Strategy Triad

The data analysis section consists of the sections of our Optimal Strategy Triad (OST), along with the data that was gathered during the interviews, using content analysis of the transcripts. In this section we would methodologically lay the data in the various analytical components of our OST, namely the stakeholder analysis, business context analysis, and SWOT analysis. In the next chapter, we would optimize the data gathered and would present our recommendations for the company.

4.1. Stakeholder analysis

There are various stakeholders involved in the business decisions of the company. Each of these stakeholders have their interests that need to be met to reach a win-win solution, that is acceptable by all. The reason we are taking their opinions in consideration is because they are being directly or indirectly affected by the decision that the parent company takes, which means they can become a potential barrier if the decisions negatively affects them. But when we consider their needs and demands, we can plan our strategies to incorporate everyone being affected, and increase the chances of successful implementation of our business strategy.

During the research a number of stakeholders were identified, who would be affected by the company's decision of pursuing a PSS for their C2C certified products. These include:

1. Parent company
2. Dealers
3. End-customers
4. Assemblers
5. Recycling companies
6. Local municipalities

These stakeholders can be divided into three different types, based on how deeply they are affected by the company's actions, either positively or negatively:

1. Primary stakeholders: These are the stakeholders that are most affected by the organization's actions, either positively or negatively. In our research, these would include the Parent company and Dealers.
2. Secondary stakeholders: These are the stakeholders that are affected indirectly by the organization's actions, either positively or negatively. In our research, these would include the Assemblers and End customers.
3. Tertiary stakeholders: These stakeholders would be least affected by the organization's actions, either positively or negatively. In our research, these would include the Local municipalities and Recycling companies.

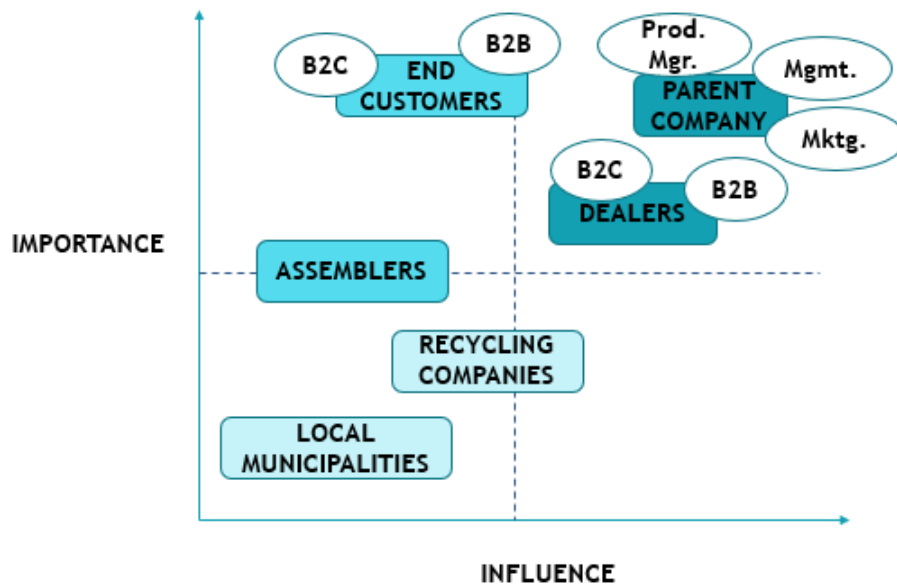


Figure 21: Stakeholder Map

Figure 21 shows the stakeholder map. This was plotted using the information from interviews, provided by individual stakeholders, about the influence and the impact of Luxaflex's decisions on them. The detailed explanation of each stakeholder is provided in [Appendix-5](#). We will now discuss the stakeholder's interests for the project:

4.1.1. Parent company- Luxaflex

4.1.1.1. Upper management

1. The business plan must be financially feasible for the company. There must be some profits generated from product take-back services.
2. We need to find economical solution to encourage the dealers to come on board with our plan. They would need some incentives, maybe financial.
3. The certification is already done, we need successful strategies for large-scale commercialization of those certified products.

4.1.1.2. Technical managers

1. There is a need for a market pull for such sustainable strategies. There is a lot of inertia for change in the market.

2. A customer survey must be done to understand if the customers would pay a higher cost for the company's efforts. Unless we have that data, it's a risk to encourage such strategies further.
3. Additional product innovation can be done by R&D, for Design for Recycle (DfR) and increasing material reutilization, but we need a market demand for these strategies first.

4.1.1.3. Sales and marketing

1. They need a fixed plan from the management, about the course of actions to be taken.
2. They need an understanding of how much effort must be put for effective communication, how many times they need to communicate, with whom, and through what channels.
3. We need to avoid greenwashing and focus on explaining the story in detail, to earn the trust of end-consumers.
4. Keep the content of communication relevant to the customer, and easy-to-understand. They don't simply understand a C2C certificate, because they don't have any context.
5. It is important to pass down information to the dealers, to prepare them if end-customer asks them directly.
6. Use multiple marketing channels- brochures, sample books, dealers, website, social media, public media houses, small movie, press releases, bloggers and influencers.

4.1.2. Dealers

4.1.2.1. Business-to-Business Dealers

1. The dealers face difficulty to access the information about C2C form Luxaflex. They want the information to be easily accessible and clearly explained about all details. They want Luxaflex to have presentations and display of the new products and their sustainable characteristics, to efficiently pass the information forward, and not just through email.
2. Luxaflex should take responsibility for setting up efficient logistics for product take-back. They are ready to take the product to their office, if there are containers set up for waste sorting.
3. They are ready to take responsibility of product disassembly and separation, if Luxaflex can come within one week to empty the containers.
4. They want some sort of certificate or proof that the products would actually be recycled after take-back, as government institutions and architects demand it.
5. Better involvement and explanation during training programs.

4.1.2.2. Business-to-Consumer Dealers

1. The dealers face difficulty to access the information about C2C form Luxaflex. They want the information to be easily accessible and clearly explained about all details.
2. It's difficult to provide incentive to the residential consumers, due to lack of awareness.
3. Better involvement and explanation during training programs.
4. They already take products back, but don't know what to do with it apart from recycling.

4.1.3. End-customers

4.1.3.1. Business-to-Business Customers

1. The end-customers, like governmental institutions, have difficulty to accept the sustainability claims of various companies. They want to avoid 'green-washing'.
2. The sustainable strategies of the company must be efficiently communicated to the end-customers, either directly, or through the dealers.
3. They have higher awareness about C2C products or sustainable alternatives.
4. Projects market sometimes ask for proof of what the dealers are doing with the old products that they take back. They want a proof of recycling, if any.

4.1.3.2. Business-to-Consumer Customers

1. These are the residential consumers, who have their own individual preferences regarding sustainability. It's difficult to generalize their interests.
2. The price of the product is a major factor when choosing between standard and sustainable products.
3. These individual customers would be interested to get rid of old products, if the dealers take them back, and they don't have to pay for it.

4.1.4. Assemblers

1. Some assembly centres have recycling points and sorting systems on site. So, they would be capable of disassembly and separation of metal parts, if the recycling company comes and takes the wastes away.

4.1.5. Recycling companies

1. A financially feasible plan must be suggested for a win-win solution for them and Luxaflex.
2. A stakeholder meeting should be done, to make a deal for setting up containers and signing a monthly contract for old product take-back.
3. They want optimal scale of the flow of old products, for them to have financial gains after material recycling.

4.1.6. Local municipalities

1. Better and healthy community.
2. Opportunities to create public awareness about the sustainability concept.
3. Financial benefits due to lower responsibility of window blinds waste collection and processing, as the company would take care of it.
4. Increasing awareness of manufacturing companies to take responsibility of their products, even after sale.

4.2. Business context analysis

The business context analysis is the study of the external environment of the business setting. Here, we are trying to find out the barriers and drivers that are present in the external environment of Luxaflex, regarding the introduction of the two sustainable business strategies, cradle-to-cradle and product-service systems. These barriers and drivers are important for the research as they would in turn be used to develop the two SWOT matrix. This section lists the barriers and drivers that the respondents mentioned during the interviews, as shown in [Figure 22](#). This list also includes the pre-determined list of barriers and drivers that was identified during literature search, and was also presented to the respondents during the interview, to trigger the answers and help them connect to the questions better.

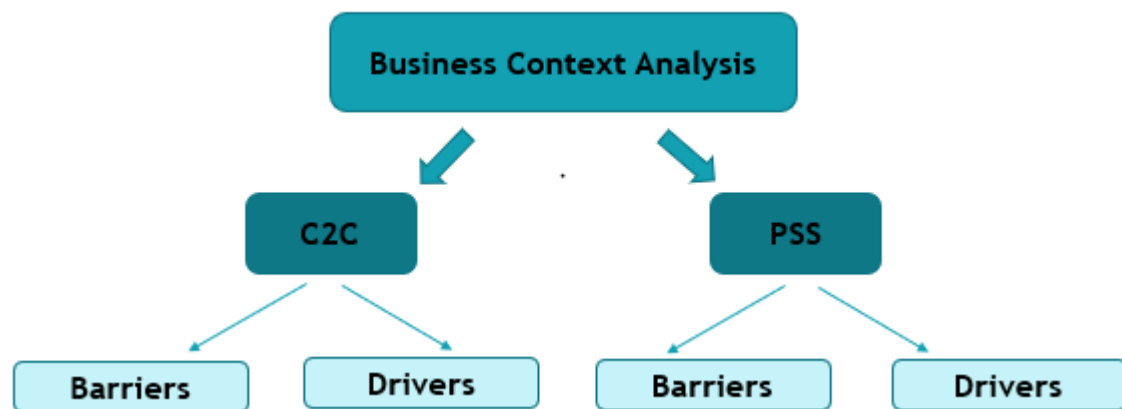


Figure 22: Business context analysis

The two concepts, C2C and PSS have their own list of barriers and drivers, mentioned below. Each of the item is numbered accordingly (BC.1, BC.2 and DC.1, DC.2, etc. for barriers and drivers of C2C, and BP.1, BP.2 and DP.1, DP.2, etc. for barriers and drivers of PSS) for easy identification and analysis. These would then be reflected in the SWOT analysis part of our research.

4.2.1. Barriers (C2C)

1. C2C efforts are not globally recognized yet. Not many countries want to invest. In other international market, specifically Sweden, there is not much demand for C2C products. They have their own environmental standards to get product approval. Dealers feel C2C is only going to help them get these national standards approved. **(BC.1)**

"In this part of the world, C2C is not the main environmental requirement, we have different local standards and systems for our products. the demand for the national standards is higher here"- Manager Luxaflex Scandinavia.

2. Public mindset towards product conservation is not widespread. People want to get rid of products with least efforts and costs. **(BC.2)**

"Some people just ignore old products, and want to get rid of anything. Unless there is a change in this public mindset, we would suffer a lot." - Dealer.

3. Financial burden. High costs and efforts to get the certification done. **(BC.3)**
4. Lack of tools and methods to measure long-term benefits of a C2C certificate. Companies feel their efforts would not be reflected into increase in sales. **(BC.4)**
5. Lack of technical skills and quality of products, to get the C2C certification. Some products are 'monstrous hybrids'- products where separation of individual materials is very difficult. These products have difficulties to get a certification. **(BC.5)**

6. Conservativeness in business practices and lack of information of sustainable strategies. Traditional businesses don't prefer any disruptive changes to the product design or processes. Thus, they tend to avoid certification, or recycling. **(BC.6)**

"We have to look at it economically for companies that have to bring back old products, they have less margin for profits, and it's not necessary they would adopt such strategies"- Dealer.

7. Lack of understanding and communication of sustainable practices down the value chain. Even if companies get product certification, not everyone in the value chain is involved. **(BC.7)**
8. Lack of customers willingness-to-pay a higher price for sustainable products. There is a lack of customer survey to determine if customers would prefer spending a little more for C2C certified products. **(BC.8)**

"In the end it is on the end consumer's willingness-to-pay the additional price for sustainable products that gives competitive edge."- Business Unit Manager Luxaflex.

4.2.2. Drivers (C2C)

1. C2C and CE are necessary for the planet. Growing awareness for sustainability. Market demand for sustainable products is growing among government projects, building owners and the architect community. **(DC.1)**

"We find many customers asking for such certificates these days. They ask very good questions about this field. This external push motivates us. Market demand. Simple." **Business Unit Manager Luxaflex.**

2. Generating new revenue streams from potential increase in sales. This is because the company can now cater to sustainability-driven market, with their C2C products. **(DC.2)**
3. Hunter Douglas has the capacity and volume to pursue such sustainable strategies and also have a positive impact. Increased availability of resources and capabilities by big corporations can motivate other companies in the value chain. **(DC.3)**

"It is a great initiative to be the first mover. Hunter Douglas has the power and volume to make these strategies happen." - **Dealer.**

4. Resource constraints and potential for preventing negative environmental impact. Having safe and healthy materials in our product can only reduce the negative environmental impact of **(DC.4)**

4.2.3. Barriers (PSS)

1. No clear identification tag for the products. Even if we try to bring old products back, it is difficult for anyone to identify the product as a Luxaflex product. **(BP.1)**

"It is a risk to our company, because when people bring back their products to us, there is no specific identification technique like logos or something to identify that these are Luxaflex products. We first need solutions to identify our own products." - **Dealer.**

2. The use-cycle of each product is different. Some products might be returned sooner, some later. Difficult to keep track of every product. **(BP.2)**
3. High administration costs, energy and resources required. Need for large investments. **(BP.3)**
4. Complicated structure of leasing model. As every product is unique there is no solution of reusing a leased product. Thus, ownership should remain with the customers. **(BP.4)**
5. Low requirement of servicing for blinds. Internal blinds need less servicing than exterior blinds due to less exposure to damage by rain, wind or dust. **(BP.5)**
6. Lack of network support and infrastructure for product recovery and handling. The entire value chain must come together to establish a logistic system for product recovery. **(BP.6)**

"It should be somewhat convenient to act on these ideas. If things are too complex, even motivated people would forget about it. But when it's easy then money also wouldn't be a big problem. It's a big trade-off." - Dealer.

7. Difficult with business-to-consumer (B2C), as individual product recovery is not economically feasible. But as they are the major source of revenue for Luxaflex, it's very important to cater to them. **(BP.7)**
8. Not directly doing business with the end customers. More the distance between the manufacturing companies and end-customer, more complex the recovery system would be, and unnecessary logistics of old and used products. **(BP.8)**

"The major barrier I feel is that the dealers are our customers, and they sell it further to the end-consumers, so, in the end, we actually don't have direct contact with the end-consumers." - Business Unit Manager Luxaflex.

9. High complexity of design of products. Difficult to recycle or separate individual materials. Blinds are made of complicated parts and these are difficult to separate into different material streams. **(BP.9)**

"That's the problem with the whole sustainability item that it will cost a lot. If the product is too complex, it would be difficult to recycle." - Dealer.

10. Every product is custom-made. They are made-to-measure for every single window. So, there is no product that can be used twice. So only option is recycling of materials. **(BP.10)**

"We cannot reuse our products ourselves, as everything is made to measure. Size is unique. Thus, we need a recycling step in between to get materials." - Business Unit Manager Luxaflex

11. Lack of financial resources to contribute to the product recovery system, as many individual dealers are small businesses and don't have space or resources. **(BP.11)**

12. Past negative experiences of product take-back and similar strategies. **(BP.12)**

13. Recycled materials costs more than virgin materials due to complexity in recovery systems. Until the virgin materials are available cheap, companies would not prefer spending more for recycled materials. **(BP.13)**

14. Lack of government regulations regarding waste-disposal. Complex and overlapping regulations. There are a lot of varying regulations and certificate in different countries. It becomes difficult for a single company to comply with every one of them. **(BP.14)**

"You cannot influence mass-adoption, until there are governmental legislations in place, and people have to act on it." - Dealer.

4.2.4. Drivers (PSS)

1. We are in charge of product take-back and recovery. Better handling by experts. **(DP.1)**
"It's a good thing that we are in charge and we take care of bringing the product back, so, it's in our power to make changes. It's easier to close the circle. A contract is important to bring back the products."- Dealer.
2. Works well with business-to-business (B2B) section of market as they have separate purchasing department to handle the accounts. **(DP.2)**
3. Maintains good customer relationships. **(DP.3)**
4. A good revenue generating scheme by increasing value capture. **(DP.4)**
5. Smart dealers can use service contract to earn more by working less, as the products don't actually need servicing. **(DP.5)**
6. Helps to be safe from potential future governmental regulations regarding recycling. Extended Producer Responsibility (EPR), a regulation where manufacturing companies are required to be responsible for their products even after their sale, is already present in many industries like electronics and automobile. **(DP.6)**
"Seeing the trend right now, in 10-20 years, sustainability would be great factor defining a company. We might be attacked by governmental regulations to take-back our old products"- Business Unit Manager Luxaflex.
7. A lot of dealers are already taking old products back when they go to install new ones. The logistics between end-customers and dealers is cost-effective as no one pays anything and the old products are coming back in empty trucks. **(DP.7)**
8. Quality and satisfaction. If companies are successful in having a recovery system in place, they can invest in increasing quality and life of products, as the investments would yield results. **(DP.8)**
9. Increasing possibilities for waste separation at the source gives us a good opportunity to separate our products from wastes. This way, there would be reduction in the amount of garbage disposal to landfills. **(DP.9)**
10. Potential for reducing resource dependence. Materials extracted from recovered products can reduce dependence on virgin raw materials. **(DP.10)**

4.3. SWOT analysis

The SWOT analysis helps us to understand the complexities and possibilities that are presented by various internal and external factors of the company, towards our sustainable strategies. For our research, we are going to conduct data analysis of these factors using the SWOT matrix, to generate strategies to overcome the barriers and promote the drivers, for the concepts, cradle-to cradle (C2C) and product-service systems (PSS), as shown in [Figure 23](#).

The data gathered during the interview regarding the strengths, weaknesses, opportunities and threats of C2C and PSS, along with the business context analysis for identification of barriers and drivers, are used as data source for the SWOT matrix. The SWOT matrix would be presented here in the form of list of the strengths, weaknesses, opportunities and threats of C2C and PSS.

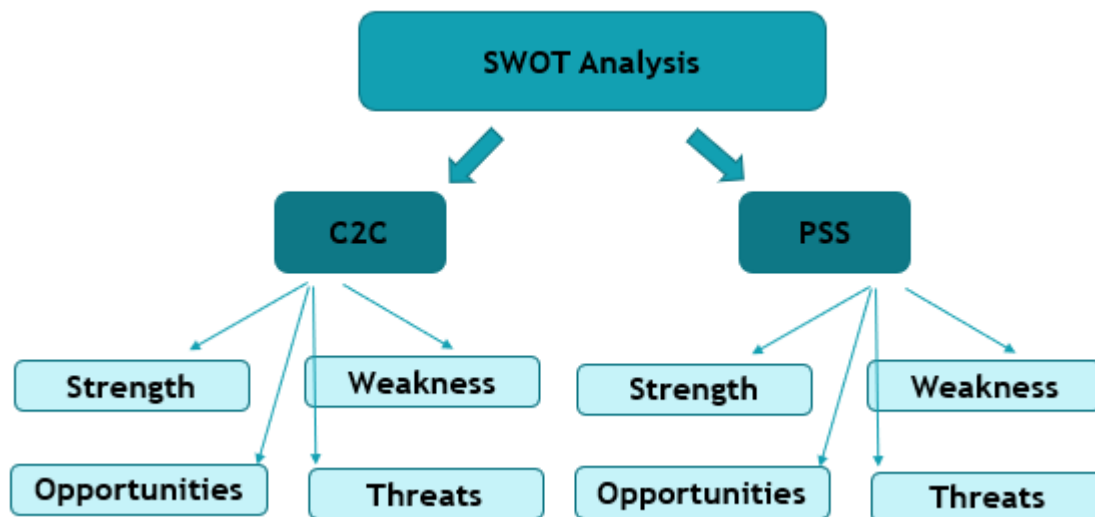


Figure 23: SWOT Analysis

The two concepts, C2C and PSS, have their own list of strengths, weaknesses, opportunities and threats, and thus we would list them all separately. Each of the item is numbered accordingly (SC.1, WC.1, OC.1, TC.1, etc. for strengths, weaknesses, opportunities and threats of C2C, and SP.1, WP.1, OP.1, TP.1, etc. for strengths, weaknesses, opportunities and threats of PSS) for easy identification and analysis. These would then be reflected in the SWOT matrix.

4.3.1. Strengths (C2C)

1. High positive impact on the environment. Safe and healthy products and processes. **(SC.1)**
2. Luxaflex is already focused on strict supplier selection. So, we can claim that only safe and healthy materials are used in the production. **(SC.2)**
"We already pay a lot of attention on supplier selection and our purchasing department looks thoroughly on the supplier's certifications"- Business Unit Manager Luxaflex.
3. High quality of products made it easy for getting the bronze level certificate. As Luxaflex maintains high product standards, the certification process was quite easy. **(SC.3)**
4. None of the dealers have faced any barriers for selling C2C products. It's only an added advantage of having sustainable products on the shop-floor. **(SC.4)**
5. Previous study has found that consumers are more interested in C2C than any other green initiative of the company. **(SC.5)**

4.3.2. Weaknesses (C2C)

1. High costs to maintain certification standards. If company tries to increase the price of products, to compensate for their efforts, consumers would not prefer sustainability over costs. **(WC.1)**
"At this time, it will cost a lot of money and time to go to gold. So, our most optimistic aim would be the silver level."- Product Manager.
2. No recognizable sales improvement due to the certification. People keep buying from Luxaflex due to their brand image. **(WC.2)**
"I don't think we have seen an increase in sales due to the certification. People only buy because they know the brand and tend to keep buying Luxaflex products."- Product Manager
3. The effort of getting product certification was a science push rather than demand pull. The market was not asking for it, but the company wanted to pursue it, to increase their sustainability impact. **(WC.3)**
4. Information regarding C2C certification process has not been passed down efficiently to the dealers or end customers. Lack of communication of the C2C story. Unless the company does not tell their story clearly, there would be no positive impact on sales and profits. **(WC.4)**
"There is still a lack of consumer awareness and uncertainty of consumer responsiveness, because of lack of communication about our efforts to the value chain."- Product Manager
5. Marketing team believes that social media promotion about C2C has not been done enough to target the young generations. **(WC.5)**

6. In fabrics, the non-certified fabrics (65% of total) are selling more than the certified fabrics. (WC.6)

4.3.3. Opportunities (C2C)

1. Growing sustainability awareness among projects business. There is increasing demands among government institutions and projects market. Needs more communication in the residential business. Dealers get extra points over their competitors if they show a C2C certification with the products they sell. Government institutions and architects have shown growing interest in sustainable products. (OC.1)
"C2C has been a plus point indeed. More and more end users expect that manufacturing companies take care of such things. We get extra points when we present our products along with the certificate information. Good for business."- Dealer.
2. 98% recycled aluminium, used for venetian blinds, is a good marketing base to promote C2C. (OC.2)
3. Training in Luxaflex academy can help make the dealers aware about the story of C2C. Dealers feel, if Luxaflex takes responsibility of spreading awareness about C2C products, then they would be better equipped to understand the changes and also respond to growing customer demands for sustainable products. (OC.3)
"The dealers should have knowledge to help out the customers. To make the dealers understand, we need to reach out to the dealers through education and training programs in the academy."- Marketing Manager.
4. The marketing department doesn't need incentives, to promote the C2C story. What they actually need is clear plan for action from the top management. (OC.4)
"As incentives, we do not need anything. It is something we have to do no matter what. All we need is a clear plan, in which places and which moments do we need to communicate."- Marketing Manager.
5. The growing market segment called LOHAS market segment, the Lifestyle of Health and Sustainability, they prefer sustainable and environment-friendly products and services, even if they cost more. A market study of these customers can help us target our C2C products better, and helps generate a constant revenue stream. (OC.5)
6. Luxaflex is among the first-movers in the industry for these sustainable products. Gives competitive advantage. (OC.6)

4.3.4. Threats (C2C)

1. Lack of awareness among other companies in the value chain. Basically, the partners, suppliers, retailers and the end-customers are unaware about the C2C certification and its importance. **(TC.1)**

"We only get information about these sustainable strategies when people at Hunter Douglas would send that information to us. We would be interested to learn about it more, because these days many customers ask about it too." - **Dealer.**

2. Separation of technical materials is difficult due to complexity of design. Like the ability to separate paints with aluminium is a barrier for recycling aluminium. Also, the separation of coating and yarn for fabrics. These additions are important for product functionality, but make recycling complex. **(TC.2)**

"The major challenge we face is the combination of inseparable materials like aluminium and paint, fabrics and coating." - **CFO Hunter Douglas.**

3. There has not been a survey to identify the end-customer's willingness-to-pay to pay more for sustainability. **(TC.3)**

"Everything that you are planning comes at a cost, and who is going to pay for that? Because on the end it would be the customers who have to pay extra for the increase in our costs. we need to find how much will they pay for this." - **CFO Hunter Douglas.**

4. C2C is not globally acclaimed as a priority certificate. Dealers from other countries believe that their national standards are more important than C2C, and that C2C only helps to get these national standards quicker. There is just no demand for C2C there. **(TC.4)**

4.3.5. Strengths (PSS)

1. The sharing economy, by companies like UBER, Airbnb, and Netflix, has started promoting access to products and functionality over product ownership. **(SP.1)**
2. High quality and services. It is possible for dealers to maintain a good customer relationship, with the service contract. **(SP.2)**

"The service contract could be a sale plus point. We can promise good customer relationships." - **Dealer.**

3. People move faster from houses. Dealers have mentioned that customers tend to move in 7-8 years. Thus, there can be more demand for additional services with the product, like free take-back at the end of use period. **(SP.3)**

4. Product recycling can generate new revenue streams. It also helps to reduce cost of materials and energy. **(SP.4)**
5. A service contract could be seen as a plus point for sales. **(SP.5)**
6. For venetian blinds, valuable metals constitute a very high weight percentage (75%), so recycling can be financially beneficial. Thus, it would be economically feasible to start with product recovery of venetian blinds. **(SP.6)**
"Aluminium and steel are easy to recycle, by separating the wastes. The big advantage is that the valuable materials are a big part of the total weight of the product. It becomes economical to recycle"- Product Manager.
7. Luxaflex has the financial power to try sustainable strategies like take-back and recycling. The volume of products sold, and the brand image of the company, would have a positive impact to pursue a PSS for product recovery. **(SP.7)**

4.3.6. Weaknesses (PSS)

1. Financial vulnerability. Need for large investments. Establishing a product recovery system requires a lot of investment and resources. **(WP.1)**
2. Lack of network support and collaboration. Currently the company has little support from their partners for a product recovery system. **(WP.2)**
3. The products, window blinds, have less use per day. They don't give superior feel for use that the customers would actually pay for a service contract like Netflix. Also, the products don't need servicing quite often. **(WP.3)**
"From the mindset of individual customer, it would not be my top priority to have a green window product. I would be more inclined to pay extra amount for goods that are consumed quicker because that gives quick satisfaction that I played a role in saving the planet."- CFO Hunter Douglas.
4. Product ownership by the company, would encourage customers to call for repair and replacement at the slightest problem. In order to avoid this, we must keep ownership of product with the customers and avoid leasing of products. **(WP.4)**
5. No identification technique to identify the brand of returned products. Also, every product is made-to-measure. **(WP.5)**
6. Complexity of design of products makes disassembly expensive. The products must be made for recycling, so, that people can afford to put efforts in separating the materials. **(WP.6)**

"A major challenge is the disassembly of old products. the design of components is too complex. The mechanical components are composed of various kinds of plastics."- **Product Manager.**

7. Recyclability of used materials, or Material Reutilization, is low. Only about 20% of recycled material can be reused. Thus, amount of wastes would still be high. This is what we want to improve for achieving the company objective. **(WP.7)**
8. Handling of old, returned products is costly and needs special packaging to avoid contamination of new product delivery if using same trucks. **(WP.8)**
9. Complex infrastructure for recovery, if present. For now, the dealers are just taking old products and sending them to recycling centres. But dealers want Luxaflex to handle it. **(WP.9)**

"It is not only the processing of old products that will cost us, but also mainly the process of taking them from the customers to the recycling facilities that is an issue."- **CFO Hunter Douglas.**

4.3.7. Opportunities (PSS)

1. Can overcome a lot of barriers for C2C. **(OP.1)**
2. Cost reduction due to resource conservation. It will reduce the dependence on virgin raw materials. **(OP.2)**
3. Smaller value chain would provide better control for change. The reverse logistics must be as simple as possible, to avoid unnecessary costs. **(OP.3)**
4. Modularity of product can provide ease of choice for customers to choose different fabrics or system upgrades, every 5-7 years, or when they move houses. But the main structure of the window blinds stays with the building for a long time. This is a good opportunity to have long-term service contract directly with the building owner, and thus reduce the length of the value chain. Also, the product life is almost 15-20 years **(OP.4)**

"Modularity of product can be a radical innovation. People who move in could change the components of the blinds, while the main structure remains with the building. This can provide ease of choice for new products without entirely disposing old ones."- **Product Manager.**

5. If the scale of products that are returned is large enough, it can be feasible for third-party recycling companies to collect and process used products. **(OP.5)**
6. Service contract is feasible for projects market but not customer market. There is an increasing demand from building owners, to have a service contract for all interior products, like

furniture, carpets and blinds, combined as a package, for a fixed contract period, at the end of which the dealer would take back all the old products. **(OP.6)**

“Contracts based business is already used by our dealers for office buildings, where they give out maintenance contracts, for a whole package system with ceilings, floorings and blinds.”-

Product Manager.

7. Current business through dealer network, targets customers in the age range of 40+. Sustainability is not their top priority. We need to target the younger generation. Maybe through online selling and social media. **(OP.7)**

8. If the story of C2C is communicated efficiently down the value chain to the end-consumers, then they wouldn't mind paying a little extra for our efforts. It is important that they understand our sustainability claims. **(OP.8)**

9. There is a huge opportunity for recycling of venetian blinds, as 95% of materials from old products can be used again. **(OP.9)**

“We already use 98% recycled aluminium for venetian blinds. We believe we could reuse almost 95% of materials from old products.”- Product Manager.

10. Pursuing product take-back can provide safety from potential government regulations like Extended Producer's Responsibility (EPR), where it is mandatory for manufacturing companies to take responsibility of their products after their use-period. Having a pilot case already progressing successfully, would give the company major benefits, when the industry comes across such regulations. **(OP.10)**

11. When people move houses, they usually tend to keep the same blinds that are already installed in their houses. Thus, the blinds stay as long as the building remains the same. **(OP.11)**

12. The company would be the first-mover giving competitive advantage over competitors. **(OP.12)**

13. Various dealers are already taking back old products from customers, when they go to install new ones. They are even able to disassemble and separate various metal parts from other wastes. This is a great opportunity to pursue PSS and ensure a constant return of old products. **(OP.13)**

“We are already taking old products back from customers right now. When we install new product, mostly they don't want the old one anymore and we are happy to take it away”. -

Dealer.

4.3.8. Threats (PSS)

1. Organization change resistance for the traditional business models. Product take-back would be a disruptive change for well established companies. **(TP.1)**
2. Uncertain revenue streams, due to uncertain quantity of product take-back, would push companies to keep pursuing a linear model. **(TP.2)**
3. Cheap availability of virgin raw materials would keep recycling costs high. Companies would always choose virgin materials over recycled materials, as it is cost-effective. **(TP.3)**
"Currently, recycled materials are more expensive than virgin materials. Plastics are very low cost. Until new materials become expensive than recycled materials, it is not economically feasible to invest in any recycling strategies." - **Product Manager.**
4. The value chain for reverse logistics is too long. Unless we shorten the value chain, the recycling strategies would not generate profits. If we took back products directly from customers, profits can be better. **(TP.4)**
"You can only take-back products, if you are in direct contact with the customers, because they have a margin to gain, which the dealers or assemblers might use up, and we end up with nothing." - **Product Manager.**
5. Motivating other competitors to adopt sustainable strategies can make them stronger, and we can lose competitive advantage of having sustainable products. But, if we are the only one working towards product take-back, we lose money. Big trade-off. **(TP.5)**
"Bringing different competitors together is difficult, because how can you manage that in an open economy. There will always be players who say they don't want to comply to green strategies and we could lose money." - **CFO Hunter Douglas.**
6. Only 1% of individual customers would prefer product leasing. Not worth pursuing. **(TP.6)**
7. No feasible plan for situations where returned product is from different brands but Luxaflex. No way to identify brands of old products. **(TP.7)**
8. Consumers are very critical when it comes to green washing. We must present our story as clear as possible, to get returns on our efforts. Consumers are quite suspicious about sustainable statements made by companies. **(TP.8)**
"Customers are aware about the term called greenwashing, where companies try to put up vague statements regarding sustainability. They see right through it. It's important that all sustainability communication has proof with it. The certificate helps with that." - **Marketing Manager.**

4.3.9. Linking business context analysis and SWOT analysis

The following figures, Figure 24 and Figure 25, show the dependencies and combination between the barriers and drivers identified in the business context analysis, and the SWOT matrix of both C2C and PSS. The figures are important to show the interconnection between various datapoints in the two analysis tools. Most of the data in the SWOT is based on the barriers and drivers of the respective concept, as identified in the interviews, and analysed using content analysis of the interview transcripts. The symbolic representation of the actual numbers used to identify information mentioned in the interviews are shown in the figure. These can be referred from previous sections in the data analysis chapter. Simply put, these figures show how the different elements in the SWOT matrix are depended on the barriers and drivers identified.

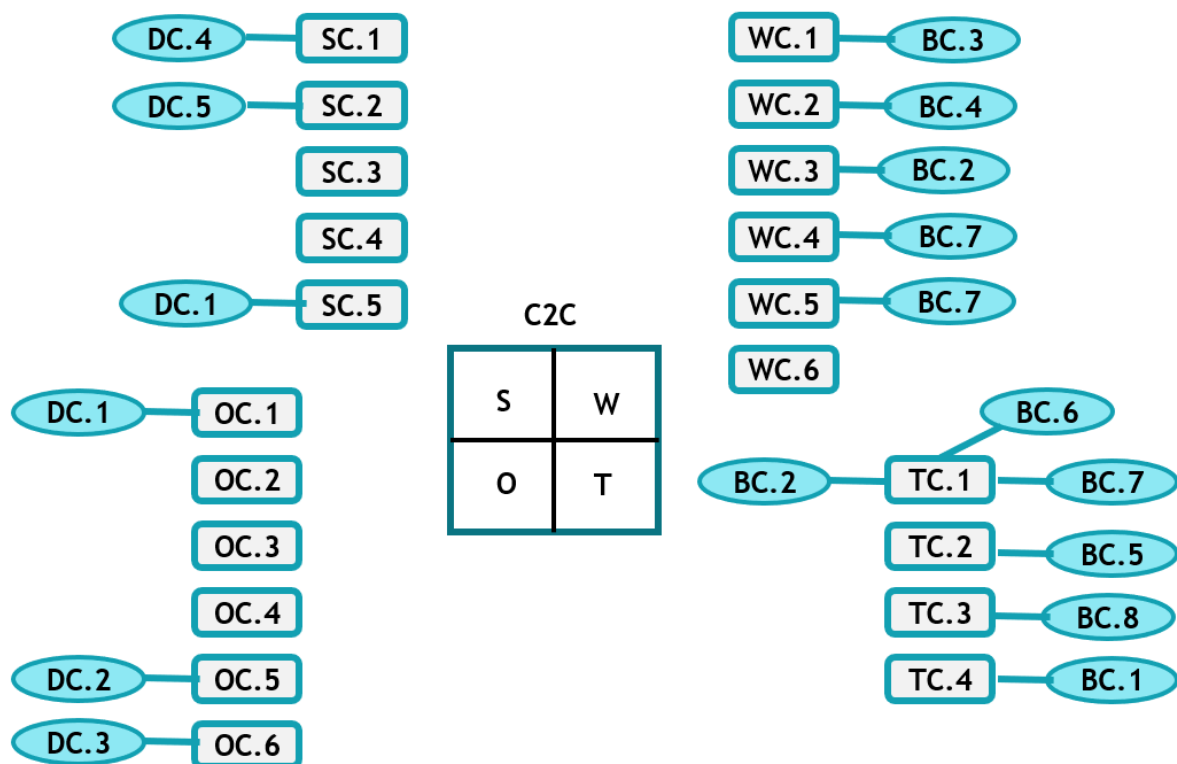


Figure 24: Combining business context analysis and SWOT for C2C

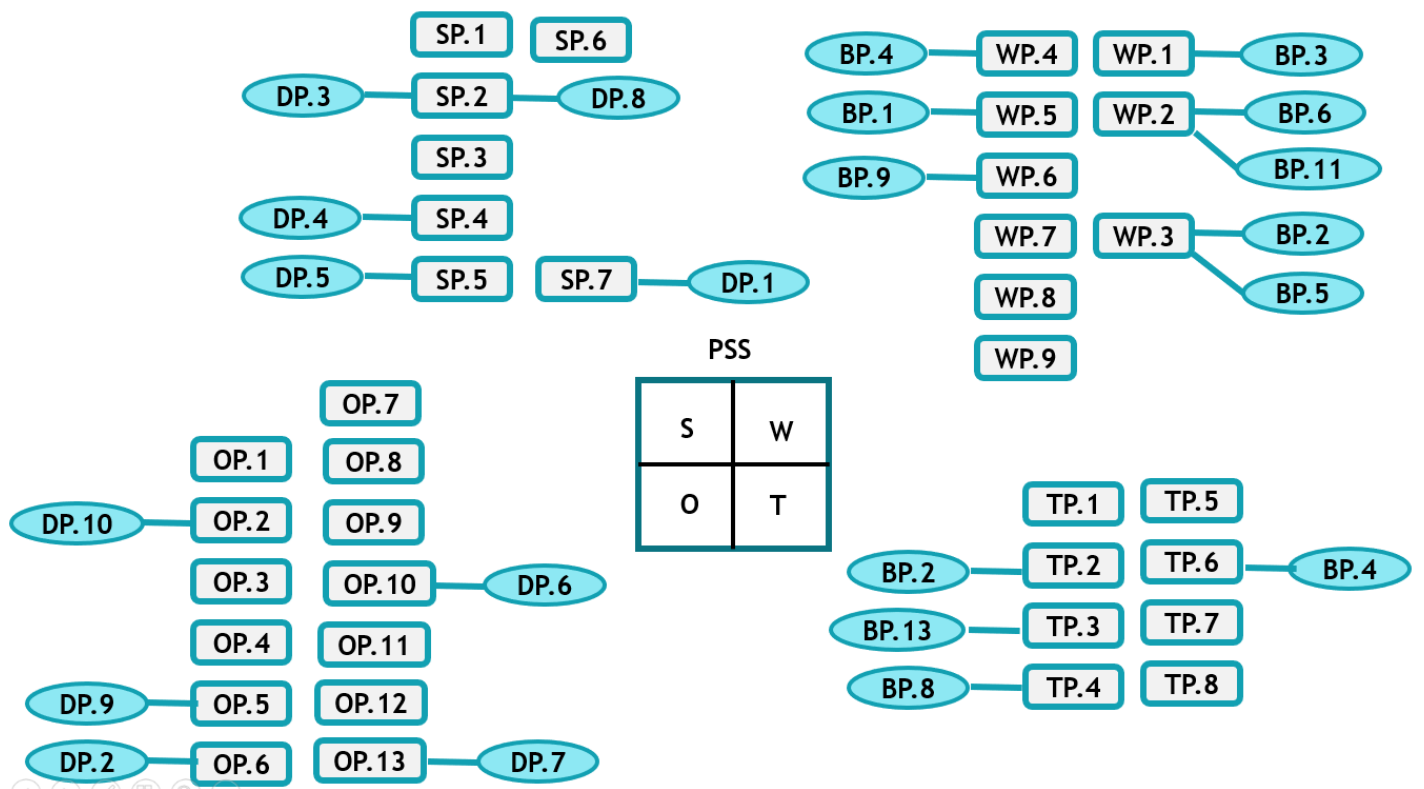


Figure 25: Combining business context analysis and SWOT for PSS

Chapter 5- Results

In this chapter, we would discuss the various results that we came across, as an output of our data collection and data analysis. The results are based on the opinions of the respondents, and have not been altered or manipulated. The results are presented as follows.

5.1. Optimal Strategy Triad

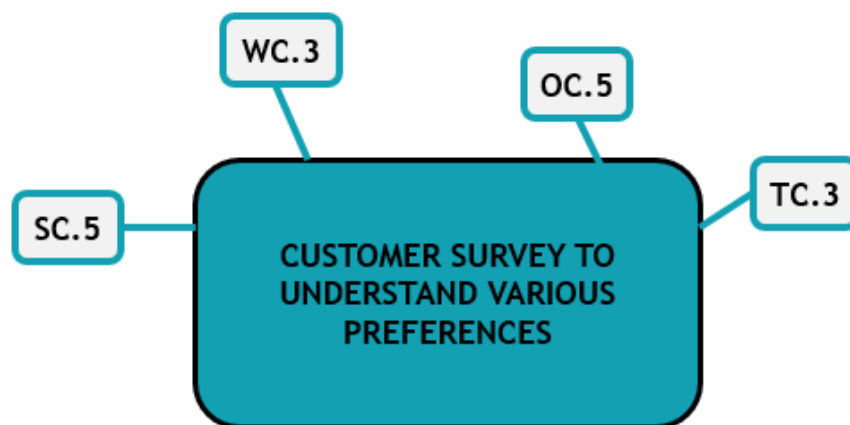
In the methodology chapter of the report, we mentioned the Optimal Strategy Triad, which would be built by the two SWOT matrixes and the stakeholder matrix. In this section, we would discuss the various strategies that fit best with the issues and problems faced by all the stakeholders. These strategies are recommendations for Luxaflex, and depends entirely on the company's decisions, how and which strategies to adopt.

The strategies would be discussed below. The figures explain the strategy being used, and indicates the strengths and opportunities, of C2C and PSS, on which they are being built. The figure also mentions the weaknesses and threats that these strategies would overcome, if adopted. The numbers used in the figures, are based on the list of strengths, weaknesses, opportunities and threats mentioned in the [SWOT analysis](#) section of the data analysis chapter.

The strategies would be explained in detail, and the validation part would explain how the specific strategy helps to overcome various threats and weaknesses, by building on the strengths and opportunities. For e.g.: If there are elements like SC.1, OP.5, etc mentioned in the strategy, it means that the strategy is built on the strength and opportunities as specified in the [SWOT analysis](#) section. Similarly, TC.3, WP.6, means that the strategy under discussion would help us overcome the specific threats and weaknesses from the [SWOT analysis](#) section. In this way, we have tried to accommodate each and every element from the SWOT matrix into eight different strategies which can be recommended to Luxaflex.

5.1.1. Conduct a customer survey to understand various preferences

Customer survey is required to understand what the customers of Luxaflex, i.e. the dealers and their end-customers as well, feel about C2C products and strategies like PSS. It is not sensible to invest in those strategies, if we don't understand what the end-customers actually want. We need to understand how aware the customers are about C2C and would they prefer a higher certification. We also need to know if their buying practices would move towards sustainability, after they understood the certification and its value. We need to see how much they would be willing to pay for our efforts. Also, there should be a clear understanding, whether the customers want end-of-life product take-back, or would prefer products with recycled materials.

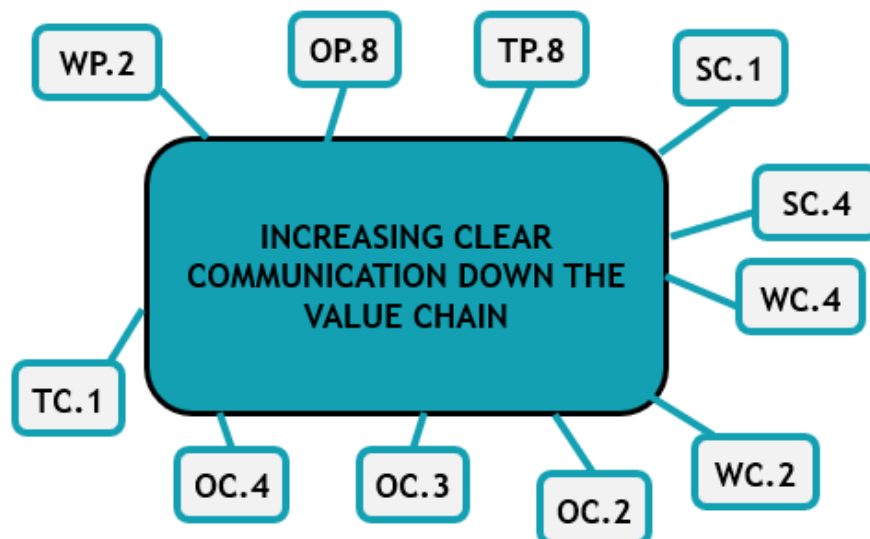


Validation:

1. Previous customer survey at Luxaflex suggested people are more interested in C2C than other green initiatives. Similarly, we can understand more preferences with more customer surveys. (SC.5)
2. If we are able to understand customer preferences, we can plan to invest our resources according to what the market demands. (WC.3) We would be well-equipped to analyse what the customer would pay for our efforts, and we can innovate accordingly. (TC.3)
3. A major new development in sustainability concept, is the new market segment called the Lifestyle of Health and Sustainability (LOHAS) customer segment. These are the people who prefer to buy organic, healthy and sustainable products and services. A customer survey could also help to understand what percentage of our customers belong to the LOHAS segment. (OC.5)

5.1.2. Increase clear communication down the value chain

The most important issue raised by everyone involved in the interview process, is the lack of communication among the different elements of the value chain (TC.1). It has been mentioned that unless Luxaflex takes the responsibility of communicating the story of their sustainable efforts, they are not going to gain high returns. We suggest that the company starts spreading awareness among the people in the organization first. When all the departments in the organization work in cohesion, their efforts would prove successful. Next, for the dealers, we can include communication regarding C2C and product take-back, during dealer training programs (OC.3). Extra efforts must be used to promote our efforts across social media platforms, collection books, product shows and personalized meetings with individual dealers explaining our plans in detail. Only an informed dealer can better promote Luxaflex down to the end-consumer.



Validation:

1. Increased communication can help build effective collaboration and support from the dealers for setting up a recovery system (WP.2), they can help to educate the end-customers about how much the company is actively working for a better planet, and also explain why their extra money is being used for a better future (OP.8). 98% recycled aluminium could be the best start for communication efforts (OC.2). It has been found that none of the dealers have faced any issues with product sale after C2C certification, so, this should be a major communication for everyone involved, as a success story of C2C (SC.4).

2. Dealers have mentioned that due to lack of awareness among the customers, there has not been a major increase in sales of products (WC.2, WC.4).
3. The marketing team is already investing a lot of resources for spreading the messages. They just need a plan to spread all the messages to the right crowd (OC.4). A clear explanation to the world would help avoid greenwashing (TP.8), by communicating the positive effects of C2C and recycling (SC.1). Greenwashing is a major problem with companies, where they try to boast false sustainable and green claims. These days consumers are very critical about every claim and want to see proof of these claims. A C2C certificate, along with support from the dealers, would be a good strategy to avoid greenwashing and negative branding.

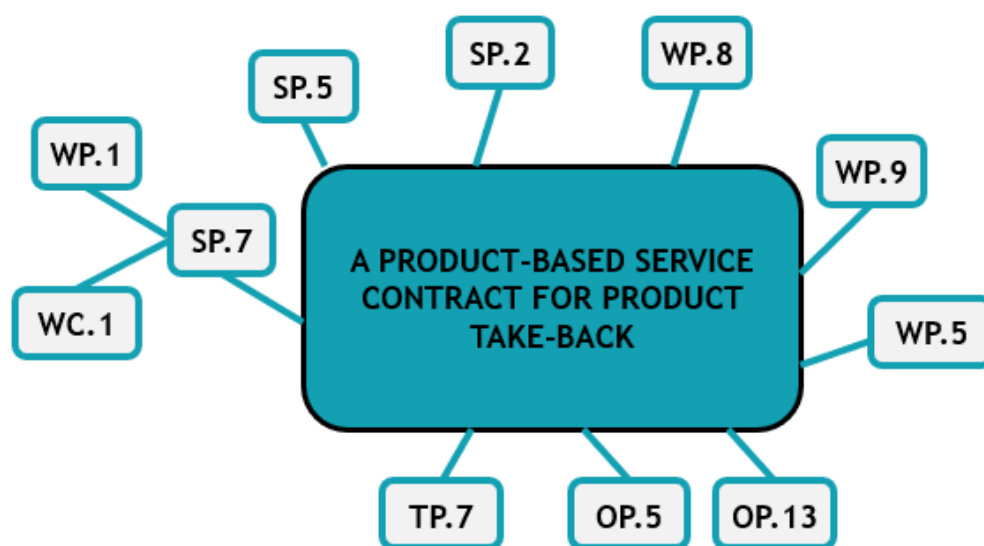
5.1.3. A product-based service contract for product take-back

The type of product-service system (PSS) accepted by most of the respondents of the interview, was the “product-based service contract”, that includes maintenance, repair, cleaning, software and hardware upgrades, and take-back guarantee. The contract would provide free services for a specific warranty period, after which it would be charged as per required servicing. In this way, the customer doesn’t pay a yearly fee, where they might not even need servicing. This is in line with what Luxaflex already does; servicing within the warranty period. With this service contract, we can ensure that the dealers can maintain a good customer relationship (SP.2), by always being available for repairs or replacements. The customers can enjoy carefree product use for the term of contract, at the end of which, they can either choose to extend their contract, or can get their product taken back by the company, thus ensuring carefree and responsible disposal. The product take-back would be charged to the customer, if they do not buy a new one from the dealer, but if they are buying another product, they would get a discount on the new product. This would ensure the system is financially feasible and attractive for all parties involved.

The service contract can be first focused only on the projects market, the business-to-business customers which include government institutions, architect’s community, sustainable communities and building owners. There is a growing demand for maintenance contract in the projects market. Similarly, if we are able to convince the residential consumers about the service contract, they can benefit from having no responsibility of the product, during use and also at product end-of-life.

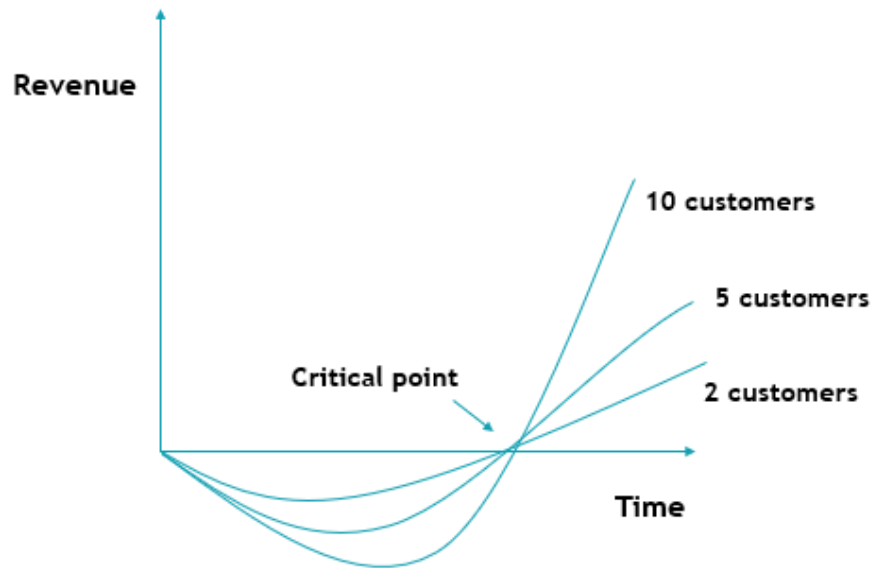
1. How the system would work for end-customers and dealers: A consumer comes to the dealer’s showroom to select a product they like, and would sign the service contract. The dealer would then visit the apartment, or building, to take the measurement, size, and specific design choice of the customer. The dealer then informs Luxaflex about the product choice and Luxaflex would deliver it to the dealer’s showroom. The dealer would then install the product on site. On the product, there would be a QR code, specific to the product, describing the date of purchase, product specification (WP.5, TP.7), and the term period of the service contract. A mobile app can be used to scan the QR code and the contract would be activated. The app can also be used for motorized operation of the blinds. This app can provide the required database for tracking which products and their contracts are in the market. The customer can use the app to call for servicing or for end-of-life replacements. The dealer gets notification and description of the products, and can come to replace or remove the product. They then disassemble the product and separate metals from plastics and fabrics.

2. How the system works for dealers and Luxaflex: When the dealers take the old product back, they bring it to their site to disassemble (WP.9, OP.13). When Luxaflex would come weekly, to deliver new orders to the dealers, they would take the old materials back, in empty trucks to avoid contamination of new products (WP.8), to the same distribution point where they picked up new products, as they are travelling the distance anyway. Luxaflex would have a collaboration with a recycling company to setup containers at the distribution centre, where they would dump the metals and other wastes, and the recycling company can come pick it up when it's full. The transportation costs can be reimbursed with the value we gain from recycling the raw materials.



Validation:

1. Luxaflex has the financial capability to pursue such sustainable strategies (SP.7, WP.1, WC.1). although the returns wouldn't be positive from the start, but once the system reaches economies of scale, we can see major financial benefits (SP.5), as seen from the graph below. A feasible solution would then be to finance the PSS model with profits from the linear and traditional model, for a while till we reach critical point. Reinvesting the profits rather than giving dividends, and clearly communicating the reason to the shareholders. The revenue would be low for a while, but once we start getting enough old products back, and we attract more consumers for our sustainability impact, we would generate profits at a constant rate.

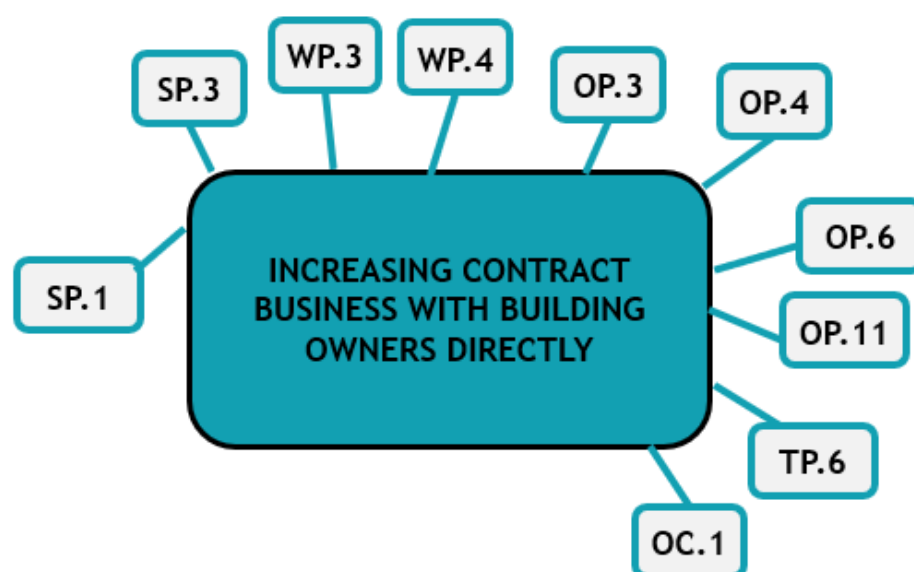


2. Looking at the graph again, we can assume that the recycling companies would also start making profits, once we have an increase in the number of returned products. It should then be financially feasible for them to bring the trucks for pickup more times in a month and also earn a lot in the value of materials that is recovered (OP.5).
3. One recycling company that fits with our study is Krommenhoek Metals. They have mentioned on their website that they can set up containers for free, and come pick up the old materials when they are full. They also provide a scrap value for the recovered metals. This can be promising path for collaboration. ("Krommenhoek Metals Services," n.d.)

5.1.4. Increase contracts business directly with building owners

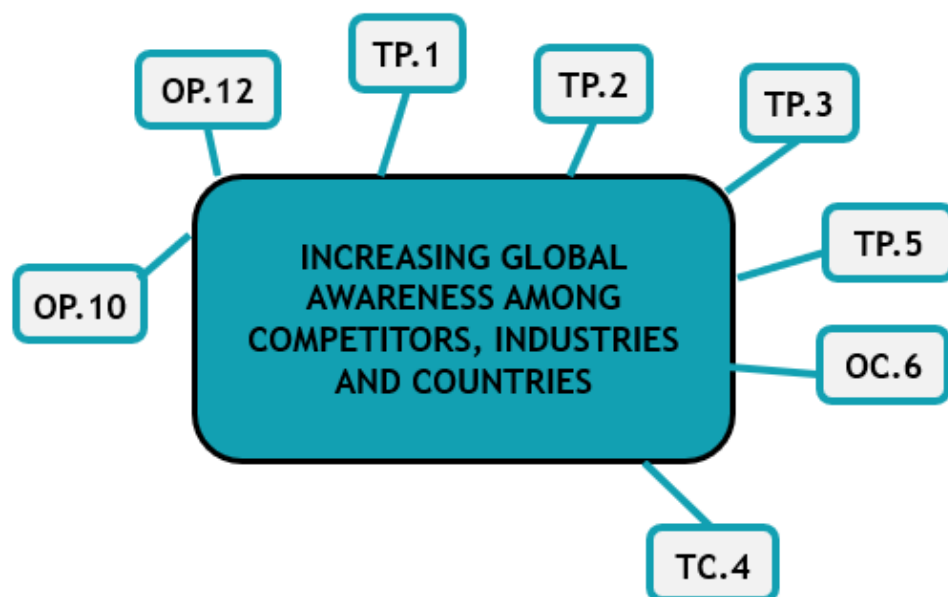
One of the most promising areas where we can focus our product-based service contracts, is with direct collaboration with building owners (OC.1). During the interviews, it has been found that contracts-based business would not work with individual consumers, as our product does not provide constant user satisfaction, like for e.g.: contract-based business of Netflix (SP.1, WP.3). The best solution then, would be to have direct business with the building owner, rather than doing business with individual occupants of the building. The occupants can be employees of a company office or individual customers in apartments. Either way, the building owner will provide the building space and the interior products together.

It would be an “Integrated Building Package”, which will include entire interior products like furniture, floorings and window blinds in the offer for occupants (OP.6). This way, Luxaflex has to make single contract for the entire building, and can maintain the products (OP.4), and also avoid individual product take-back when a single occupant leaves the building (SP.3, OP.11). Instead the blinds would stay with the building as long as it is not renovated completely. Thus, the customers can be guaranteed total and carefree maintenance of all interior products as the combined offer with the building or their apartment. Also, at the end of the contract period, Luxaflex would have a high volume of returned products. this would let us capture the value of the long “life” of our products. Having the contract directly with the building owner would reduce the number of units in the reverse logistics and can also ensure high volume of returned products and high profits (OP.3).



5.1.5. Increase the global awareness among competitors, industries and countries

This strategy is something where Luxaflex has little or no influence, but is very important for them. It is a solution to a number of problems. It is important that Luxaflex is not the only one in the industry who is pushing for product take-back and recycling. We also need to focus on building collaboration with other companies in the industry to have a unified recycling system. Also, we need government regulations that motivates every product user to recycle their products after use and avoid wastes. Similarly, regulations like Extended Producers Responsibility (EPR) can force manufacturers to be more responsible of their products even after they sell it, and government must help to make it a norm to recycle. If our recovery system would be in place, we can be safe from EPR. This is something that would happen over time, and along with the growing market awareness regarding sustainability (OP.10).

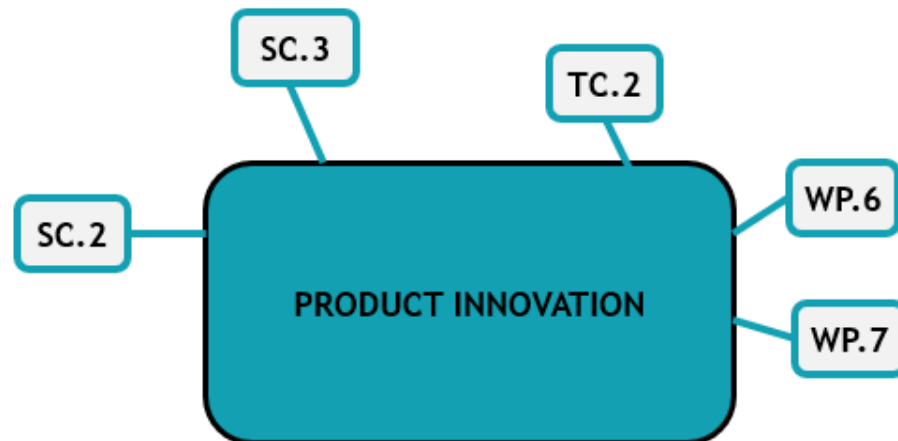


Validation:

1. Being the first mover in the industry, for product take-back and recycling, can be a major competitive advantage (OP.12, OC.6). other companies would be a follower, and would miss the opportunities of increasing their customer base, during the current trend of sustainable products.
2. The collaborative efforts of different companies and governments can help us overcome numerous issues and threats to sustainability and product recycling (TP.1, TP.2, TP.3, TP.5, TC.4).

5.1.6. Product innovation

Some major problems we face while moving towards a more sustainable world, is the product we are selling itself. The current design of the product is too complex, and it is made as a combination of different materials, that are difficult to separate at end-of-life (TC.2). the hardware of the window blinds consists of various small parts, that are difficult to disassemble. Thus, for efficient recycling, we need to make sure that our products are designed for recycling (DfR).



Validation:

1. We already have experienced the advantage of having high-quality and healthy materials for our products. the certification process was easy, only because of the exceedingly stringent supplier selection for the supply of raw materials for our products (SC.2, SC.3). Similarly, for moving up to Gold level certificate would be easy, if the products are designed with recycling in mind (WP.6).
2. If products are designed for recycling, we can increase product take-back, and recycle the materials for new products. this would help us increase our material reutilization factor (WP.7).

5.1.7. Online selling

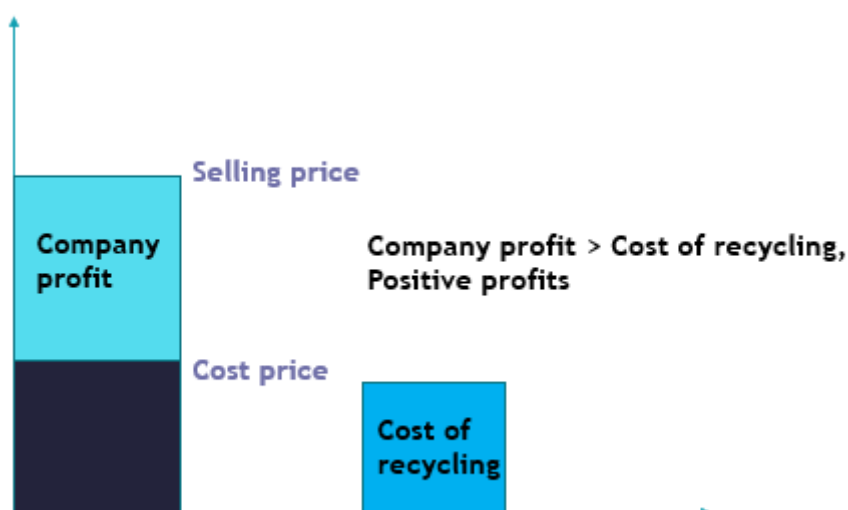
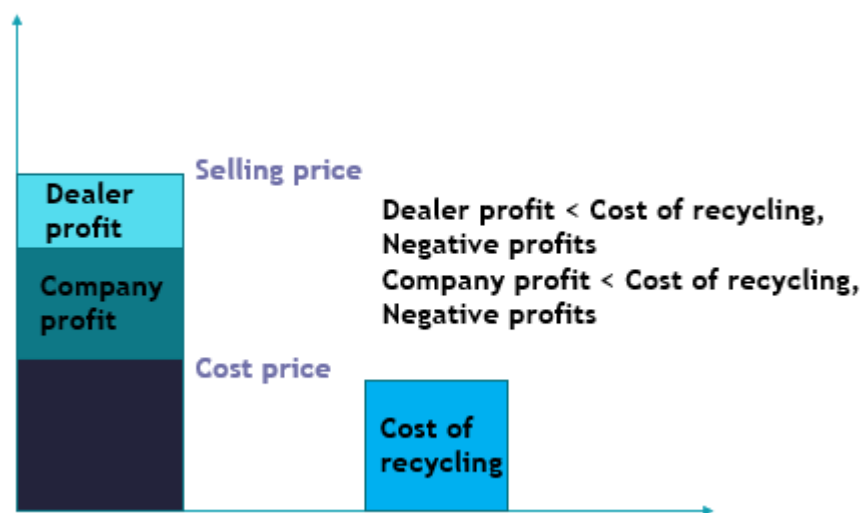
Looking at the growth of technology-based business models, the company could also enter online selling directly to the end-consumer. This can help the company avoid a lot of hassle of product recovery, and have constant and quick contact directly with the end-customers. The possibility of product recovery increases as the number of reverse logistics units is reduced. The company directly sells to the consumers, and can directly collect the product at end-of-life directly (OP.3, TP.4). A number of issues mentioned during the interviews can be solved by entering direct online selling of window blinds.



Validation:

1. Online selling and e-commerce business like Amazon and eBay have attracted more consumers than retailers and wholesalers. Over the years, Luxaflex has done business with consumers in the age range of 40+ (WC.5). Sustainability is not specifically their top priority. We need to focus on the younger generation, who believe in sustainable products and protecting the planet. Availability of online platforms to buy products can give us an edge over these younger generation of buyers, as most of the younger generation prefers online shopping (OP.7).

2. Online selling also opens up the possibility of making product recovery and material recycling, a financially feasible idea. As we can see from the two graphs shown below. If the cost structure of the company is as shown in the first graph, we see that during the presence of multiple parties between Luxaflex and the customers, the possibility of recovering the 'cost of recycling' is low. None of the parties would look to take the responsibility of recovery and recycling due to negative profits. But on the other hand, if we see the second graph, where the company is involved in direct online selling, the possibility of recovering the costs of recycling is high. The company can maintain positive profits and also handle service contract with direct contact with the customers. The figures represent approximate values based on interview data; they are not based on actual figures of the product prices and profits.

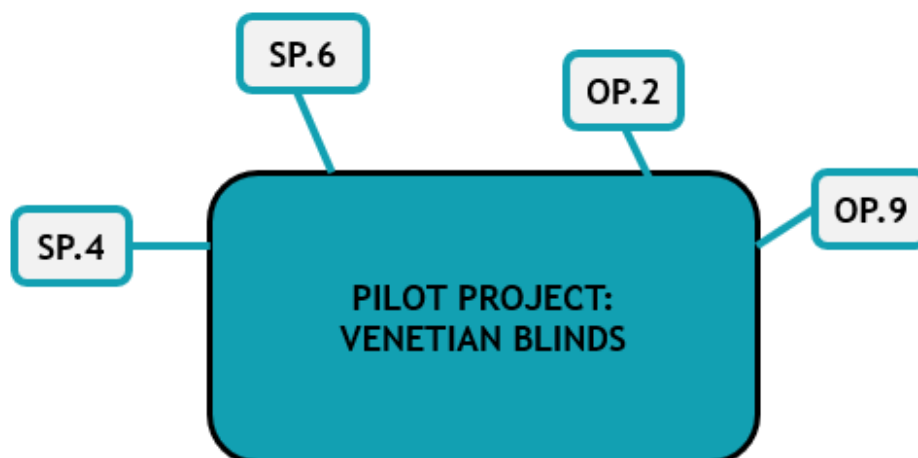


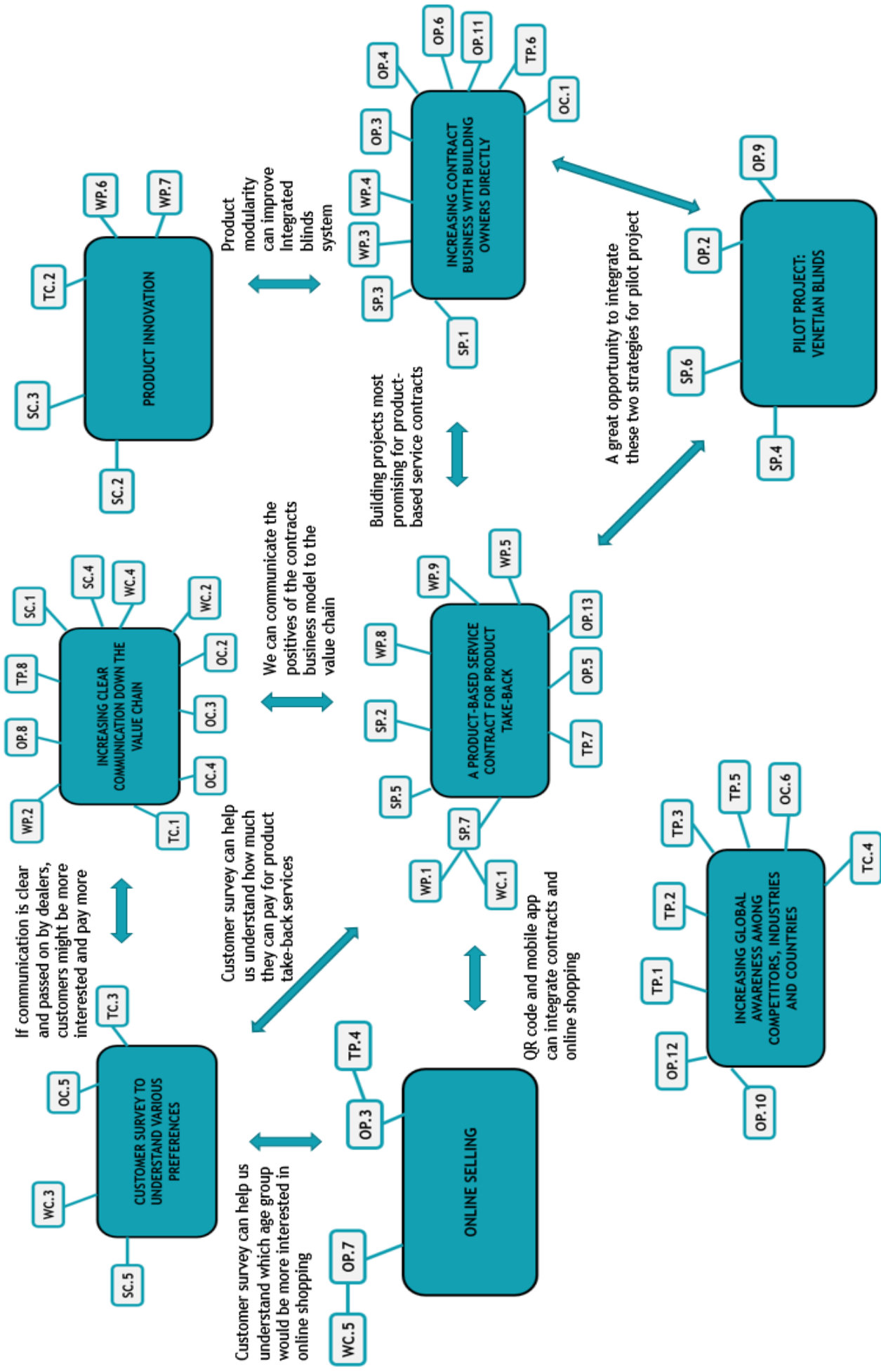
5.1.8. Pilot project: Venetian Blinds

The most promising product for our strategies of product recovery and recycling is Venetian Blinds. The following points prove why:

1. 98% of the aluminium used in venetian blinds is recycled aluminium.
2. The venetian blinds have 95% material reusability. So, if we bring the old products back, we can reuse almost 95% of the old materials in the new ones (OP.9).
3. 75% of the product weight are materials that have some value for recycling (SP.4, SP.6). This is the most promising product among the three certified product lines, as we can generate a lot of value from them (OP.2).
4. The dealers have mentioned that they are already taking back 30-50% of product they sell. They mention the maximum volume is of venetian blinds.
5. The entire product is C2C certified.
6. If we focus our initial efforts of our pilot project only on the Dutch market, working with dealers and customers for product take-back of venetian blinds, and have a collaboration with Krommenhoek metals, then this could be a success story for Luxaflex.
7. We can combine the various strategies together for our pilot project. We can work with building owners in Netherlands, for a service contract for the window blinds, provided by the dealers, and tracked by the mobile app. The dealers could then take-back the products at end-of-life.

Thus, if Luxaflex would want to slowly start adopting the strategies mentioned in this report, it is most feasible to start with venetian blinds.





5.2. Sustainability awareness

After the interviews with the respondents, it was found that some of them did not have a clear understanding about C2C or PSS. This is a serious indication of how much efforts Luxaflex has put in explaining the C2C certification process, among the people in the organization and the dealers itself. The following data can be stated about the awareness about C2C, and is shown in [Figure 26](#):

1. 14% respondents interviewed, mentioned that they have very little knowledge about the C2C concept, the certification process and what it means, to have the certificate.
2. 35% respondents, mentioned they are familiar with the C2C and what it means. Although they still don't know about the criteria that are fulfilled for the certification.
3. 51% respondents said they perfectly understand the C2C concept and the certification criteria. They have been through the process of certification, or have been involved with the story of certification in some way.

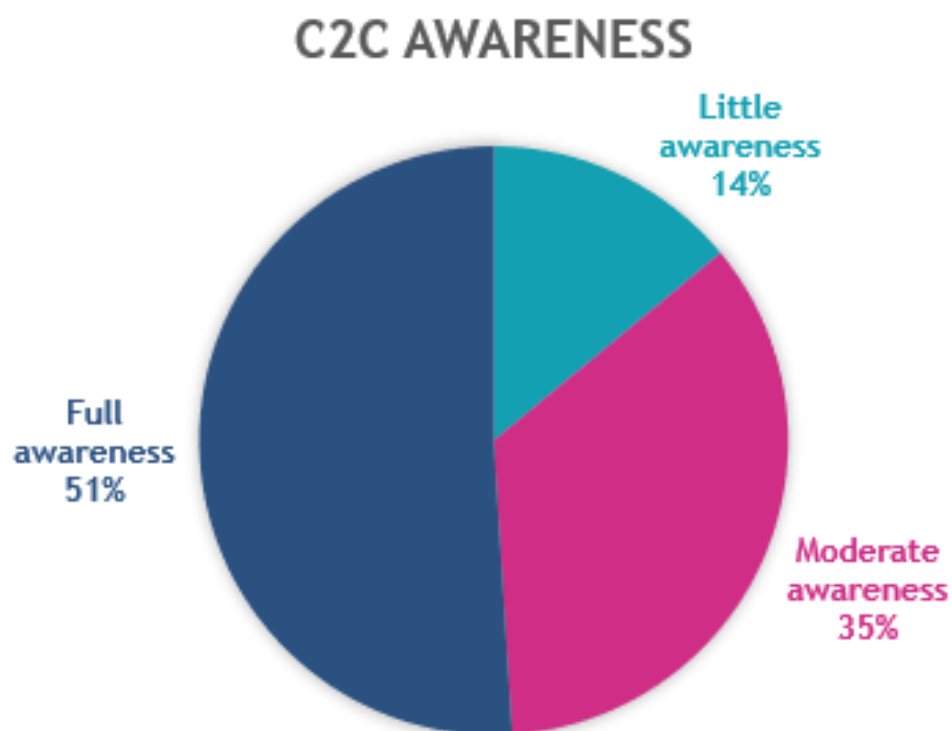


Figure 26: C2C awareness

During the interview, the respondents were also asked what their opinion was, regarding adopting a PSS for our C2C products, the following data was generated, also shown in [Figure 27](#):

1. 21% of respondents mentioned that they had never had an experience with providing a PSS for their products.
2. 28% of respondents said that they were experienced with PSS, but would not see them work for Luxaflex C2C window blinds.
3. 51% of respondents said they are aware about the PSS business model and that it would be a good innovative idea to pursue, and which can be researched further to find feasible solutions.

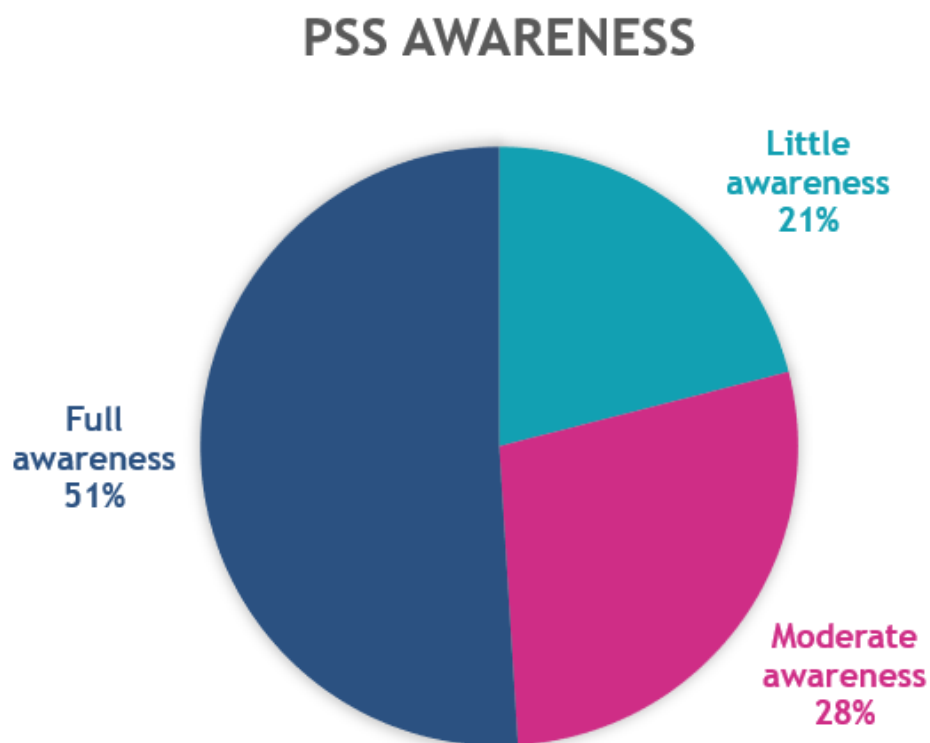


Figure 27: PSS awareness

Also, among the people who preferred PSS, when asked which PSS model would they prefer for the C2C products:

1. 85% preferred "Product related services". Provision of a service contract with the sale of products
2. 15% preferred product leasing. Providing functionality to customers rather than product ownership.

5.3. Priority market segment

Luxaflex does business through the dealers. Customers buy their products by visiting the dealer's showrooms, and choosing from a wide variety of products and brands. But there are two types of customers that the dealers do business with, Business-to-Consumers (B2C) and Business-to-Business (B2B). The following data were identified during the interviews, also shown in [Figure 28](#):

1. More than 90% of the respondents have mentioned that C2C is a requirement for purchase only with the B2B customers. Customers like government institutions, architect's community, building owners and projects business (Green Zones and Seminar halls), demand sustainable options for their interiors.
2. Almost all the respondents have confirmed that a PSS model, or to be specific, a product related service contract, would work only for the B2B market. It is easier as they have separate purchasing departments to maintain the contract and also because the number of product takeback would be higher. With individual customers (B2C), product take-back would not be economically feasible.
3. Only about 10% of respondents say that residential customers or, B2C customers, come looking for C2C certification as their top priority for product purchase. Usually these customers prefer a good quality and functional window blind. Respondents also mention that these customers would not necessarily pay extra costs of buying a sustainable product.

PRIORITY MARKET SEGMENT

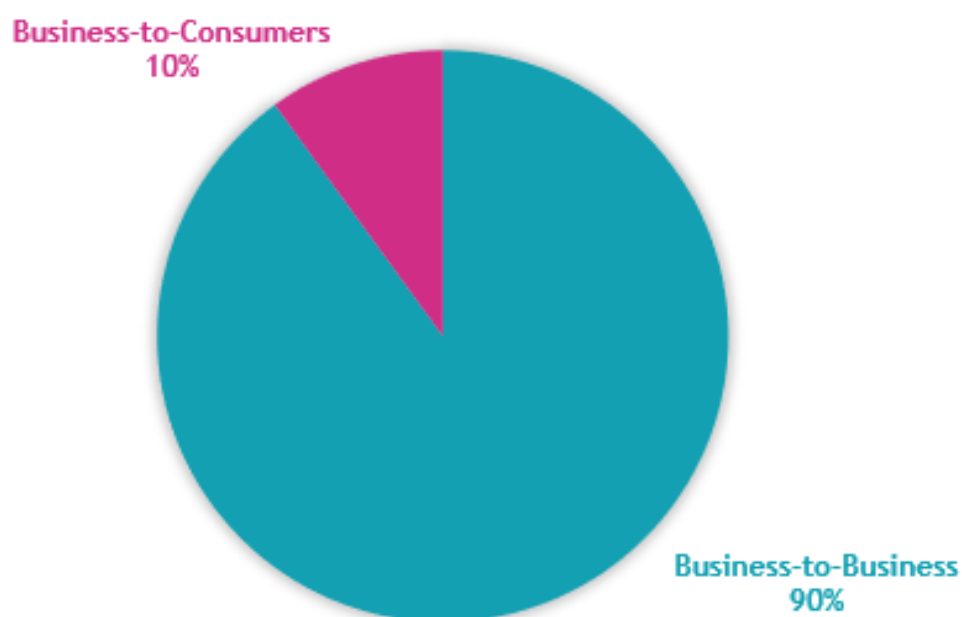


Figure 28: Priority market segment

5.4. Trade-offs

During the content analysis of the transcripts of the interviews, we came across a lot of trade-offs that the dealers and the customers face, when manufacturing companies introduce product innovations like C2C and business model innovations like product take-back and PSS. The graphs are not prepared as per numerical figures, and are figurative representations, only presented for clear understanding about the relation between different elements. The following data can be listed:

1. Willingness-to-pay and Complexity of recovery systems: The customer's and dealer's willingness-to-pay (WTP) for sustainable strategies adopted by manufacturing companies, is inversely proportional to each other. If the recovery and take-back systems are simple and easy to understand, customers wouldn't mind paying a little extra. If it is too complex to understand, they would not be paying a lot. [Figure 29](#).

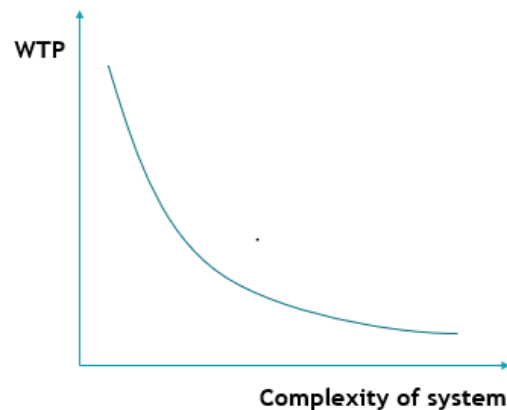


Figure 29: WTP v/s Complexity of system

2. Product design complexity and Complexity of recovery systems: The product design is also a major concern for a successful take-back system. The product can surely be taken back from the customers, but until there are a lot of components involved and a complex design which

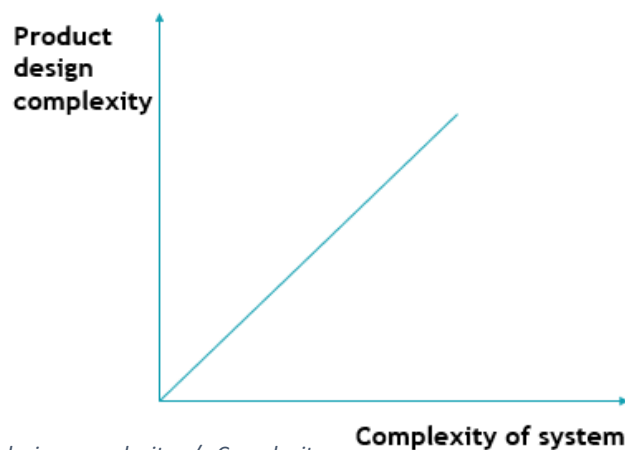


Figure 30: Product design complexity v/s Complexity of system

is not difficult for disassembly, then the recovery systems would become more complex. This in turn would also reduce the WTP of the customers. [Figure 30](#).

3. Sustainability comes at a Cost: No matter which unit of the value chain is choosing for sustainability strategies like C2C or PSS, there is an attached cost to such a change. [Figure 31](#)

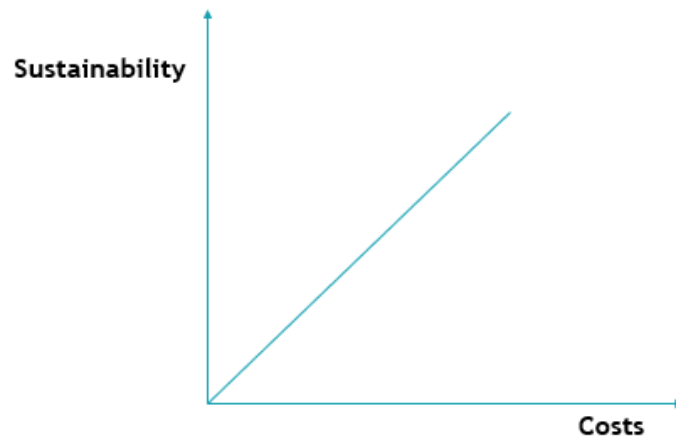


Figure 31: Sustainability v/s Costs

4. Sustainability and Profits: This is in relation to the costs incurred by the organization making changes. If the costs of setting a recovery system is high, and the customer's WTP is low, the profits of the organization would go down. [Figure 32](#).

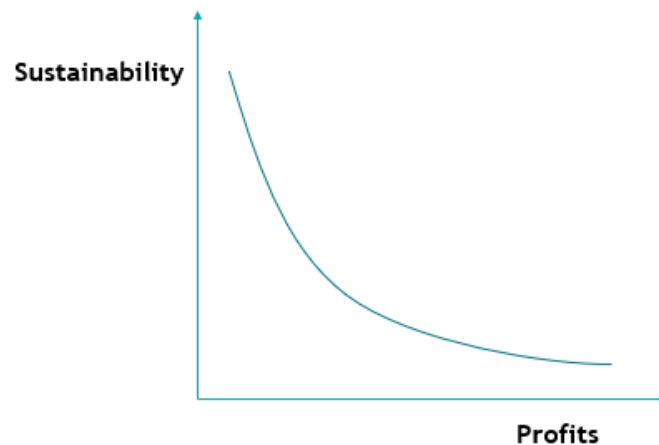


Figure 32: Sustainability v/s Profits

5. Sustainability and design options: In order to avoid additional costs due to complexity in recovery systems, sustainable strategies would reduce the number of design options available and thus in turn increase the WTP, which can be really profitable. [Figure 33](#).

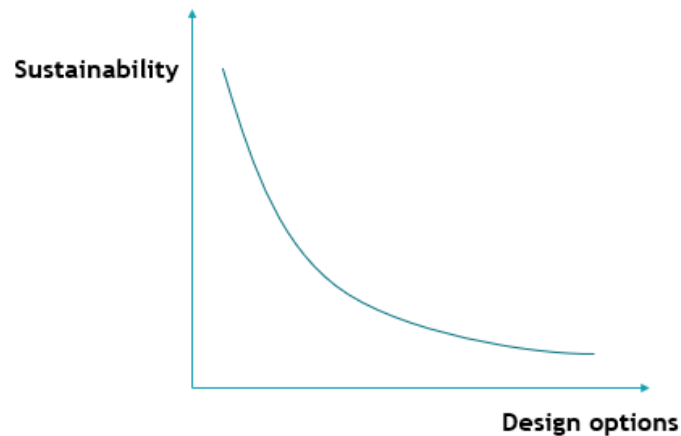


Figure 33: Sustainability v/s Design options

6. Product ownership and Functionality: The best trade-off that we have understood from the research, is that when people start preferring the functionality that the product provides, over the ownership of products, then manufacturing companies can invest more to use safe, healthy materials and processes, and also benefit from product innovations. For e.g.: Customers are now choosing a PSS model for washing machines, where the product is still owned by manufacturers, and customers pay only for the use of the product. The companies can then invest in high-quality long-lasting machines, to increase overall profits. These business models involving services with products, are important for sustainability. [Figure 34](#).

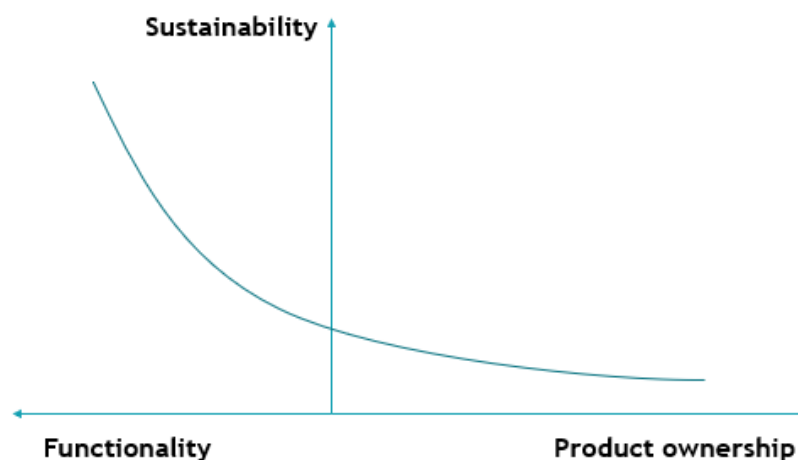


Figure 34: Sustainability v/s Functionality

7. Life of products and Profits: A major negative impact of sustainability is the fact that when companies try sustainable strategies like C2C and PSS, they are trying to make sure that the products stay in use for a longer time, and thus ensure waste reduction and lower material usage. But if products last long, this would affect and cannibalize the sale of new products. If customers have the products for long, they wouldn't be interested in buying a new one. [Figure 35](#).

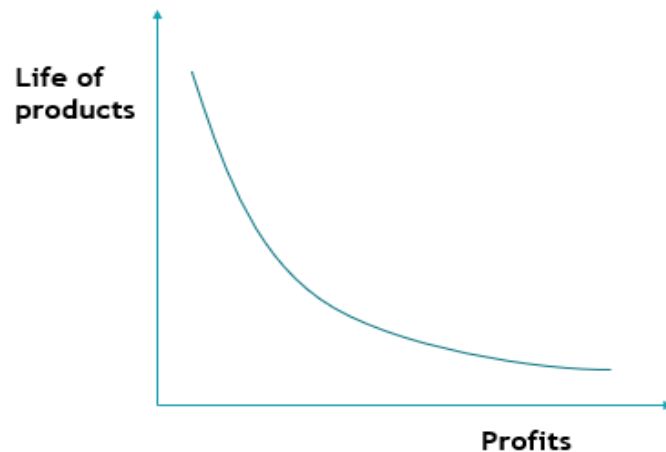


Figure 35: Life of products v/s Profits

8. Company's influence on the Value chain: It has been concluded that the company's influence or control reduces as we go down the value chain. This proves an important barrier, as our strategies also involve these players. If the company can't control them, they need to provide incentives for their support. This makes the system too complex, which is also reflected by a complex recovery or take-back system. [Figure 36](#).

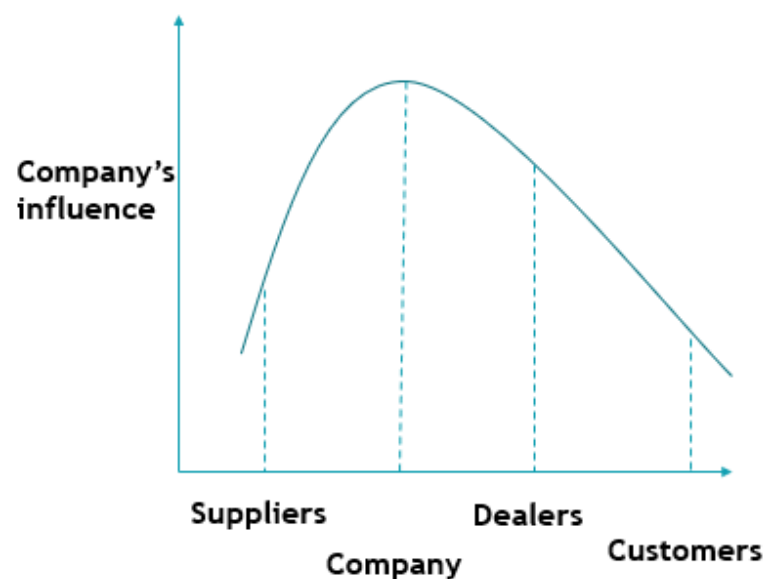


Figure 36: Company's influence v/s Value chain

5.5. Recommendations to each stakeholder

1. Parent company: The recommendations that we would give to Luxaflex is to focus on identifying the customer requirements, to better understand the market demand. The strategies mentioned in the OST would work only if the company knows customer preferences. The other recommendation would be to communicate their sustainability efforts in an efficient way to all the partners involved, as well as the customers.
2. Dealers: Dealers are a key stakeholder to Luxaflex. The dealers must find what their individual customers prefer, and inform Luxaflex accordingly. This way they can make effective use of personalized service contracts for different customer segments. They should invest in disassembly activities, so, that they can also be part of the sustainable family of Luxaflex, and prove their involvement in helping the environment.
3. Customers: The customers must be more positive towards the efforts taken by manufacturing companies for sustainability. The public mindset must adopt the much-needed change to a circular economy, for the better future of the planet. They must be willing to pay a little extra towards the cost of saving the environment.
4. Assemblers: The assembly centres must have specialized disassembly points for efficient products take-back. Also, they must have large containers set up at their facility, to provide a single point pickup for all the materials from old products.
5. Recycling companies: The recycling companies should provide services of reverse logistics for the materials recovered from the old products. The company must be willing to provide these services for a minimum charge and can earn from the sale of recycled materials that they recover. The recycling company must also come together to join the Luxaflex family and their steps towards sustainability.
6. Local municipalities: Local municipalities can prove their importance by increasing the customer awareness and changing public mindset towards resource conservation and responsible waste disposal.

Chapter 6- Conclusions

Finally, to conclude our report, we would summarize all the important facts that we came across from our research. we would also see how we were able to answer our research questions, and what strategies were recommended to Luxaflex for product recovery.

6.1. Answers to research questions

1. Answer to sub-question 1: “What is the current state of C2C certification?”

The C2CPII is the institute that provides all necessary guidelines and assistance regarding the certification, for companies that are looking to get their product certified. There are five criteria for C2C certification, which the product needs to fulfil. Material health, where we see how safe and healthy are the materials used in the product. Material reutilization, how much materials from old products can be used again in new products. Renewable energy, how much energy used for production is renewable energy. Water stewardship, how pure is the water after use in production processes. Finally, social fairness, what social impact does the product have. Based on the individual scores on these five criteria, the overall level of certification is decided.

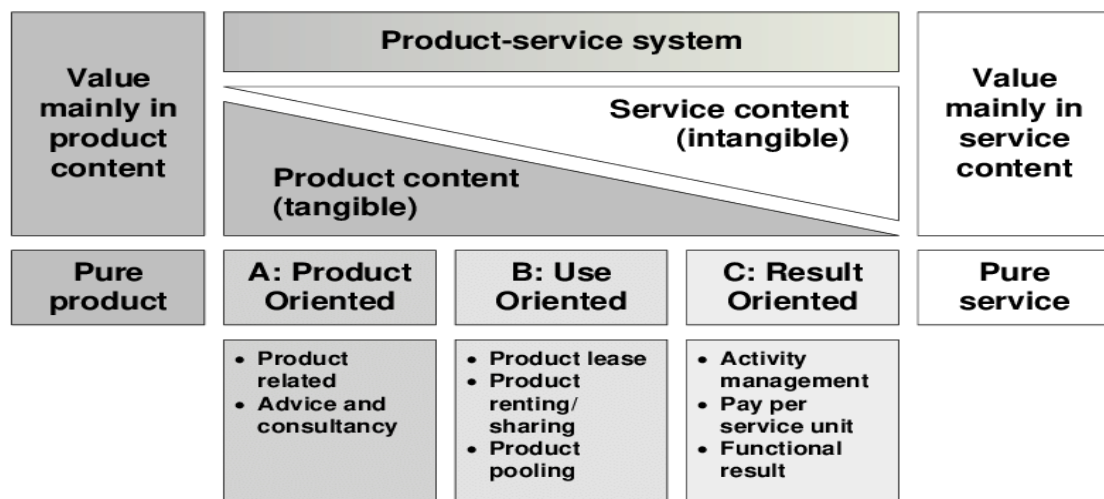
Currently, Luxaflex has three product lines that are C2C bronze level certified. These are the Venetian blinds, EOS500 Xcel roller shades and the fabrics.

Cradle to Cradle Certified Product Scorecard	
MATERIAL HEALTH	Bronze
MATERIAL REUTILIZATION	Silver
RENEWABLE ENERGY & CARBON MANAGEMENT	Bronze
WATER STEWARDSHIP	Bronze
SOCIAL FAIRNESS	Silver
OVERALL CERTIFICATION LEVEL	Bronze

2. Answer to sub-question 2: “What are the existing PSS models in practice?”

From the literature on circular business models, we came across Product-service systems, which is one of the most trending business models for a lot of successful companies like Netflix and Uber. The concept of providing services along with products is promising, because manufacturers can stay in contact with their products even during use, and can adopt responsible end-of-life strategies.

There are 8 types of PSS described by Tukker (2004). These can be seen in the figure below (Tukker, 2004).



Through literature research, we came across that most executives prefer “product-based service contracts” and “product leasing”, as the most effective circular business models. Through our interviews, we found that maximum respondents prefer a “product-based service contract”. This is the reason we selected this PSS type to build our strategies for Luxaflex and their C2C products.

3. Answer to sub-question 3: *“What are the most optimal strategy recommendations for successfully commercialization of C2C certified products, based on a PSS model?”*

Based on the foundation of the project, we decided to research what the general opinion was towards product-based service contract, product take-back and recycling. We tried to consider all the stakeholders involved in the decision, and interviewed top-level executives for their opinions. After data collection about the barriers and drivers of C2C and PSS model, we could build the SWOT matrix of these two concepts. Based on the individual elements of the two SWOT matrix, we could combine different such elements into 8 different strategy recommendations. These can be referred to be part of the Optimal Strategy Triad. These strategies can help us overcome several threats and weaknesses, while building on the strengths and opportunities. The following 8 strategies were suggested:

- a. Customer survey to understand various preferences
- b. Increasing clear communication down the value chain
- c. A product-based service contract for product take-back
- d. Increasing contracts business directly with building owners
- e. Increasing global awareness among competitors, industries and countries
- f. Product innovation
- g. Online selling
- h. Pilot project: Venetian Blinds

It is clear that once these strategies are adopted by Luxaflex, they can efficiently recover their products after use, and can try to reuse the materials they used in the old products. this way, Luxaflex has an opportunity to increase their C2C certification, and in turn, move ahead from the competition in sustainable efforts. Successful product take-back and recycling can help Luxaflex increase their material reutilization criteria in C2C certification, which in turn would make it easy to get a higher overall C2C certification.

4. Answer to research question: *“How can a product-service system (PSS) model, be used with the combination of cradle-to-cradle certified products, to help increase the certification level?”*

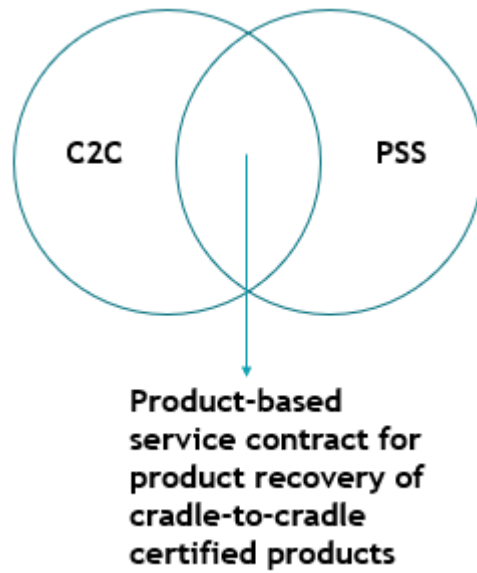
In order to answer the main research question, we had divided our research into three sub-questions. The answer to those sub-questions, combine to answer the main research question.

The current level of certification of Luxaflex C2C products is bronze. We found that the most feasible PSS model would be the “product-based service contracts”. In order to move higher in the level of certification, we need product innovation and development. Specifically, if we choose the material reutilization criterion of C2C certification, before we invest in product innovation to improve the material reusability of the product, we need to make sure that we can bring back the products to us. If we can have a successful product recovery system, then Luxaflex can be sure that the products they produce will one day come back to the system, and then they can reuse the materials from old products, again in the new products. we researched the feasibility of setting up a product recovery system, and which strategies need to be adopted to increase product take-back and material recycling. These strategies prove that a product recovery system is feasible. This in turn, means that once these strategies are in place, Luxaflex can focus on product innovation to boost their material reutilization factor, and increase the level of certification.

Finally, we see how the strategies discussed in the optimal strategy triad, can help Luxaflex to move up in the level of certification desired by the company. Previously, in the literature review section, the certification process was described in detail. It's clear that the final level of certification for the product, is decided based on the individual scores of the five criteria: material health, material reutilization, renewable energy, water stewardship and social fairness. The focus of our research was on the material reutilization criterion.

It can be shown that, the strategy of product take-back at the end of customers use, could be a major benefit for increasing the material reusability. If the product recovery system is in place, and we find enough economies of scale of returned products, then it could be feasible to invest in innovating the product, to increase the material reusability. When we know that the product we sell, would be coming back to us at the end-of-use, then we can invest resources to increase the quality of product and material reusability, to reuse the materials again in the production of new products. This research was focused to learn “if” it was possible for product take-back, and if “yes”, how? Once we have that answer, we can start focusing on product innovation and improving our certification standards. Thus, Luxaflex can benefit from adopting a PSS model of a “product-based service contract”, to ensure

product take-back and recycling, to increase their material reutilization criterion, to ultimately help them increase their overall C2C certification.



6.2. Limitations of project

During the research we came across a number of limitations, that we should acknowledge before finishing the report. These include:

1. The interviews were done in English. Language could be a major barrier between understanding what the respondents actually wants to say, and what they actually say. We tried to make sure that we interviewed top executives who understood English. This limits our research from potentially more experienced Dutch speakers. As the project is focused typically on the business in Netherlands, this language barrier was a limitation to the project.
2. Secondly, as we mentioned that the project included respondents mainly from the Dutch market, it is difficult to generalize our findings to the entire European division of Luxaflex. We cannot specify what the dealers and company executives in other countries would feel about our strategies from the optimal strategy triad. The data and opinions would vary geographically.
3. It has been seen that the certification companies like C2CPII have to sign non-disclosure agreements (NDAs) with manufacturing companies regarding the content of their products, when they submit their documents for certification. These prevent different suppliers and manufacturing companies, to share knowledge about making their products and processes more sustainable and effective. For e.g.: if company A has product X as a by-product, which they probably dispose and scrap, and there is company B who uses product X as their raw materials, could use the scrap from company A, but due to NDAs with the certification companies, no one is aware of such possibilities. This is one of the limitations of C2C certification. The certification institutions must start acting like knowledge centres, to share opportunities among different companies.
4. Finally, during literature search we found that PSS is aimed at achieving eco-efficiency (doing less bad) and C2C is more focused on eco-effectiveness (doing more good). These are two conflicting ways and could be an issue when combining both concepts together.

6.3. Future research

Looking at the solutions generated from this report, a number of future researches are possible and should be pursued, with this report being the foundation.

1. A customer survey needs to be done, to understand how they feel about sustainable window blinds. We need to see how much they are willing to pay for these services and if they are comfortable with product take-back and end-of-life. Unless we understand what the end-consumer needs, there is no use of implementing any radical strategy, that would then be a huge cost to the company.
2. The project must also be done on a much larger scope, taking into consideration the opinions of dealers and organisations, in different countries of the EU region. This way we would be able to generalize our findings, and have much more refined strategies of product recovery.
3. Product innovation must be researched, to understand if there could be a product, that can satisfy all the criteria of C2C certification, and also integrate PSS model into the traditional business model of the company. Innovations like modularity and single-material products must be researched for feasibility in the market and with the technical managers.
4. A cost-benefit analysis must be done, to see how financially feasible would the contract-based business model be, and how much profits can the company generate in a specific time period. The initial growth would obviously be slow, but we need to research when we could hit the breakeven point of positive profits. A financial research is important.

6.4. Discussion

I started this research report, with the objective to identify successful possibilities where cradle-to-cradle (C2C) and product service systems (PSS), could exist mutually. This was based on the clear and scientific literature support, which showed that these concepts have individually been radical innovations in the field of circular economy and corporate sustainability. So, firstly, I would like to discuss the unavailability of literature from other topics revolving circular economy, in this report. These include topics like reverse logistics, reverse supply chain management, closed loop supply chains, and circular supply chains. This is to focus completely only on the two concepts of this research and the topics that they are built from. Further, to understand the coexistence of these two concepts together, I decided to focus on the case of Hunter Douglas. At Hunter Douglas, there are three product which are already C2C bronze-level certified. I then only had to study the feasibility of a PSS system for these products which would help me to achieve my objective.

The data analysis approach of this research is a stakeholder analysis, then a barrier analysis and finally a SWOT analysis. So, basically, we start with identifying what the stakeholders of Hunter Douglas expect from C2C and PSS. Then we move on to the barriers and the drivers of these two concepts. And finally, we decide what the strengths, weaknesses, opportunities and threats of both C2C and PSS. The data required for this report was collected by interviewing top-level executives from various department in the company and the retailers as well. The elements of the barrier analysis and the SWOT analysis, help to formulate potentially successful strategies for the combination of C2C and PSS. These strategies, if implemented, would theoretically be able to overcome all the barriers that stakeholders are facing in the present. I presented eight such strategies, that could overcome various combination of weaknesses and threats, while building their foundations on the strengths and the opportunities available and these strategies also work in combination with each other. These are presented as the Optimal Strategy Triad (OST).

The OST brings the focus the second point I would like to discuss. The strategies that were the outcome of the data presented in the report, are not only focused on Hunter Douglas. In fact, they have broader relevance outside Hunter Douglas too, as other manufacturing companies who produce 'made-to-measure' designer products, can implement these strategies, in their pursuit of becoming sustainably aware and responsible. The reason we chose 'product-based service contracts' as the type of PSS that suits Hunter Douglas products the most, the reason behind the selection is that each and every product here is customized as per the customer's requirements. Thus, this rules out 'product leasing' 'product renting' as the PSS type to select, as the product can never be reused, only recycled. Thus,

we find the third topic of discussion. We still need to research the combination of C2C, with other types of PSS models, described in the literature. Only then, would we be able to generalize the results for successful combination of C2C and PSS.

Fourth, I would like to point that the eight strategies described in the results chapter, are the basic requirement to overcome the recent barriers and threats to C2C and PSS. They are built by accommodating limited information on the positives and negatives, from a limited group of respondents. This is theoretically proving successful, as implementation of these eight strategies would mean that the company wouldn't face any difficulties. But practically, the manufacturing companies have to do a lot more than just these strategies or the combination of them. Financial and economic study needs to be done, a market analysis is required, and the main stakeholder, the customers, needs to be involved in the research. Thus, we can say that these strategies are the foundation of any company's journey towards sustainability, but the companies individually have to build their own additional components, suitable for their own company and their market.

Finally, to conclude the discussion section, I would like to point out the various methods of overcoming the limitations of this project, mentioned in the previous section. The limitations of this research can be overcome by starting with increasing the scope of this project, by including dealers from other countries. The dealers involved in our research were from Netherlands and the Scandinavian region. If we have to implement business strategies among the company offices across the globe, then we need to include dealers from those regions as well. This will increase the generalizability of the research and the solution would seem much more practical. Also, we need to include customers in the research as well, as they are also one of the most important stakeholders. The research results could be refined further, if the interview is conducted in Dutch language, as the respondents would then be able to answer more elaborately. The language problem must be overcome for each region that the interviews are conducted in, as this would make the respondents comfortable to answer accurately, thus increasing the reliability of the research.

6.5. References

- About the Institute - Cradle to Cradle Products Innovation Institute. (n.d.). Retrieved April 17, 2019, from <https://www.c2ccertified.org/about>
- Ankrah, N. A., Manu, E., & Booth, C. (2015). Cradle to cradle implementation in business sites and the perspectives of tenant stakeholders. In *Energy Procedia* (Vol. 83, pp. 31–40). Elsevier. <https://doi.org/10.1016/j.egypro.2015.12.193>
- Antikainen, M., & Valkokari, K. (2018). A Framework for Sustainable Circular Business Model Innovation. *Technology Innovation Management Review*, 6(7), 5–12. <https://doi.org/10.22215/timreview/1000>
- Araujo Galvão, G. D., De Nadae, J., Clemente, D. H., Chinen, G., & De Carvalho, M. M. (2018). Circular Economy: Overview of Barriers. In *Procedia CIRP* (Vol. 73, pp. 79–85). Elsevier. <https://doi.org/10.1016/j.procir.2018.04.011>
- Bakker, C. A., Wever, R., Teoh, C., & de Clercq, S. (2010). Designing cradle-to-cradle products: A reality check. *International Journal of Sustainable Engineering*, 3(1), 2–8. <https://doi.org/10.1080/19397030903395166>
- Bjørn, A., & Strandesen, M. (2011). The Cradle to Cradle concept - Is it always sustainable? In *Life Cycle Management (LCM) conference* (pp. 1–10). Retrieved from http://orbit.dtu.dk/files/6443333/Bjoern-The_Cradle_to_Cradle_concept-773_ax%5B1%5D.pdf
- Bocken, N. M.P., Schuit, C. S. C., & Kraaijenhagen, C. (2018). Experimenting with a circular business model: Lessons from eight cases. *Environmental Innovation and Societal Transitions*, 28, 79–95. <https://doi.org/10.1016/j.eist.2018.02.001>
- Bocken, Nancy M. P., Pauw, I. de, Bakker, C., & Grinten, B. van der. (2015). Product design and business model strategies for a circular economy. *Journal of Industrial and Production Engineering*, 33(5), 308. <https://doi.org/10.1080/21681015.2016.1172124>
- Braungart, M., McDonough, W., & Bollinger, A. (2007). Cradle-to-cradle design: creating healthy emissions - a strategy for eco-effective product and system design. *Journal of Cleaner Production*, 15(13–14), 1337–1348. <https://doi.org/10.1016/j.jclepro.2006.08.003>
- Ceschin, F. (2013). Critical factors for implementing and diffusing sustainable product-Service systems:

- Insights from innovation studies and companies' experiences. *Journal of Cleaner Production*, 45, 74–88. <https://doi.org/10.1016/j.jclepro.2012.05.034>
- de Bruijn, H., & ten Heuvelhof, E. (2014). Management in Networks. *Management in Networks*. <https://doi.org/10.4324/9780203885666>
- De Pádua Pieroni, M., Blomsma, F., McAloone, T. C., & Pigosso, D. C. A. (2018). Enabling circular strategies with different types of product/service-systems. In *Procedia CIRP* (Vol. 73, pp. 179–184). Elsevier. <https://doi.org/10.1016/j.procir.2018.03.327>
- De Pauw, I. C., Karana, E., Kandachar, P., & Poppelaars, F. (2014). Comparing Biomimicry and Cradle to Cradle with Ecodesign: A case study of student design projects. *Journal of Cleaner Production*, 78, 174–183. <https://doi.org/10.1016/j.jclepro.2014.04.077>
- Drabe, V., & Herstatt, C. (2016). *Why and how companies implement Circular Economy concepts-the case of Cradle to Cradle innovations*. Retrieved from <http://www.desso-airmaster.com/en/home/>
- Ellen MacArthur Foundation. (2015). Delivering the Circular Economy: A Toolkit for Policymakers. Retrieved from https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_PolicymakerToolkit.pdf
- Geissdoerfer, M., Morioka, S. N., de Carvalho, M. M., & Evans, S. (2018). Business models and supply chains for the circular economy. *Journal of Cleaner Production*, 190, 712–721. <https://doi.org/10.1016/j.jclepro.2018.04.159>
- Geissdoerfer, M., Vladimirova, D., & Evans, S. (2018, October 10). Sustainable business model innovation: A review. *Journal of Cleaner Production*. Elsevier. <https://doi.org/10.1016/j.jclepro.2018.06.240>
- Groenendijk, L., & Dopheide, E. (2003). *Planning and Management Tools: A Reference Book. ITC Special Lecture Notes Series*. Retrieved from https://webapps.itc.utwente.nl/librarywww/papers_2003/tech_rep/groenendijk.pdf
- Helen, K. (2019). Green-washing or best case practices? Using circular economy and Cradle to Cradle case studies in business education. *Journal of Cleaner Production*, 219, 613–621. <https://doi.org/10.1016/j.jclepro.2019.02.005>

- Hoornweg, D., & Bhada-Tata, P. (2012). What a Waste : A Global Review of Solid Waste Management. Retrieved from <https://openknowledge.worldbank.org/handle/10986/17388>
- Jensen, J. P., & Remmen, A. (2017). Enabling Circular Economy Through Product Stewardship. *Procedia Manufacturing*, 8, 377–384. <https://doi.org/10.1016/j.promfg.2017.02.048>
- Jørgensen, M. S., & Remmen, A. (2018). A Methodological Approach to Development of Circular Economy Options in Businesses. In *Procedia CIRP* (Vol. 69, pp. 816–821). Elsevier. <https://doi.org/10.1016/j.procir.2017.12.002>
- Joyce, A., & Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, 1474–1486. <https://doi.org/10.1016/j.jclepro.2016.06.067>
- Kirchherr, J., Reike, D., & Hekkert, M. (2017, December 1). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*. Elsevier. <https://doi.org/10.1016/j.resconrec.2017.09.005>
- Korhonen, J., Nuur, C., Feldmann, A., & Birkie, S. E. (2018). Circular economy as an essentially contested concept. *Journal of Cleaner Production*, 175, 544–552. <https://doi.org/10.1016/j.jclepro.2017.12.111>
- Kowszyk, Y., & Maher, R. (2018). *Case studies on Circular Economy models and integration of Sustainable Development Goals in business strategies in the EU and LAC*. Retrieved from <http://www.innovacional.com/>
- Krommenhoek Metals Services. (n.d.). Retrieved July 22, 2019, from <https://www.kh-metals.nl/en/services/>
- Kumar, P. S., & Suganya, S. (2019). Systems and models for circular economy. In *Circular Economy in Textiles and Apparel* (pp. 169–181). Woodhead Publishing. <https://doi.org/10.1016/B978-0-08-102630-4.00008-X>
- Kuo, T.-C., Chiu, M.-C., Hsu, C.-W., & Tseng, M.-L. (2019). Supporting sustainable product service systems: A product selling and leasing design model. *Resources, Conservation and Recycling*, 146, 384–394. <https://doi.org/10.1016/j.resconrec.2019.04.007>
- Macarthur, E. (2012). Towards the circular economy 1. *Journal of Industrial Ecology*, 10(1–2), 4–8. <https://doi.org/10.1162/108819806775545321>

- McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things*.
- McDonough, W., Braungart, M., Anastas, P., & Zimmerman, J. (2011). Applying the Principles of GREEN Engineering to Cradle-to-Cradle Design. <https://doi.org/10.4135/9781412973793.n35>
- Peters, F. H. J. (2009). Scooter logistics from a Cradle-to-Cradle perspective. *Master Thesis Project*.
- Product Registry - Cradle to Cradle Products Innovation Institute. (n.d.). Retrieved July 20, 2019, from <https://www.c2ccertified.org/products/registry>
- Raihanian Mashhadi, A., Vedantam, A., & Behdad, S. (2019). Investigation of consumer's acceptance of product-service-systems: A case study of cell phone leasing. *Resources, Conservation and Recycling*, 143, 36–44. <https://doi.org/10.1016/j.resconrec.2018.12.006>
- Ranta, V., Aarikka-Stenroos, L., & Mäkinen, S. J. (2018). Creating value in the circular economy: A structured multiple-case analysis of business models. *Journal of Cleaner Production*, 201, 988–1000. <https://doi.org/10.1016/j.jclepro.2018.08.072>
- Richardson, J. E. (2007). The Business Model: An Integrative Framework for Strategy Execution. *Ssrn*, (September), 1–27. <https://doi.org/10.2139/ssrn.932998>
- Ritzén, S., & Sandström, G. Ö. (2017). Barriers to the Circular Economy - Integration of Perspectives and Domains. In *Procedia CIRP* (Vol. 64, pp. 7–12). Elsevier. <https://doi.org/10.1016/j.procir.2017.03.005>
- Romero, D., & Rossi, M. (2017). Towards Circular Lean Product-Service Systems. In *Procedia CIRP* (Vol. 64, pp. 13–18). Elsevier. <https://doi.org/10.1016/j.procir.2017.03.133>
- Sekaran, U., & Bougie, R. (2016). *Research Methods for Business*.
- Senthil Kumar, P., & Femina Carolin, C. (2019). Future for circular economy. In *Circular Economy in Textiles and Apparel* (pp. 207–217). Woodhead Publishing. <https://doi.org/10.1016/B978-0-08-102630-4.00010-8>
- Sousa-Zomer, T. T., Magalhães, L., Zancul, E., & Cauchick-Miguel, P. A. (2018). Exploring the challenges for circular business implementation in manufacturing companies: An empirical investigation of a pay-per-use service provider. *Resources, Conservation and Recycling*, 135, 3–13. <https://doi.org/10.1016/j.resconrec.2017.10.033>

- Supporting The Circular Economy Transition. (n.d.). Retrieved July 20, 2019, from <https://www.oliverwyman.com/our-expertise/insights/2018/feb/climate-resilience-handbook/by-oliver-wyman-authors/supporting-the-circular-economy-transition.html>
- The Cradle to Cradle® design concept - EPEA. (n.d.). Retrieved July 20, 2019, from <https://epea-hamburg.com/cradle-to-cradle/>
- Toxopeus, M. E., De Koeijer, B. L. A., & Meij, A. G. G. H. (2015). Cradle to cradle: Effective vision vs. Efficient practice? In *Procedia CIRP* (Vol. 29, pp. 384–389). Elsevier. <https://doi.org/10.1016/j.procir.2015.02.068>
- Tran, T. A., & Park, J. Y. (2014). Development of integrated design methodology for various types of product — service systems. *Journal of Computational Design and Engineering*, 1(1), 37–47. <https://doi.org/10.7315/jcde.2014.004>
- Tukker, A. (2004). Eight types of product-service system: Eight ways to sustainability? Experiences from suspronet. *Business Strategy and the Environment*, 13(4), 246–260. <https://doi.org/10.1002/bse.414>
- Tunn, V. S. C., Bocken, N. M. P., van den Hende, E. A., & Schoormans, J. P. L. (2018). Business Models For Sustainable Consumption In The Circular Economy: An Expert Study. *Journal of Cleaner Production*, 212, 324–333. <https://doi.org/10.1016/j.jclepro.2018.11.290>
- Veleva, V., & Bodkin, G. (2018). Corporate-entrepreneur collaborations to advance a circular economy. *Journal of Cleaner Production*, 188, 20–37. <https://doi.org/10.1016/j.jclepro.2018.03.196>
- Vezzoli, C., Ceschin, F., Diehl, J. C., & Kohtala, C. (2015). New design challenges to widely implement “Sustainable Product-Service Systems.” *Journal of Cleaner Production*, 97, 1–12. <https://doi.org/10.1016/j.jclepro.2015.02.061>
- World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100 | UN DESA | United Nations Department of Economic and Social Affairs. (2017). Retrieved February 12, 2019, from <https://www.un.org/development/desa/en/news/population/world-population-prospects-2017.html>
- Xing, K., & Ness, D. (2016). Transition to Product-service Systems: Principles and Business Model. In *Procedia CIRP* (Vol. 47, pp. 525–530). Elsevier. <https://doi.org/10.1016/j.procir.2016.03.236>
- Zou, W., Brax, S. A., & Rajala, R. (2018). Complexity in Product-Service Systems: Review and

Framework. In *Procedia CIRP* (Vol. 73, pp. 3–8). Elsevier.
<https://doi.org/10.1016/j.procir.2018.03.319>

i. Appendix-1

Company and Product information

1. Hunter Douglas Europe

1.1.Introduction



Hunter Douglas is a world market leader for window covering solutions and architectural products. The company is actively working towards creating innovative solutions for various households and commercial offices with top quality products and customized services. The company is a coalition of more than 130 various small and medium-sized enterprises (SMEs), located across the world in 100 countries, which are provided freedom to innovate, manufacture and market their product, with a decentralized connection with the parent company. They can even be rival competitors in the same market selling their own products. This is in line with the guiding principle of Hunter Douglas, *'Business is people'*, as they have a culture of individual entrepreneurship, which allows fast decision-making for the managers of the companies and helps to innovate and respond quickly to changing customer needs. These companies are managed by the least amount of people, which falls perfectly with their second core principle, *'Minimum interference, Maximum accountability'*.

The company was founded in 1919 by Henry Sonnenberg, in Dusseldorf, Germany. He joined hands with Joe Hunter, to establish a production line of continuous casting and fabrication of aluminium, to produce the aluminium slats used for making blinds. In order to have an American name for the company, they decided to name the company *'Hunter Douglas'*. In 1971, they moved the group headquarters to Rotterdam, the Netherlands, and Hunter Douglas N.V. became the worldwide Parent Company. The company has spent decades since then to develop innovative products which has made them the global market leader.

The much-relaxed decentralized structure of the company allows for innovative experimentation by various independent managers, to develop customized products for local customers. The innovation focus is distributed across various departments like, material suppliers, equipment design, component manufacturing, automated assembly, high-tech marketing and customer-friendly installation and services. This also helps for marketing and distribution, as the network of localized companies manufacture and sell the products on their own and this closeness ensures top quality products and services. Hunter Douglas also has strong tie-ups with more than 100,000 retailers who are the point of contact with the customers, as the company sells product through the retailer's showrooms and is yet to initiate online product shopping. But the company is actively promoting their products through, radio, television, online videos, and magazine advertising campaigns.

1.2. Product portfolios

The two major categories of product portfolios for Hunter Douglas are:

1. Window coverings- There are various fully assembled structures for window covering solutions, including venetian blinds, vertical blinds, roman, roller, pleated, and woven wood shades, wooden blinds, exterior venetian blinds, screen products, shutters and awnings. The company also has proprietary fabric shades which are high quality and have brilliant design features for the roller shades systems. These products provide privacy, heat and cold insulation, noise control, UV ray protection and light control using a range of innovative design and fabrics. The product is customized specifically to the customer needs and delivered within a week of ordering. The innovative designs for the products and the operating systems have received various awards for their unique design and functionality.
2. Architectural products- Although window coverings comprise of the majority of business for Hunter Douglas, the Architectural products also provide solutions for exterior building performance and internal air quality, with the focus to reduce energy consumption. The various products include sun-control solutions, suspended metal and wood ceilings, decorative resin and glass architectural solutions, terracotta facades and ventilated facades systems. The company collaborates with architectures or home-owners to provide them advice and design assistance for light control, energy efficiency and acoustics solutions.

1.3. Brands available

“Your brand is what other people say about you when you are not in the room” – Jeff Bezos.

The company can be recognized by the brand name it uses in the region and which is easily remembered by the customers. ‘*Hunter Douglas*’ is the leading brand for residential window coverings in North America, Latin America and Asia, while on the other hand, ‘*Luxaflex*’ is the brand name, which is recognized in Europe and Australia. All the products and systems are sold individually under these brand names in different regions.

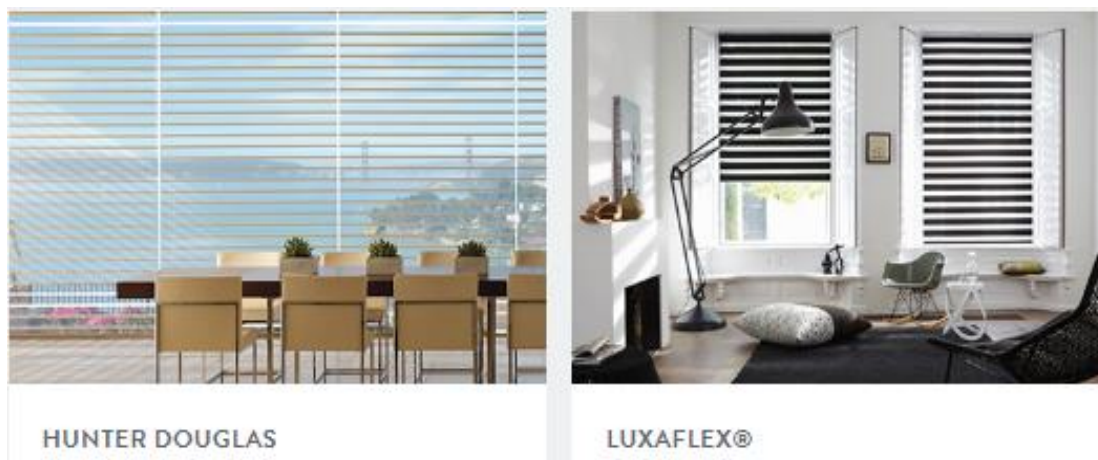


Figure 37: Hunter Douglas brands

1.4. Company objectives

The following are the company’s objectives, as seen on the company’s website:

1. Expand its Window Coverings and Architectural Products businesses at a growth rate exceeding that of the market while continuing to be the best company in the industry.
2. Develop and introduce innovative new products.
3. Seek acquisitions that add to the company’s organic growth by expanding product lines or distribution and that meets its return targets.
4. Have an efficient decentralized entrepreneurial organization, based on the principle of ‘*Minimum interference and Maximum accountability*’.

The focus of this report is based on the second objective, where the company has tried to manufacture an innovative product, that is in-line with the current market requirements and the global environmental regulations. The project and product specification would be discussed later in the report.

1.5. Sustainability

The company is also socially and environmentally conscious, as they are developing innovative solutions to incorporate sustainability in their products and processes. They have company initiatives to reduce water usage, energy consumption and overall carbon footprint. They are designing products with focus on sustainability and green energy. Specifically, the metal venetian blinds, which will be discussed in detail in the next sections, is currently using about 98% of recycled aluminium. This has great environmental benefits as recycled aluminium requires 5% energy of the energy needed for virgin aluminium, and also it reduces carbon emissions by 95%. The fabrics, rollers shades system and the venetian blinds are cradle-to-cradle bronze level certified. The fabrics for the shades are LEEDS certified as well. Some of the fabrics are made of recycled cotton and linen, while there is a product which is made specifically with recycled ocean plastic waste. These practices have brought the company at the frontline of sustainably aware companies, which is the need for today. Very few market competitors have been identified to be sustainably active in the daylight and shading market. The company is now looking for new ways to reduce wastage, energy consumption and dependence on virgin raw materials.

Aluminium venetian blinds:

1. Venetian blinds were first introduced in 1946 and have since been the vintage version for window coverings. They are a simple in design and quite durable. They are mainly produced using aluminium slats (thin sheets of metal placed parallel to each other to form the blind) and can be manufactured as per customer needs and dimensions. They are suitable for any type of windows like turning windows, glass doors, sloped windows and partitions.
2. The slats used for each window can be designed for multiple options for dimensions, colours, and finishes, which the customer might select. The unique 'bounce-back' quality, which allows the slats to recover their shape if they are bent, that increases the life of the blind. Also, there is option for various thermal and colour selection for the blinds, which combines heat reduction properties with visually appealing aesthetics. The operation system could be made of chains or automated rollers, to open and close the blinds, which can be set for top-bottom/ bottom-top operations. The slats can also be arranged vertically, to open sideways for sliding doors.
3. The material used for production is made of 98% recycled aluminium, which has a high corrosion resistance, and is cradle-to-cradle bronze level certified.



Figure 38: Venetian blinds

EOS 500 Xcel roller blinds:

1. The EOS 500 Xcel roller blinds system consists of a head rail, a rotary system, stainless steel endless chain, and the shading fabric. The blind can be easily fixed on the window columns and has an easy-to-fit profile. The endless cord is soft, easy-to-use and is child friendly to prevent accidents.
2. The blinds are used widely in office applications for light and heat control. The operation is smooth and the fabrics used are stretched across the window or set of windows to form a single-control system for multiple blinds. The roller blind operating system is cradle-to-cradle bronze level certified.



Figure 39: EOS500 Xcel roller blind system

Roller shading fabrics:

1. The Green Screen Eco fabric is one of the first eco-friendly fabric used for shading and can be used in various products including the EOS 500 Xcel roller blind system. The Green Screen is environmental-friendly and delivers high quality light and glare-control. All fabrics are highly corrosion and heat-resistant and provide a wide variety of colour, shades, print and textures for varied customer needs.
2. The fabrics are completely recyclable, environmentally-safe and PVC-free, providing thermal insulation and solar protection. They are highly durable and would not sag or stretch, thus ensuring a longer product life.
3. The Green Screen Eco fabric and other fabric range are cradle-to-cradle bronze level certified and have also been used in a number of LEEDS certified projects. It has low VOC (Volatile Organic Compounds) gold level certification from Green Guard, and are halogen free.

Hunter Douglas
Polyester FR and
non-FR shading
fabrics

HUNTER DOUGLAS EUROPE

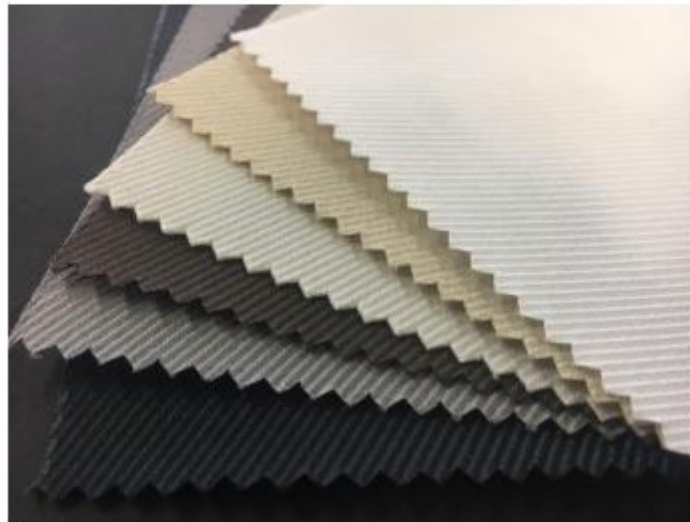
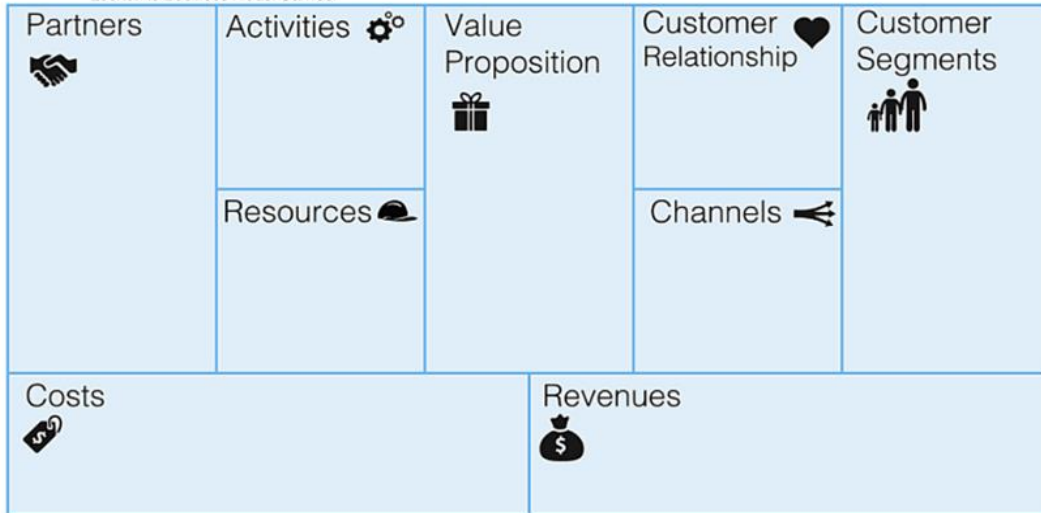


Figure 40: Roller shading fabrics

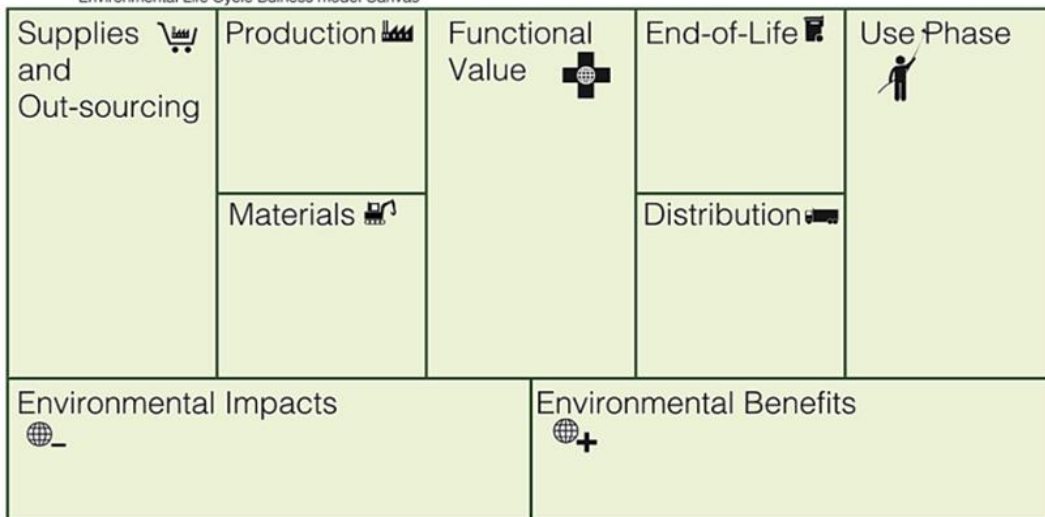
ii. Appendix- 2

Triple Layered Business Model Canvas

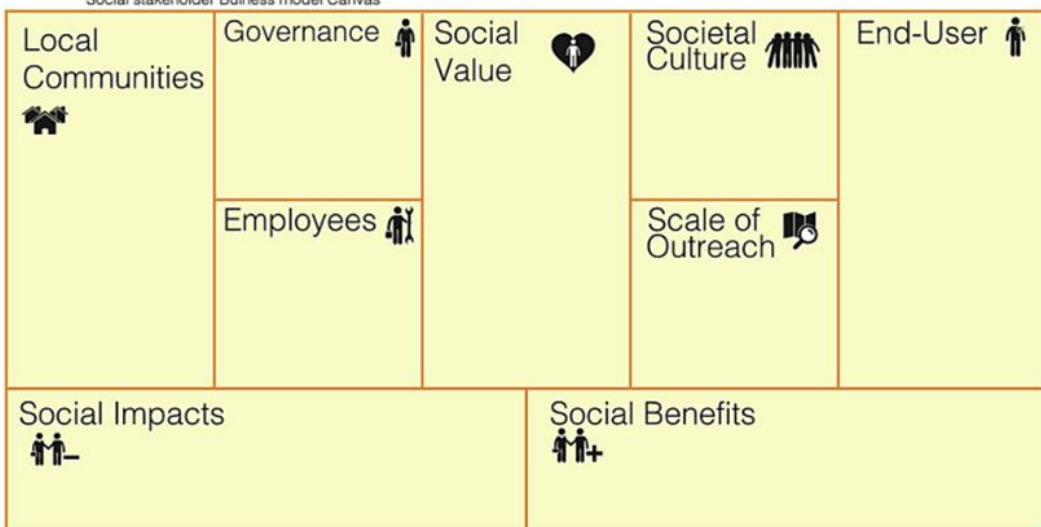
Economic Business model Canvas



Environmental Life Cycle Business model Canvas



Social stakeholder Business model Canvas



2.1. Economic Layer

1. Value proposition: What is the value delivered to the customer? Which value propositions cater to which customer segment?
2. Customer segments: What are the customer segments for which the value is being created?
3. Customer relationships: What are the types of customer relationships maintained with the current customer segments?
4. Partners: Who are the key partners involved with the company in providing value to the customers? Who are the partners that would best suit our needs?
5. Channels: Through what channels are customers reached? What options are there for setting up a reverse channel for product take-back?
6. Activities: What are the key activities required for delivering the value proposition, operating channels, maintaining customer relationships, and capturing revenue streams?
7. Resources: What are the key resources required for delivering the value propositions, operating channels, maintaining customer relationships, and capturing revenue streams?
8. Costs: What are the most important costs incurred by the company? Which key resources are most expensive? Which key activities needs most resources?
9. Revenues: What amount are the customers paying for the value provided? What is the mode of transaction?

2.2. Environmental Layer

1. Functional value: What are the focal outputs of the product by the organization? What is the value that is being provided to the customer in a certain period of time?
2. Use phase: What is the customer's contribution to the environmental impact by product use?
3. End-of-life: What are the various alternatives available for customer to get rid of used products after their use period, and what are their environmental impacts? What would a service model help for sustainable end-of-life practices?
4. Supplies and out-sourcing: What are the activities that have been out-sourced but are vital for the company? Which of these activities can be changed to in-house activities?
5. Distribution: What are the physical means by which the company ensures access to the functional value, and what are the environmental impact of these?
6. Production: What are the actions taken by the company for transforming raw materials into finished goods, and what are their environmental impacts based on resource depletion?

7. Materials: What are the organization's key materials and their environmental impact in terms of virgin resource depletion?
8. Environmental impacts: What are the overall ecological costs to the environment due to company's practices?
9. Environmental benefits: What is the overall ecological benefit to the environment due to company's practices?

2.3. Social Layer

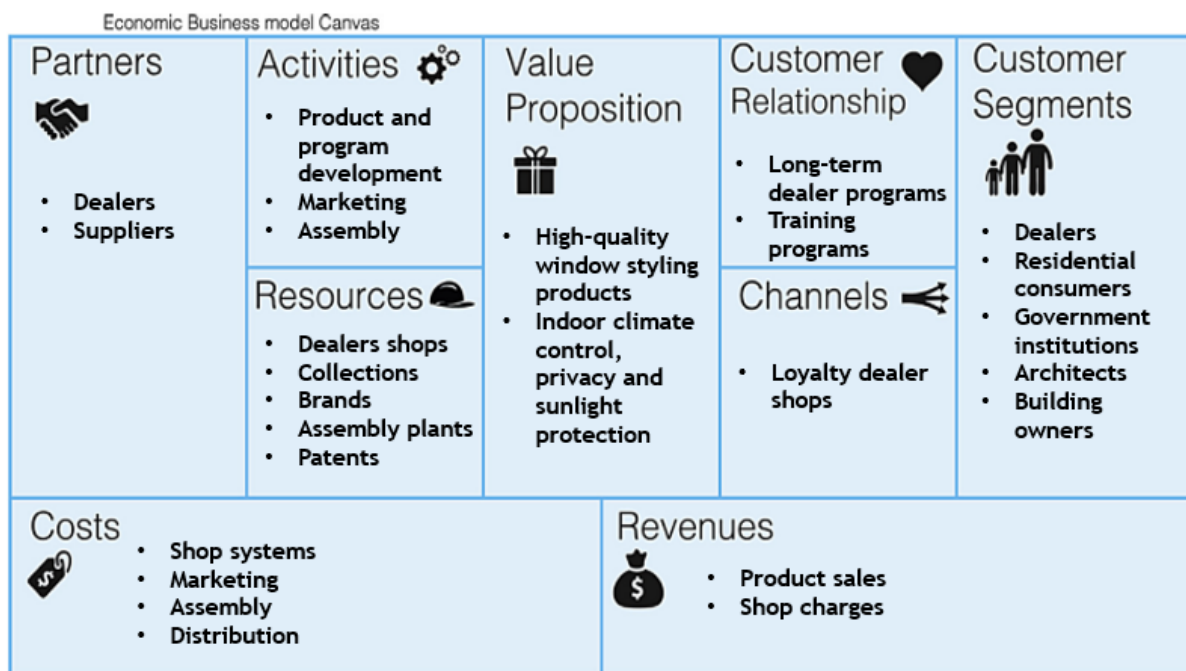
1. Social value: What is the social value that the company is aiming to target?
2. End user: What does the end-customer gain from the value proposition provided by the company?
3. Societal culture: What is the potential impact of the organization on the society?
4. Local communities: What social relationships are in place with the suppliers and their local communities? Which additional relationships would be required?
5. Scale of outreach: What are the depths and breadths the organization is ready to go to build relationships with the stakeholders?
6. Governance: What is the organizational structure and how the stakeholders are actively involved and engaged?
7. Employees: What are the elements related to employees that play a major part in the company's success?
8. Social impacts: What is the social impact of the organization? What changes would be brought on the society due to the organization's working?
9. Social benefits: What are the social benefits of the organization? What positive societal value is created due to the organization's working?

iii. Appendix-3

Business Model Assessment

Business model assessment

Next, we see what the current business model of the company looks like, and how the elements have a change, when we introduce a PSS model for C2C products. The elements of the canvas, have been briefly described by the upper management of the company, and includes the data that could be provided, based on what they understand. The elements that are blank, have no available data for inclusion. In the results chapter, we will see how the elements of the business model canvas would change when we adopt a PSS model into the traditional business model.



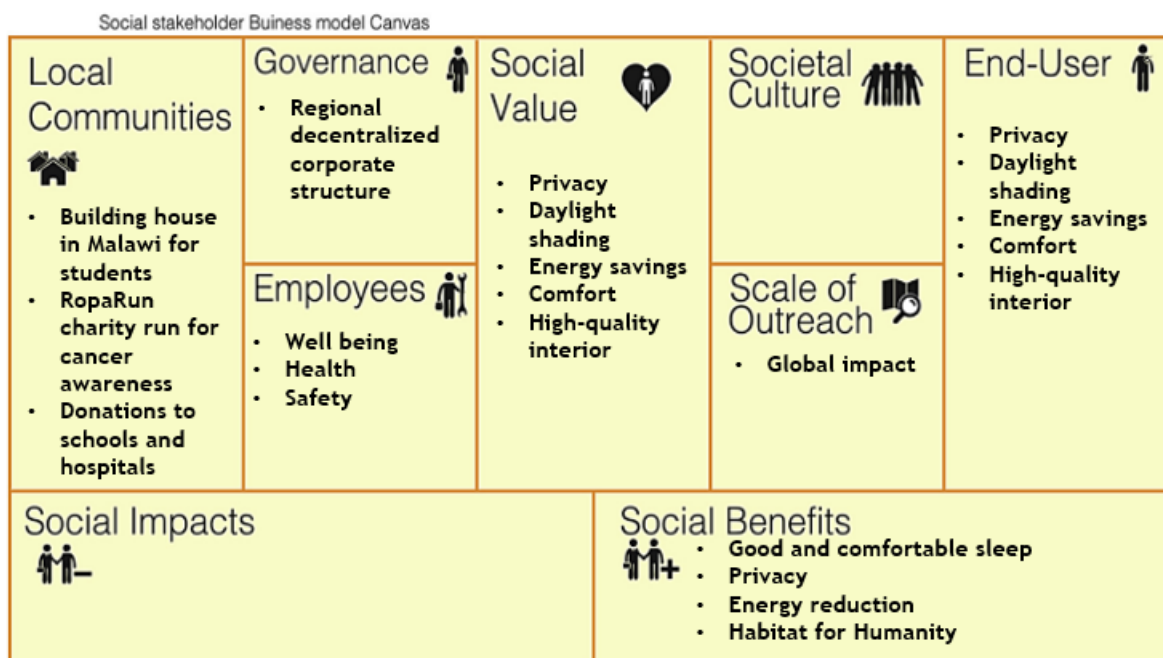
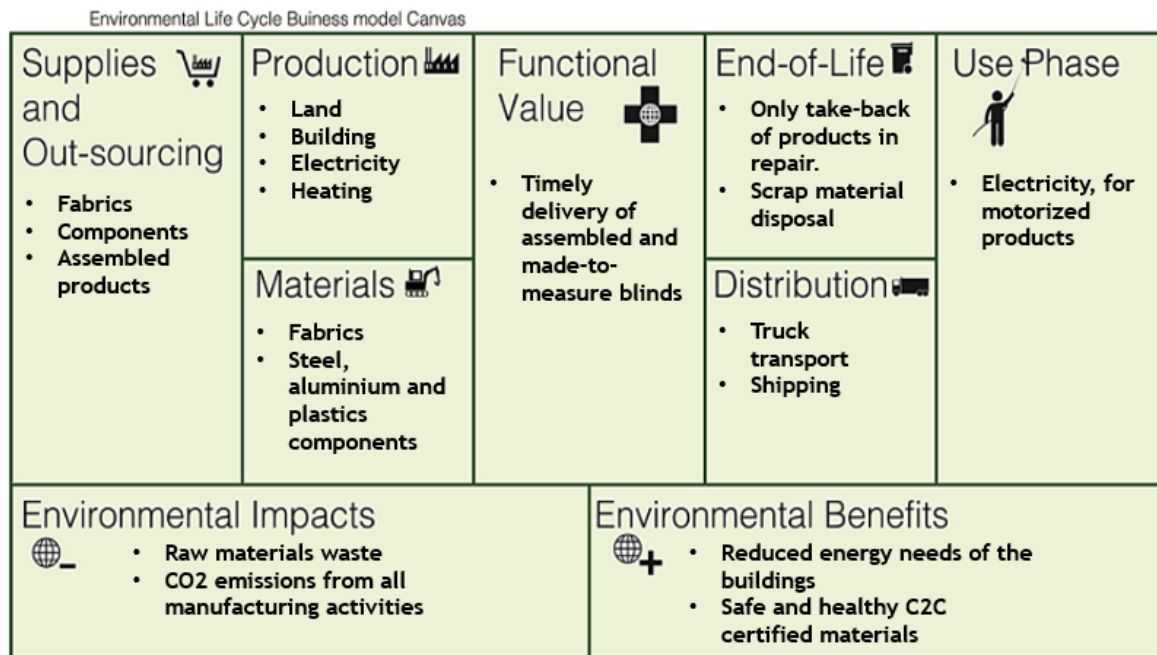


Figure 41: Current business model

In this section, we see how the business model would change by the introduction of our strategies from the Optimal Strategy Triad. The green elements indicate a positive impact on the economic and environmental canvas, and the red elements show a negative impact. We have found no impact on the social layer of the business model as the new strategies would affect only the economic and environmental impacts of the company.

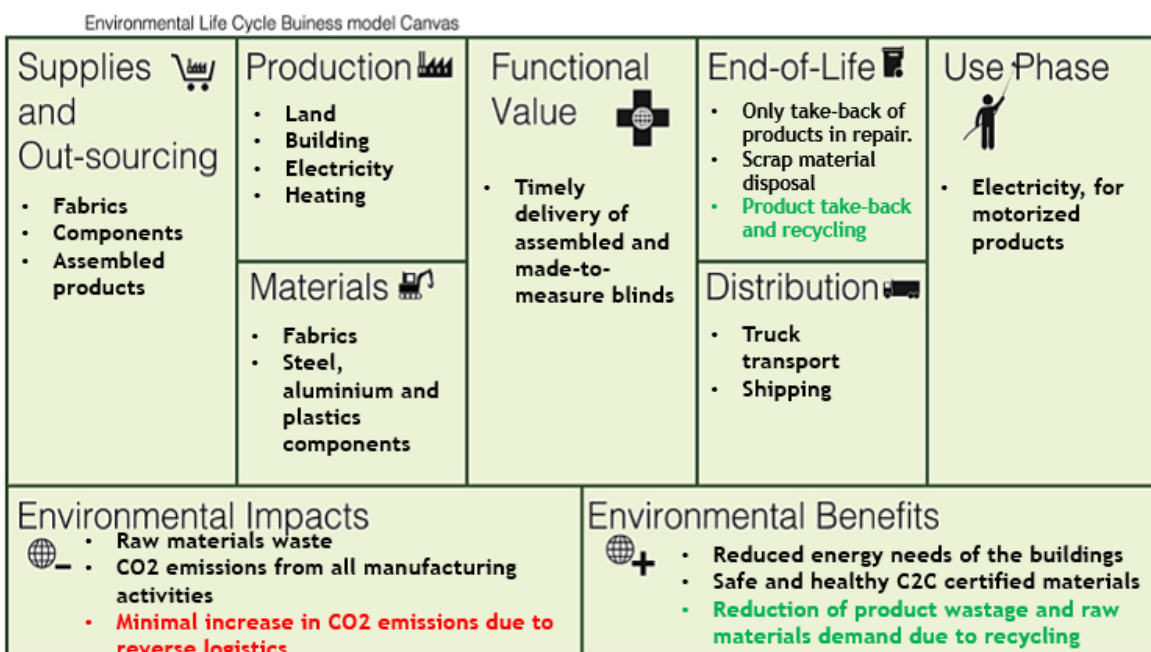
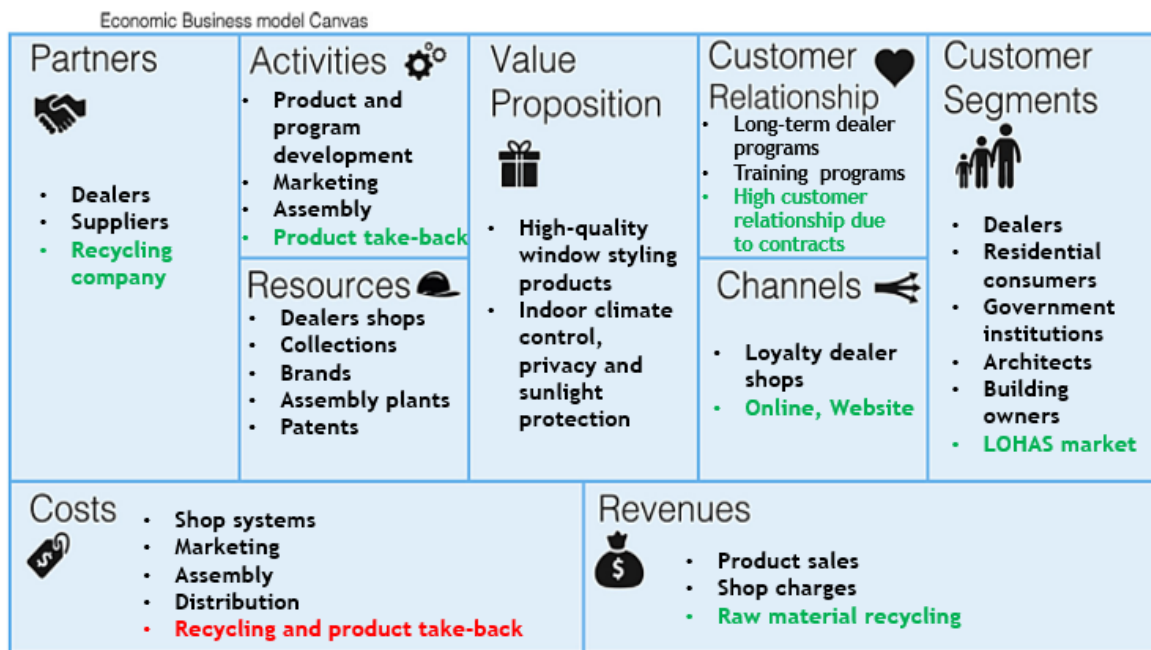


Figure 42: Potential business model

iv. Appendix-4

Interview protocol

INTERVIEW QUESTIONS

1. Research details

1.1. Research questions:

1.1.1. "How can a product-service system (PSS) model, be used with the combination of cradle-to-cradle certified products, to help increase the certification level?"

1.2. Sub-questions:

1.2.1. "What is the current state of the C2C certification process?"

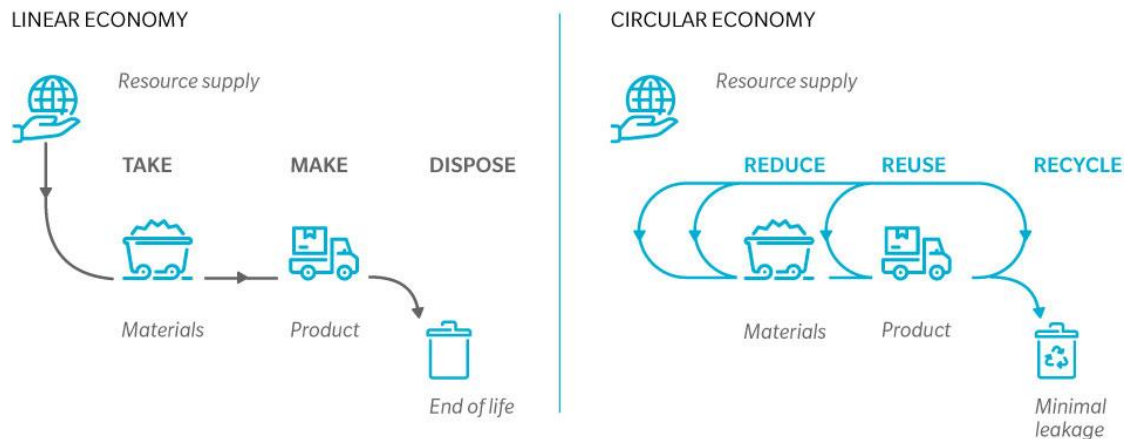
1.2.2. "What are the existing PSS models in practice?"

1.2.3. "What are the most optimal strategy recommendations for successfully commercialization of C2C certified products, based on a PSS model?"

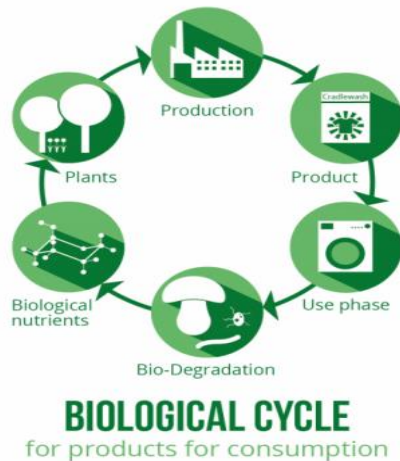
The first two sub-questions have been answered by extensive literature-based research. The last sub-question would be based on the responses generated from the interview.

The following pages contain several concepts and their brief explanations. The intention of this document is to brief you for the personal interview. It is beneficial to have some pre-requisite outlook regarding the topic of the discussion before the interview, and it would also boost the input of data for the research. Please feel free to fill out the information that you feel is appropriate, along with some inputs already provided in the charts and figures. These inputs would then be discussed in detail during the interview.

2. Circular Economy and Cradle-to-Cradle.



- 2.1. How familiar are you with the concept of circular economy? What sustainability practices are available in your company?
- 2.2. How familiar are you with the concept of cradle-to-cradle?



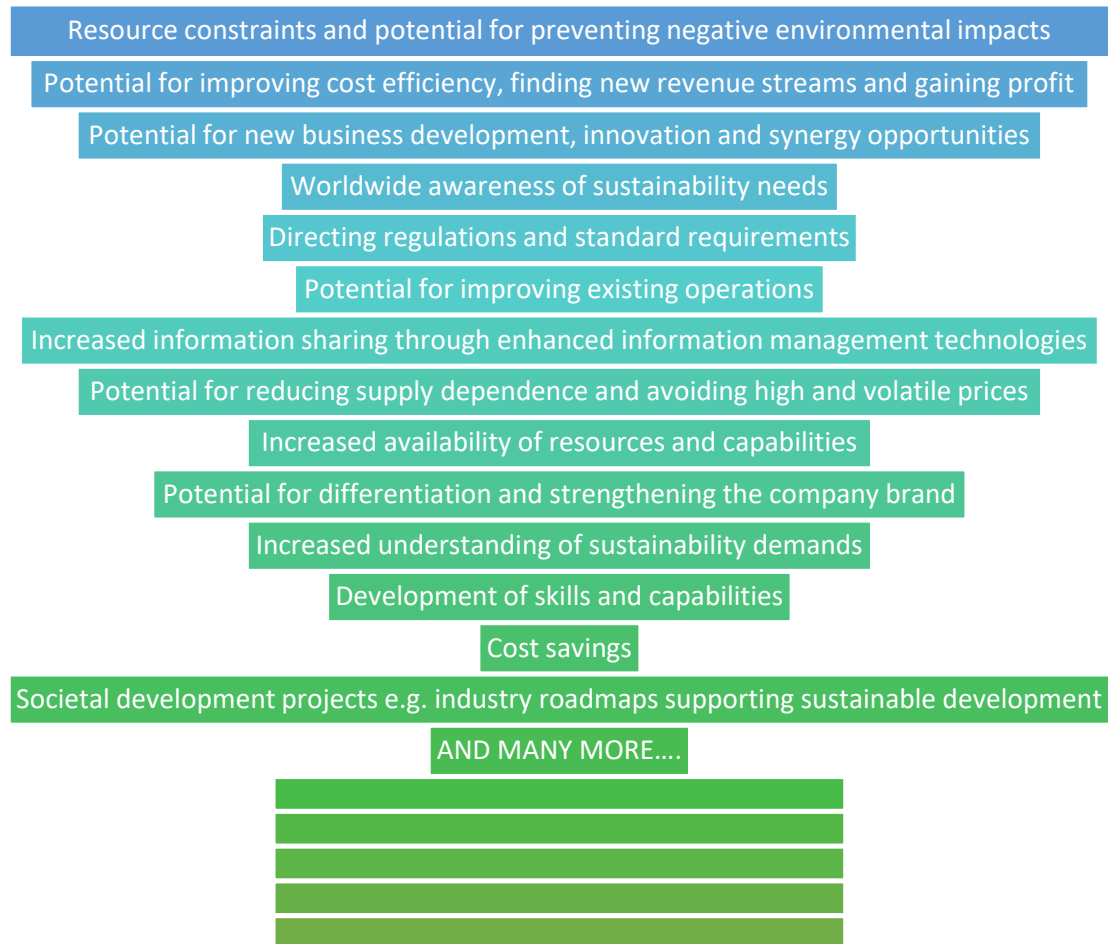
- 2.3. Are you aware about the cradle-to-cradle certification process? These products from HDE are cradle-to-cradle certified.



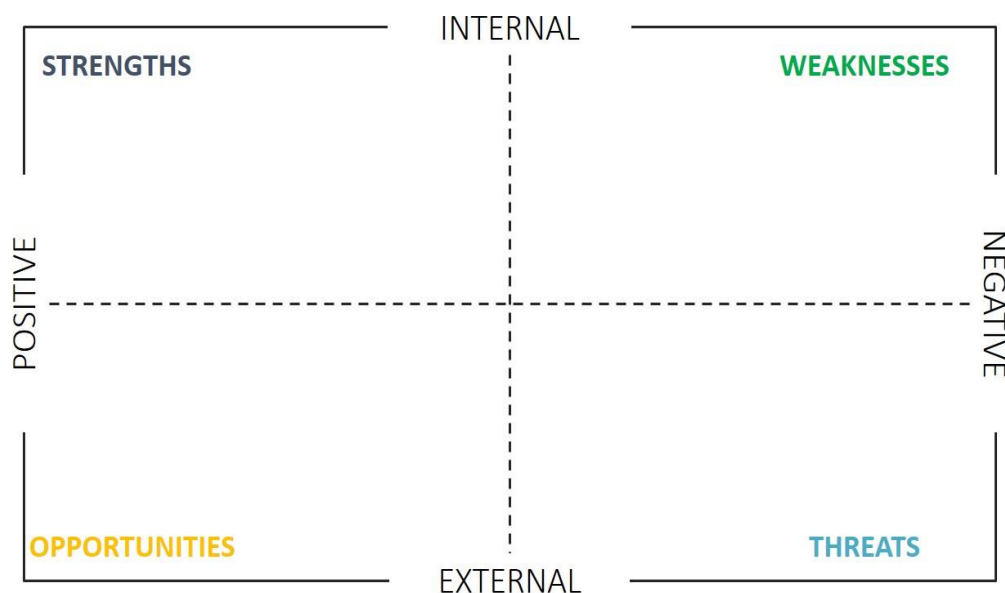
2.4. *What do you think are the barriers to the adoption of cradle-to-cradle products? Which of your choices would you find to be the most important factors?*



2.5. *What do you think are the factors for uptake or enablers of these products? Which of your choices would you find to be the most important factors?*

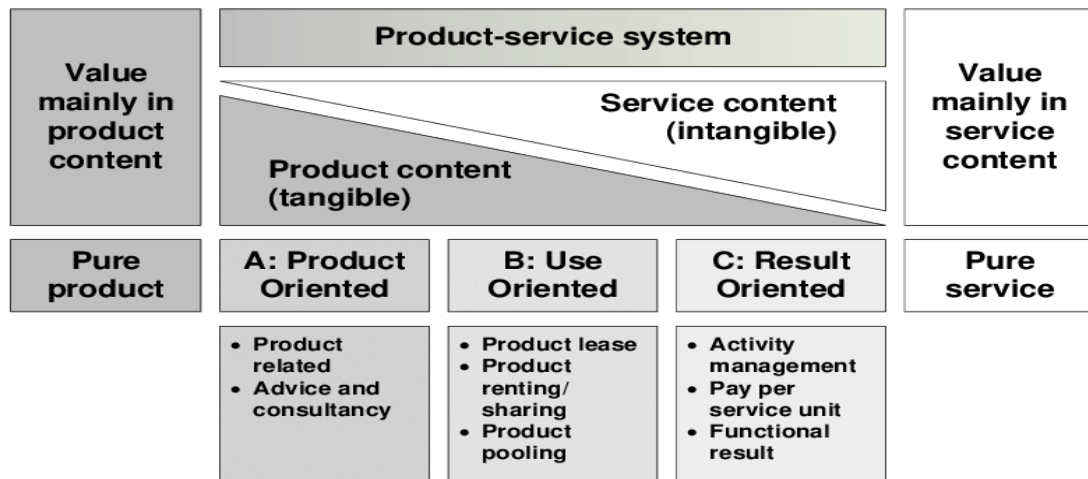


2.6. *What do you think are the strengths, weaknesses, opportunities and threats for the cradle-to-cradle products?*

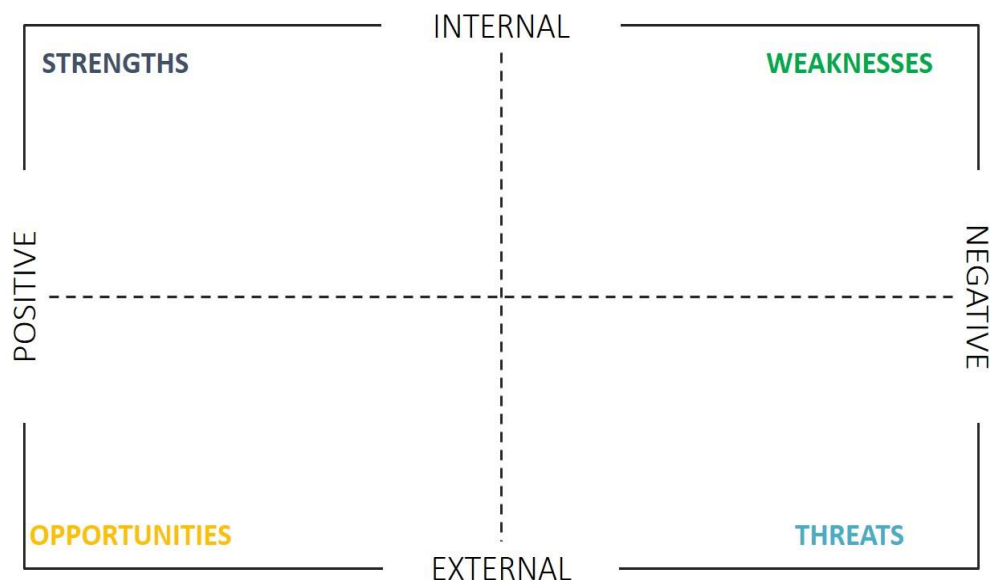


3. Product service System

- 3.1. What is your opinion on a product-service system business model? Will it be attractive to get the products back to our company and reuse them, or let it flow in second-hand markets, for downcycling, as per the customer decision?
- 3.2. Instead of selling window-covering products, we are providing daylight shading solutions. What are your ideas for such service provisions.? What would your customer prefer, ownership or leased products?
- 3.3. Which of the following PSS model would be best suited for our cradle-to-cradle certified products? And why?



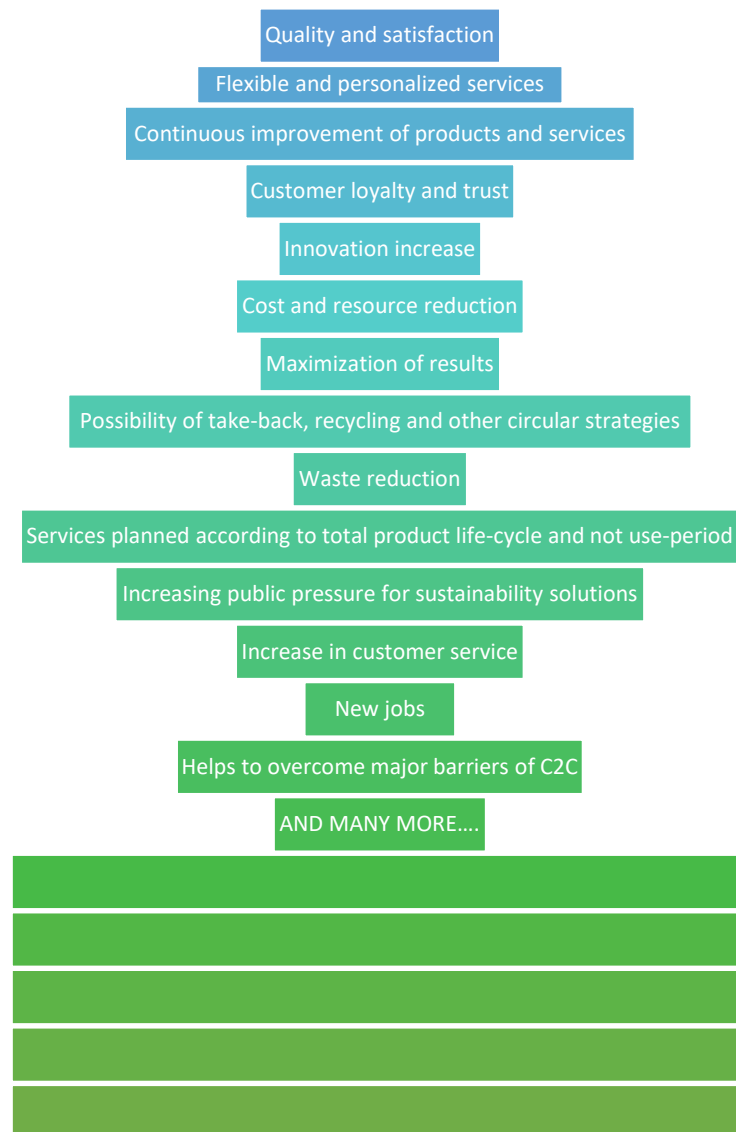
- 3.4. What do you think are the strengths, weaknesses, opportunities and threats for the product-service system model?



3.5. *What do you think are the barriers that firms would face for the adoption of a product-service system model? Which of your selected options do you think is the most important?*



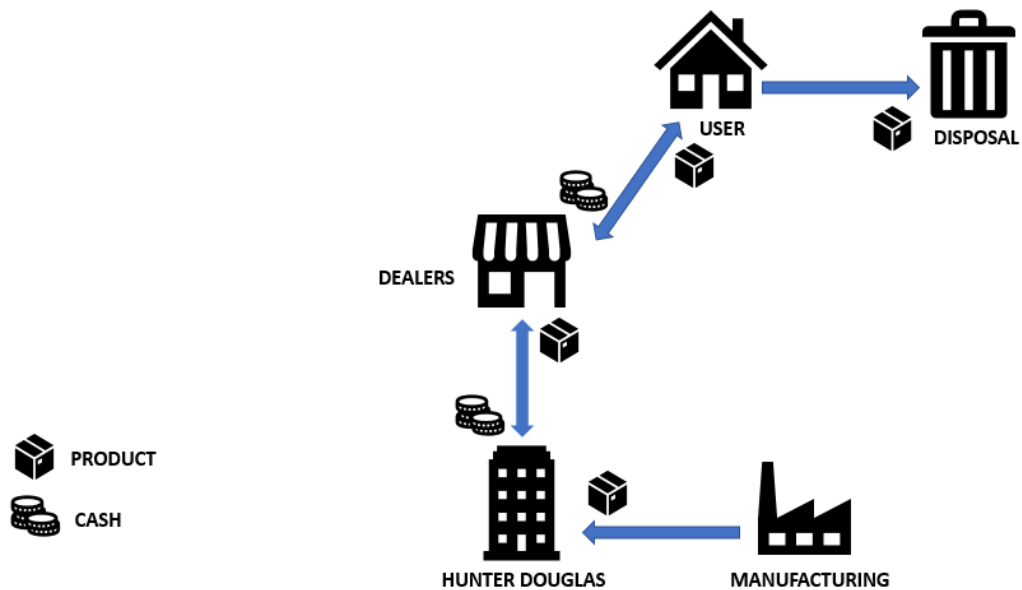
3.6. *What do you think would be the enablers for adoption? Which of your selected options do you think is the most important?*



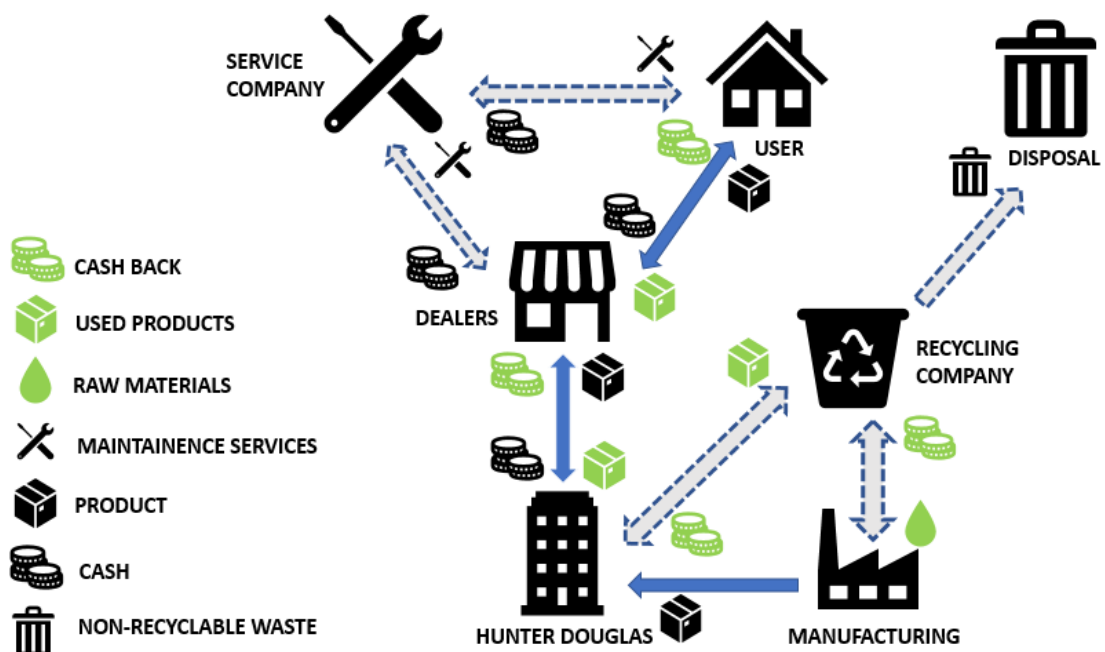
4. Company's value network for cradle-to-cradle products

- 4.1. Do you agree with the position of your firm? What else do you think must be added here?
- 4.2. How do you think a change in the value chain would occur if a product-service system model is adopted? What additional units would be added and how and where would they be connected?
- 4.3. What strategy would you suggest for the change? Which activities are additionally required in the strategy? What impacts will it have on the company?

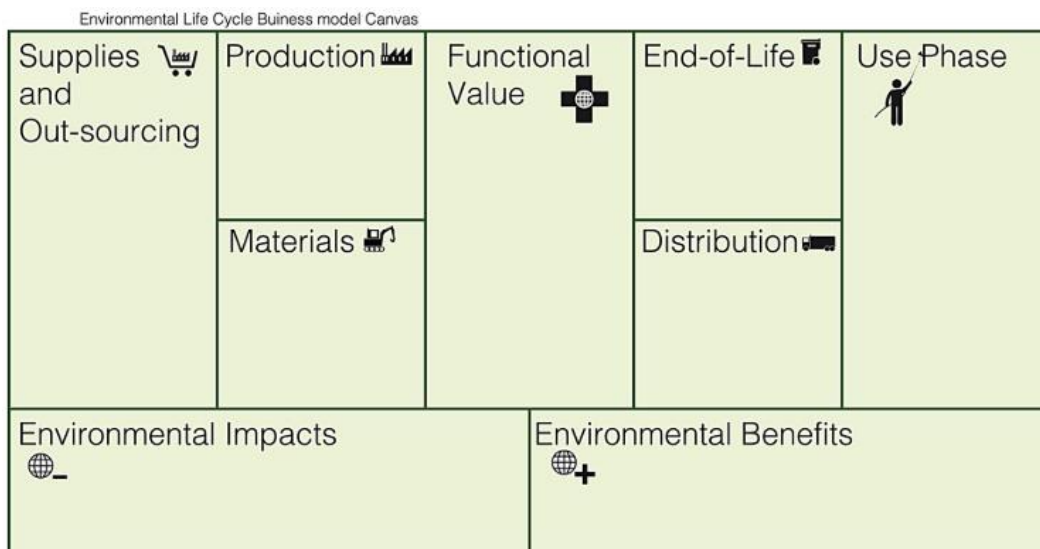
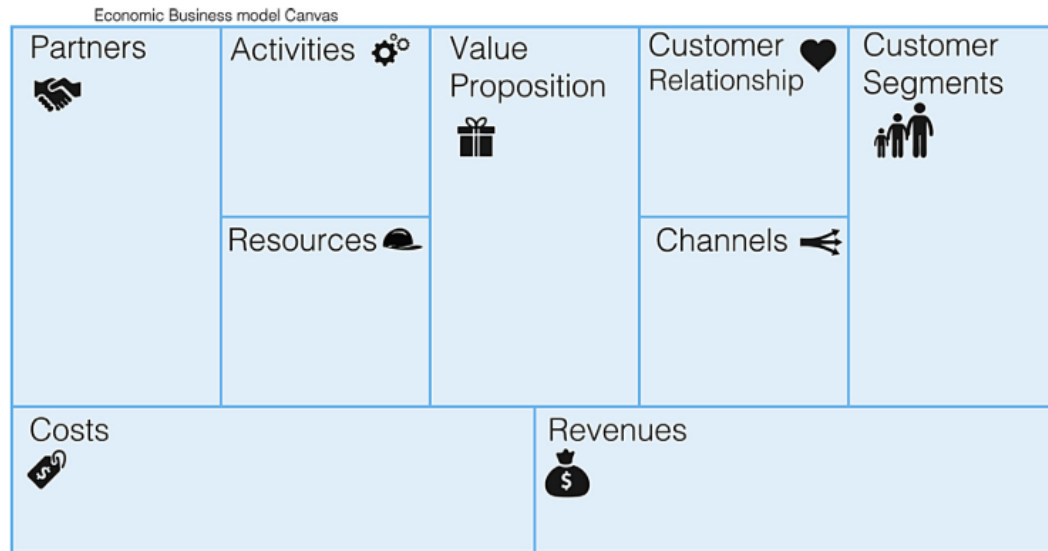
CURRENT



PROPOSED



5. Business Model Mapping on Triple Layered Business Model Canvas (current)



For the previous figures, we are trying to understand the business model of the company. Please feel free to fill out any elements that you have information about, in a few words. It is not necessary to fill all of them. For better clarity on what the different elements mean, try reading the questions associated with them from the text below. Further discussion, if necessary, would be done during the interview.

5.1. Economic Layer

- 5.1.1.Value proposition: *What is the value delivered to the customer? Which value propositions cater to which customer segment?*
- 5.1.2.Customer segments: *What are the customer segments for which the value is being created?*
- 5.1.3.Customer relationships: *What are the types of customer relationships maintained with the current customer segments?*
- 5.1.4.Partners: *Who are the key partners involved with the company in providing value to the customers? Who are the partners that would best suit our needs?*
- 5.1.5.Channels: *Through what channels are customers reached? What options are there for setting up a reverse channel for product take-back?*
- 5.1.6.Activities: *What are the key activities required for delivering the value proposition, operating channels, maintaining customer relationships, and capturing revenue streams?*
- 5.1.7.Resources: *What are the key resources required for delivering the value propositions, operating channels, maintaining customer relationships, and capturing revenue streams?*
- 5.1.8.Costs: *What are the most important costs incurred by the company? Which key resources are most expensive? Which key activities needs most resources?*
- 5.1.9.Revenues: *What amount are the customers paying for the value provided? What is the mode of transaction?*

5.2. Environmental Layer

- 5.2.1.Functional value: *What are the focal outputs of the product by the organization? What is the value that is being provided to the customer in a certain period of time?*
- 5.2.2.Use phase: *What is the customer's contribution to the environmental impact by product use?*
- 5.2.3.End-of-life: *What are the various alternatives available for customer to get rid of used products after their use period, and what are their environmental impacts? What would a service model help for sustainable end-of-life practices?*
- 5.2.4.Supplies and out-sourcing: *What are the activities that have been out-sourced but are vital for the company? Which of these activities can be changed to in-house activities?*
- 5.2.5.Distribution: *What are the physical means by which the company ensures access to the functional value, and what are the environmental impact of these?*
- 5.2.6.Production: *What are the actions taken by the company for transforming raw materials into finished goods, and what are their environmental impacts based on resource depletion?*
- 5.2.7.Materials: *What are the organization's key materials and their environmental impact in terms of virgin resource depletion?*

5.2.8.Environmental impacts: *What are the overall ecological costs to the environment due to company's practices?*

5.2.9.Environmental benefits: *What is the overall ecological benefit to the environment due to company's practices?*

5.3. Social Layer

5.3.1.Social value: *What is the social value that the company is aiming to target?*

5.3.2.End user: *What does the end-customer gain from the value proposition provided by the company?*

5.3.3.Societal culture: *What is the potential impact of the organization on the society?*

5.3.4.Local communities: *What social relationships are in place with the suppliers and their local communities? Which additional relationships would be required?*

5.3.5.Scale of outreach: *What are the depths and breadths the organization is ready to go to build relationships with the stakeholders?*

5.3.6.Governance: *What is the organizational structure and how the stakeholders are actively involved and engaged?*

5.3.7.Employees: *What are the elements related to employees that play a major part in the company's success?*

5.3.8.Social impacts: *What is the social impact of the organization? What changes would be brought on the society due to the organization's working?*

5.3.9.Social benefits: *What are the social benefits of the organization? What positive societal value is created due to the organization's working?*

v. Appendix-5

Stakeholder analysis

Parent company- Luxaflex

The parent company is the primary stakeholders which would be affected the most due to the new strategies and would also have the most influence to make changes, if required. The parent company is further divided into several departments, and each of these departments have their own interests and demands. These were successfully identified during the interview process. In order to get accurate results from each of these department, the respondents were selected to incorporate what the various department's opinions were, regarding sustainable practices like C2C and business model transformations to product take-back and PSS.

Upper management

The upper management has the authority to approve any new plans that the company thinks of implementing. The upper management considers every financial, economic, sales feasibility and company brand image elements in their decision-making.

Technical managers

The technical managers are the product managers of each individual product line, that are the focus of our research. During the interviews, we talked to the product managers of venetian blinds, EOS500 roller shades system, and the fabrics expert centres, to identify what were their interests in the proposed project plan.

Sales and marketing

The most important department for our research is the sales and marketing department. These are the individuals who would help us overcome the biggest barrier identified in the project; the lack of customer awareness about sustainable practices adopted by the company. The marketing team, specially, is responsible for communicating with the retailers as well as the end customers, through the various marketing channels available.

Dealers

The dealers, or retailers, are the most important stakeholder, after the parent company. This is because according to the traditional business model of the company, product selling is done through the dealers. They are the point of contact with the end-customers. The customers visit the dealer showrooms and select their required product, from an assortment of products, including both Luxaflex

and other brands. Then the dealer sends the requirement to Luxaflex and then the product is sold. As the dealers are the ones communicating with the end- customers, their opinion is important for the research. The dealers can be further divided into the ones that cater to the projects market (B2B) and the ones that sell to the residential market (B2C).

End-customers

Although customer interviews were not included in our research, we have tried to understand the trends of customer preference, and what they would feel about our strategies, from the point of contact with the customers; the dealers. The dealers have an understanding of what their customers would want, due to years of contact, and thus have mentioned their opinion too. The customers are also divided into two market segments: B2B and B2C customers. B2B customers include, government institutions, architects, and building owners. B2C customers are residential customers

Assemblers

The assemblers are the unit in the value chain, where the actual product is 'born'. When Luxaflex gets an order for a product, all the customized components of the specified product are brought to the assembly point, and the final product is produced. Assemblers have very little influence on any business plans of Luxaflex, but they are still important as they are best equipped for disassembly of take-back products. Although, this stakeholder was also not part of our research, we have understood some of their interests.

Recycling companies

The recycling companies are important for our research, as Luxaflex does not have recycling processes for the old products in place. The recycling companies have recycling processing facilities and is capable to take the scrap metals from Luxaflex and process into raw materials. The recycling companies have medium importance and have little influence on the company's business decisions. We still need to understand what the recycling companies feel about our strategies.

Local municipalities

The local municipalities have very low influence on the company's decisions. As long as the company is trying to benefit the society and the environment, they are acceptable for any business change. It is believed that the local communities would be positively affected by the introduction of C2C certified products, and a product take-back service for old and used products.