Master's Thesis Internship – Master Sustainable Business and Innovation

Faculty of Geosciences, Utrecht University

MAINSTREAMING RECYCLED TEXTILES

An analysis of drivers and barriers for circular business model diffusion in the Dutch apparel industry

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Preface

Hereby, I present you my master's thesis ´Mainstreaming Recycled Textiles – A comparative analysis of drivers and barriers for circular business model (CBM) diffusion in the Dutch apparel industry'. This thesis is written at MVO Nederland – a Dutch business network aimed at fostering sustainability - during and after I undertook an internship at this organisation for fulfilment of the graduation requirements of the MSc Sustainable Business and Innovation at Utrecht University. During the internship, I worked in the international team and engaged with sustainability projects related to sustainability and circularity in Sri Lanka and India. Simultaneously to these projects the scope for this thesis was developed together with my supervisors, Dr. Juliana Subtil Lacerda (Utrecht University) and Michiel van Yperen (MVO Nederland). I have been engaged in the research for this thesis from October 2018 until June 2019.

In this thesis, a case study for the potential of the diffusion of recycled textile in the Dutch apparel industry is presented. This research fosters a systematic and holistic approach for the case study with the aim to stress academic and corporate underpinnings for CBM diffusion in the Dutch apparel industry.

As sustainability within the textile industry is a true passion for me, it was a delight to conduct this research and gain and share knowledge about and within this sector. I hope you will enjoy reading this master's thesis and it will give you new insights into the current state-of-the-art considering the diffusion of recycled textiles – and CBM - within the apparel supply chain.

Aniek Baltussen

June 21st, 2019

Summary

Sustainability is recognised as one of the grand challenges of our time. Being one of the most polluting industries, the textile industry currently takes steps towards sustainability. The implementation of circular business models (CBM) in this industry is one of the potential solutions for diminishing externalities. However, it remains unclear what factors can drive or hinder the diffusion of CBM in the textile sector. This thesis takes up this challenge by seeking to map drivers and barriers for the diffusion of CBM through a case study on the diffusion of textile recycling in the Dutch apparel industry.

The research question '*What are the drivers and barriers for circular business model diffusion in Dutch apparel companies?'* is therefore aimed at investigating drivers and barriers through a holistic and systematic approach.

CBM are innovative business models developed upon the characteristics of the circular economy. The development of newly introduced business models can be understood following innovation theories. Diffusion of CBM is constantly influenced by other factors. Eight categories of drivers and barriers were presented in a framework built upon a review of the state-of-the-art academic literature, namely: attitudinal, economic, environmental, institutional, operational, organisational, structural, and technological drivers and barriers.

The data for this research was gathered through 10 semi-structured interviews with representatives from Dutch apparel companies. Furthermore, three interviews were conducted with representatives from the recycling industry in India and Sri Lanka as supplier countries to link the data gathered by Dutch interviewees to current developments on the supplier side.

The main results found are that the economic, attitudinal and structural category are the top three most important ones. In the attitudinal category relatively the most drivers can be found, whereas the operational category consists of relatively the most barriers. The most important drivers found by this research (but are not limited to): company-internal values, technological developments and collaborations; while the most important barriers include (but are not limited to): Lack of consumer interest, high prices, and scale.

This research has found a balanced figure of drivers as barriers whereas current changes in attitude and ongoing technological developments stand the most positive prospects for CBM diffusion. The existing drivers and barriers are interconnected, which makes breaking lock-in a key factor for further diffusion. For example, upscaling of technological solutions is currently lagging. However, there are positive prospects due to acceleration of technological developments, changes in market mechanisms and institutional drivers.

Executive Summary

Sustainability is recognised as one of the grand challenges of our time. The industrial sector is confronted with challenges to increase sustainability practices. Within the transition towards more sustainability, the implementation of Circular Business Models (CBM) is key. Hereby, the master's thesis, 'Mainstreaming recycled textiles: An analysis of drivers and barriers for circular business model diffusion in the Dutch apparel industry' is presented. The research presents a case study to map the main drivers and barriers for Dutch apparel companies that enable or hinder the implementation of recycled materials in their company. These results are analysed with secondary literature and through linking the results to information from the recycling industry in India and Sri Lanka for a more supply chain inclusive overview. From this case study conclusions are drawn upon the potential for CBM diffusion in the apparel sector.

Context of the research

The thesis has been hosted by MVO Nederland. This is a Dutch networking organisation that aims to have 20% of the Dutch GDP generated through sustainable practices (the new economy) in 2025. This is done by creating business connections and facilitate collaborations and projects between interested parties to unfold the Corporate Social Responsibility (CSR) practices of the Dutch industry.

The case study of this thesis is connected to projects undertaken in the international team of MVO Nederland. One project is the creation of a zero-waste hub in Sri Lanka in the food, tourism and textile sector in collaboration with Dutch companies. In this project, a potential solution for zero waste in the Sri Lankan textile industry lies in the development of a large textile recycling plant through collaboration between the biggest apparel suppliers in the country. Furthermore, MVO Nederland also initiated the Clothes the Circle consortium which aspires to produce recycled clothing in India and the Netherlands. Within these projects, the main questions that came up were whether there actually is demand for recycled materials and what are the reasons of companies behind the implementation of recycled materials and/or circular business strategies. Answering these questions gives these projects the opportunity to respond to developments and wishes in the industry to be commercially viable. This thesis aims to take a step into the direction of answering these questions.

Aim

As one of the most polluting industries worldwide, the apparel industry is taking up the challenge to decrease environmental externalities. Resource depletion and an enormous and continuous waste stream are one of the main environmental issues within the industry. The diffusion of CBM is one of the ways to diminish these effects. However, these are rarely applied in the textile industry. The reasons for this are not yet thoroughly covered in academic research. This thesis aims to contribute to understanding why CBM are or are not implemented by companies through mapping the drivers and barriers for CBM diffusion in the textile industry. Hence, this thesis contributes to academic research as a pioneering qualitative study on drivers and barriers for CBM diffusion in the

apparel industry by answering the research questions: '*What are the drivers and barriers for circular business model diffusion in Dutch apparel companies?'*

Theoretical Framework

The theoretical framework of this thesis is established upon a literature review covering the aspects of drivers and barriers for sustainability in the textile industry, acceleration of circular economy, and corporate CBM implementation. These drivers and barriers were categorised for a systematic and comprehensive overview of potential drivers and barriers for CBM diffusion in the apparel industry. The framework exists of eight categories of potential drivers and barriers; attitudinal, economic, environmental, institutional, operational, organisational, structural, and technological.

Methodology

For this research, a case study is conducted on the diffusion of recycled textiles in the Dutch apparel sector. This case study is done through semi-structured interviews with 10 representatives of Dutch apparel companies. The interview protocol was established according to a theoretical framework to give the interviewee the opportunity to cover all categories of the theoretical framework. Following the same interview protocol, however, adapted to the interview results from the Dutch respondents, three interviews were conducted with representatives from the textile recycling industry in India and Sri Lanka. These interviews were used to correlate, benchmark and analyse the results from the Dutch respondents. All interviews were coded and structured in a database organised by importance (in terms of emphasis by respondents and frequency of mentioning in the interviews). The results were calibrated to importance divided into the eight categories established based on literature and divided into sub-categories for a better structured analysis. These results were compared with existing reports and literature to create comprehensive conclusions.

Results

From coding the interviews 409 factors that influence the diffusion of recycled textiles in the Dutch apparel industry came forth. If these influential factors 42% had the function of drivers and 45% were barriers, which leaves 13% unidentified as driver or barrier. These drivers and barriers were calibrated according to their importance and categorised which resulted in the division shown in figure A. The main results found are that the economic, attitudinal and structural category are the top three most important ones. In the attitudinal category relatively the most drivers can be found, whereas the operational category consists of relatively the most barriers.

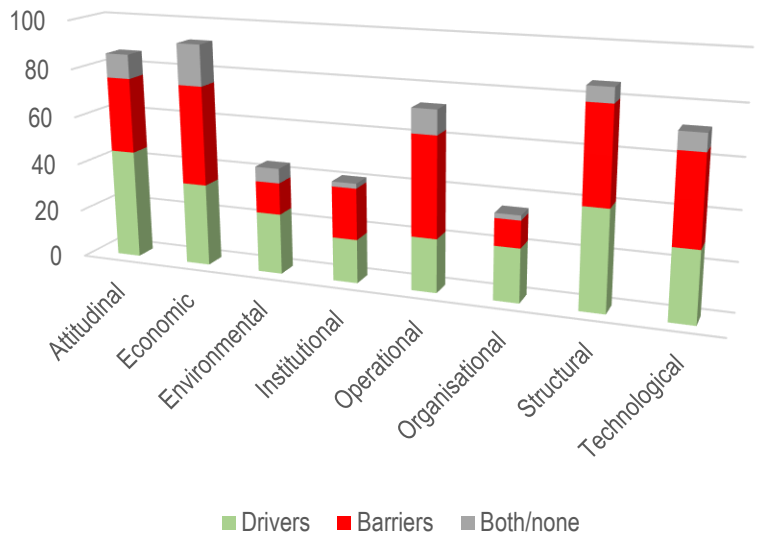

Figure A: Division of drivers and barriers per category

The most important drivers found in this research are (but are not limited to): intrinsic perception, technological developments, and collaborations; while the most important barriers found in this research include (but are not limited to): high prices, scale and lack of consumer interest. It should be noted that the established categories and found drivers and barriers are interlinked and influence each other.

Conclusions

General conclusions were drawn from the results of this research. First, CBM diffusion is happening and proceeding at this moment mainly through the positive attitude of the companies. This can be increased by creating institutional or economic incentives. There are still technological barriers to overcome, but there is general trust in the ongoing technological developments. The supply chain structure is still a major barrier and better supply chain internal collaborations and information sharing help to create logistics for circularity.

Recommendations

Recommendations for policy and the industry are included in this research. A step-by-step approach is recommended to make companies ready for a change in the long run. Furthermore, pre-competitional collaborations should be created, including supply chain actors and markets for recycled material could also be found in a trans-sectoral way. For successful collaboration openness, information sharing, and transparency are key. An open-source database would be of additional value. Moreover, the driver of willingness within companies should be enhanced and created in companies that lag in this field. Furthermore, a better waste-management is required for both post-industrial and post-consumer textile waste and can be gained through enhancing supply chain internal collaborations.

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[1] Figure A is identical to Figure 8

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1. Introduction

This chapter lays out the context leading to this master's thesis. An academic literature review is conducted from which the scientific and societal relevance, aim and research question for this thesis were generated.

1.1. Background

The world is facing a major challenge in the transition towards finding a balance in environmental, social and economic sustainability (Brundtland & et al., 1987) to mitigate the effects of climate change (IPCC, 2007, 2018), reduce environmental pollution (Carlsen et al., 2018) and diminish social inequality (Dempsey et al., 2011). Industries and businesses are influential stakeholders in this transition and their sustainability agendas are replete with corporate responsible actions (Bocken et al., 2014). A transition towards sustainability is slowly occurring, however, there exists a demand for accelerating factors (Caniato et al., 2012). One of the latest guiding principles that tends to push this transition, is the Paris Agreement. This has been signed in December of 2015 by 127 countries to collaborate on climate change mitigation and maintain global warming to a maximum of 1.5-2.0°C by 2050 compared to pre-industrial levels (Hulme, 2016). There is a wide consensus that a profound alteration in the conventional way of production is essential for the Paris Agreement targets to be reached (Robiou du Pont & Meinshausen, 2018). To shift the conventional way of production, fundamental and systematic interruptions are to be implemented in various industrial practices (Levering & Vos, 2019).

The textile industry is one of the industries with the potential to mitigate its current sustainability issues through a change in the conventional way of production. The serious side effects of the textile industry are widely recognised and explored in academic literature (e.g. Caniato et al., 2012; Claudio, 2007; Moretto et al., 2018). In both environmental terms and social terms the textile production accounts for several issues such as a high water footprint (Chapagain et al., 2006), the use of toxic chemicals (Greenpeace International, 2012), violation of human rights (Egels-Zandén & Lindholm, 2015) and waste generation (Woolridge et al., 2006).

The global textile industry responds for 45% of apparel[2] production (Beton et al., 2014). The environmental and social externalities are largely caused by the fast production cycles that have become standard in the apparel industry (Barnes & Lea-Greenwood, 2010). This phenomenon influences customer demand as it fosters fast-changing styles and low price segments (Buchel et al., 2018). When looking at the literature about everyday apparel, there are three main factors that characterise this production model, namely: the pressure for low prices (Buxey, 2005), a linear supply chain (Woolridge et al., 2006) and a non-transparent and anonymous industry (Egels-Zandén et al., 2015). The textile sector is one of the largest economic sectors in the world with an annual growth rate of 5.5% which outperforms the yearly global GDP growth of the six largest economies in the world (BoF & McKinsey, 2017). This makes the industry influential and powerful. Hence, changes in the standard

[2] Meaning: Clothes (especially used for types of outer garments) (Cambridge Dictionary, n.d.; The Free Dictionary, n.d.)

production model of apparel could be profoundly beneficial for sustainability in general. Here, the diffusion of circular business models (henceforward denominated as CBM) in the apparel industry is a key mechanism for adapting the standard production model and to become more sustainable (de Wit et al., 2019).

1.2. Problem definition

An important challenge within the fast apparel production model lies on the complex, international, fragmented and linear textile supply chains (Pal & Sandberg, 2017). In the last decades, European and American apparel companies have outsourced parts of the supply chain to countries with lower production costs, such as India, Sri Lanka and Bangladesh (Gereffi, 1999). This has created the space for fast, inexpensive and continuous production pathways (Delaney, 2008). As a result, one of the main environmental challenges of the apparel industry lie in the use of large amounts of natural resources to create products characterised by short durability and hence substantial waste generation (Ellen MacArthur Foundation, 2015).

For example, in Europe, the average consumption of textile products amounts to 19.1 kg per citizen per year (Beton et al., 2014). The average textile wasted in Europe is an estimated 16 million tons per year (EC, 2018), which accounts for approximately 31.2 kg per person considering 512.6 million European citizens (Statista.com, 2018). Additionally, high numbers of production waste are generated by apparel production companies, called post-industrial waste (Domina & Koch, 1997). In apparel production countries this waste stream outbalances the amount of consumer waste in textile. For example, In the U.S. this waste stream accounted annually for 450 – 600 million tons of textile waste in the 1990's (Kron, 1992). The post-consumer waste stream in these years was about 5.8 million tons (EPA, 2016). Hence, transforming this production and consumption pattern into a more sustainable system involves several opportunities for mitigating negative environmental impacts.

The concept of Circular Economy (CE) is gaining traction as a main pathway for the change of unsustainable production and consumption practices. The concept is based on a reconstruction of supply chains that eliminates the concept of waste by creating a recurring loop in which waste is reused as a resource for production (Ellen MacArthur Foundation, 2015). Therefore, CE creates less pollution and uses waste as a new resource (Bogner et al., 2008). CE is sometimes even described as a requirement for environmental sustainability (Martins, 2016). By businesses, this concept can be applied in the form of introducing CBM (Ellen MacArthur Foundation, 2013).

A large-scale transition towards CBM in the textile industry could have a significant impact on the mitigation of environmental issues derived by the apparel industry (Ellen MacArthur Foundation, 2013) and is seen as a "transformational priority for fundamental change" (GFA, 2019). Circular initiatives are developing in the form of, for example, circular entrepreneurs and the use of renewable materials. These actions have not reached the common way of practice in the apparel industry yet, instead they are confined in niches (Buchel et al., 2018; Caniato et al., 2012; GFA & BCG, 2018) and are rarely put into practice on large scale (Ritzén & Ölundh Sandström, 2017). The lock-in of companies in their linear supply chains is challenging (Narasimhan et al., 2009) and large

scale implementation of CBM can only be done if circumstances are supportive (Geels, 2002). Mapping drivers (factors that support, enable or enhance) and barriers (factors that impede, restrain or diminish) CBM diffusion can help to understand the reasons behind this lock-in and provide advice on how to foster CBM diffusion. Furthermore, this research can contribute to the question of how to systematically address the current business models and to identify which of its elements shall be preserved and which ones shall be replaced (Buchel et al., 2018).

1.3. Scientific Relevance

Several scholars describe drivers and barriers for sustainable transition or transition towards CE (e.g. Tura et al., 2019). Most of these articles are specified within certain fields of sustainable transition or drivers and barriers, for example, eco-innovation (de Jesus & Mendonça, 2018), energy saving and emission reduction by Chinese manufacturers (Zhu & Geng, 2013) or organisational drivers and barriers (Levering & Vos, 2019). The diverse studies deliver a specific contribution to the overall academic literature on the identification of drivers and barriers for circular transition. However, research for drivers and barriers of CBM diffusion for the apparel industry has not yet been executed. This research gap will be covered in this thesis by systematically identifying drivers and barriers for CBM diffusion in the apparel industry.

This thesis will take it a step further by contributing to the investigation of how to enhance the drivers and diminish the barriers to foster the adoption of a circular business strategy in mainstream textile production. Furthermore, results from the Dutch apparel industry will be linked to data gathered from recyclers in India and Sri Lanka to additionally include the supplier side. As a result, this thesis maps out a framework for understanding the dynamics of a transition towards the use of CBM. It builds upon the existing literature on drivers and barriers for the diffusion of business models with a focus on circularity, by studying the case of recycled textiles in the Dutch apparel industry as a diverse industry taking steps towards sustainability (SER, 2019).

In summary, this research contributes to the existing body of literature as a pioneering qualitative research on drivers and barriers for CBM transition in the apparel supply chain.

This research results in finding the main drivers and barriers for CBM diffusion in the textile industry in the structural, attitudinal and economic categories. Interrelations between different factors are important and are discussed in the analysis section of this thesis. To give two examples: 1. the high price for recycled textiles is a main barrier and is dependent on the current lack of scale of technological developments; 2. The internal attitude of companies towards sustainability and recycling forms a main driver and can be enhanced through support from institutional and economic side.

1.4. Practical relevance

Most academic literature does not elaborate on the implementation of sustainable pathways leaving room for academic research on corporate sustainability to better serve the business practices towards sustainability (Vermeulen & Witjes, 2016). The literature on the transition towards a circular and sustainable textile industry still needs to mature in terms of practicality and implementation (Caniato et al., 2012; GFA & BCG, 2018).

Hence, this research will contribute to mapping a pathway for the diffusion of circularity within the textile industry. The Dutch business network MVO Nederland[3] is an organisation that aims to accelerate sustainable and circular transitions in companies and industries. MVO Nederland aims at having 20% of the Dutch GDP generated through sustainable practices by 2025 (MVO Nederland, 2019). They contribute to several initiatives to achieve this goal, such as creating consortiums, signing agreements on sustainability and arranging international collaborations. These initiatives are meant to facilitate change in different industrial sectors as well as cross-sectoral projects and international collaborations. As an accelerator of the new economy, MVO often faces the problem that market transitions stay at a niche level and creating a new business as usual requires further policy measures.

The international MVO team (IMVO) works on sustainable and ethical business cases that include both Dutch and international companies with a focus on developing countries. One of these projects includes the recycling of textiles in India and Sri Lanka. A flow chart of the current state of the possibilities within this project is shown in Appendix C. Recently, the textile industry in these countries started working on the recycling of post-industrial waste. Many of the textile factories in India and Sri Lanka either downcycle the waste or it is treated as landfill and incinerated, recycling is done on a small scale, mainly in other Asian countries (Park & Evans, 2017). The process of recycling could be more efficient, upscaled and qualitatively upgraded if recycling could take place in the same country. What has been holding back developments is the fact that it remains unproven if there is a market for this recycled post-industrial waste. This thesis will contribute to answering this question.

1.5. Aim

This thesis focuses on the diffusion of CBM in the Dutch apparel industry. The main goal of this research is to contribute to the adoption of CBM along the textile supply chain by mapping the key drivers and barriers from a company perspective through a case study for the diffusion of recycled materials. This thesis aims to create a framework in order to give insights into the current state-of-the-art and provide insights for future research, strategy, and policy design. Understanding which factors can encourage or discourage the implementation of a circular strategy in a systematic way from different players along the supply chain can contribute to providing more effective

[3] MVO is the acronym for Maatschappelijk Verantwoord Ondernemen, which in English translates to Corporate Social Responsibility

guidance on the factors capable of contributing to further adaptation and acceleration towards CE (van Yperen et al., 2017).

1.6. Research question

With this aim, this thesis focuses on the following research question:

What are the drivers and barriers for circular business model diffusion in Dutch apparel companies?

The next chapter of this thesis will explain the theory to contextualise the research.

2. Theory

As the research question suggests, this thesis will focus on the definition of drivers and barriers for the diffusion of CBM in the textile industry. The implementation of a new business model for sustainability requires a transformative change in which all stakeholders are involved (Ritzén & Ölundh Sandström, 2017). This theory section will start with the elaboration of the CE and the CBM in the textile industry in specific. After that, the potential for implementation of CBM will be explained with innovation theories (de Jesus & Mendonça, 2018) by introduction of the Innovation Phases (Rotmans et al., 2001) and the Multi-Level Perspective (Geels & Schot, 2007). In addition, drivers and barriers explain the progression of the innovation transition (Ritzén & Ölundh Sandström, 2017). The literature review of drivers and barriers sets the basis for the analysis framework of this research.

2.1. Circular Economy

CE was introduced in academia by environmental economists in 1990 (Pearce & Turner, 1990). It is a concept that can be explained in various ways. Even though there is no consensus on a definition of CE, the principles remain similar (Kirchherr et al., 2017). Therefore, in this thesis the most common definition, of the Ellen MacArthur Foundation, is used as a basis:

"A circular economy is one that is restorative and regenerative by design and aims to keep products, components, and materials at their highest utility and value at all times, distinguishing between technical and biological cycles. This new economic model seeks to ultimately decouple global economic development from finite resource consumption." (Ellen MacArthur Foundation, 2015, p.2)

The main elements of this concept are therefore based on the principle where nature does not distinguish waste from resources (Lieder & Rashid, 2016). It is a sustainable improved version of the currently dominant linear business model for products, also called a take-make-dispose model (Ellen MacArthur Foundation, 2015). CE replaces the 'disposal'-phase by a continuing cycle of materials. Hereby it is of importance that the quality of the reused material stays high to keep the material or product from disposal (Planing, 2015). Disposal of materials is

only an option if the material cannot be used again in any form. This is called 'leakage' (Ellen MacArthur Foundation, 2015). The outline for CE is shown in figure 1. Based on these features, CE unties economic growth from environmental impact (Ghisellini et al., 2016). Transition towards CE is even believed to create jobs (Antikainen & Valkokari, 2016), to be of considerable financial benefit for the global economy (Planing, 2015), and to increase global competitiveness (Stahel, 2012).

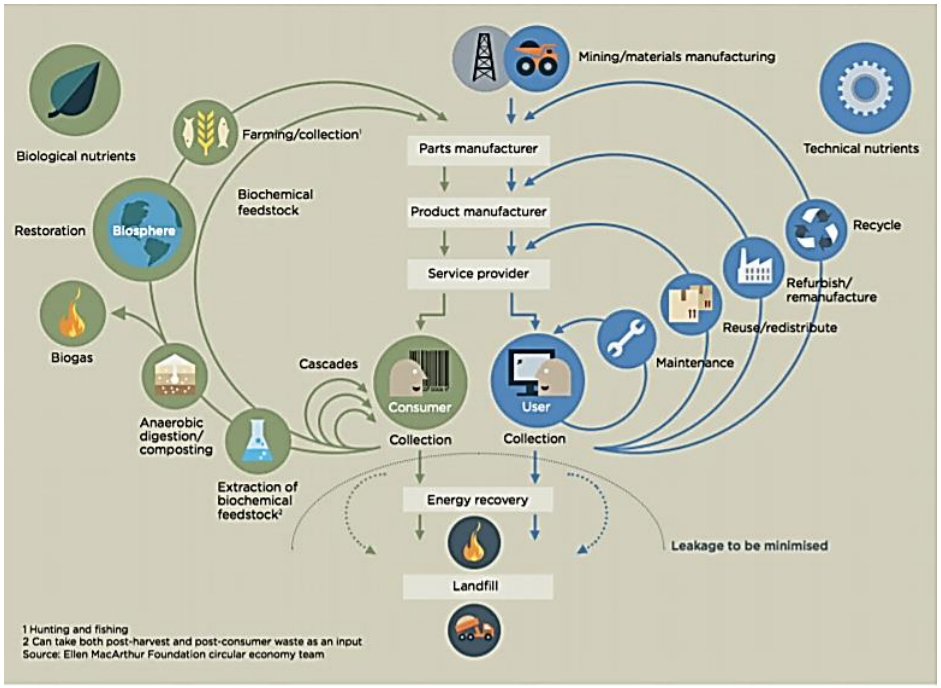

Figure 1: Outline of the circular economy (Ellen MacArthur Foundation, 2013)

In order to keep resources within a circular model, several circular strategies were developed. In the hierarchy of potential impact, they are shown in figure 2 (Cramer, 2017). To make CE a more mainstream phenomenon, companies need to systematically adopt circular strategies in their business practices and therefore endorse the implementation of CBM (Antikainen & Valkokari, 2016). CBM are business models that close the loop and slow down the pathways of resources. This can be done through different principles (shown in table 1) which can be led back to the levels of circularity (shown in figure 2).

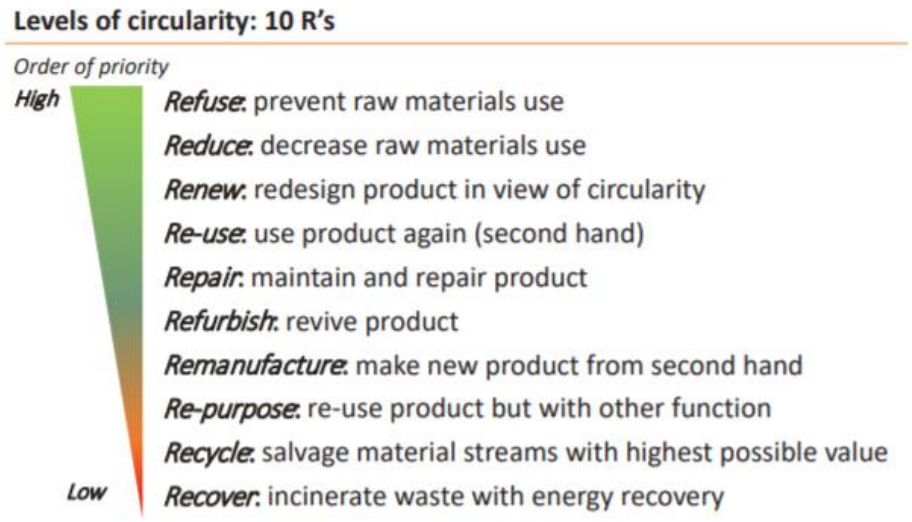

Figure 2: Levels of circularity: 10 R's (Cramer, 2011)

CBM Strategies (Bocken et al., 2016)	Short description	Potential complementary Levels of circularity (Cramer, 2017)
Access and Performance model	Based on service instead of ownership	Refuse, Reduce, Re-use, Repair
Extending product value	Exploiting the lifetime of a product	Refuse, Reduce, Renew, Repair, Refurbish, Remanufacture, Re-purpose
Classic long-life model	Qualitative products through design and repair	Refuse, Reduce, Repair, Renew, Re-use
Encourage Sufficiency	Reducing consumption through service, quality or marketing	Refuse, Reduce, Reuse, Renew, Repair, Refurbish, Remanufacture, Re-purpose
Extending Resource value	Exploiting the value of residues and 'waste'	Refuse, Reduce, Re-use, Renew, Repair, Refurbish, Remanufacture, Re-purpose, Recycle
Industrial Symbiosis	An operational collaboration between companies to create resources (for one company) out of waste (for the other company)	Refuse, Reduce, Re-use, Renew, Repair, Refurbish, Remanufacture, Re-purpose, Recycle, Recover

Table 1: CBM Strategies linked to levels of circularity (adopted from Cramer, 2017; Bocken et al., 2016)

CBM can thus be applied in several ways, with several purposes and are therefore also suited for combinations. Also, the same material can 'cascade' through different phases according to the remaining quality to keep the resource stream valid as long as possible before leaking (Ellen MacArthur Foundation, 2013). In this way, if CBM are replacing currently used business models instead of being used as an addition to them, they will always account for refusion or reduction of the used resources by that company. An example of this is the company MUD Jeans that invented a lease system for jeans (Access and performance model), manufactures jeans from denim waste material (extending resource value) and resell vintage jeans created from returned items (extending product value) (MUD Jeans, n.d.).

For the textile industry, there are several methods to adopt CBM based on the above-mentioned ones to enhance closed production cycles through recapturing the materials in their highest value. Sector-specific strategies are

highlighted in figure 3. The red circle is added to highlight the focus of the case study in this thesis, which will be based on recycling.

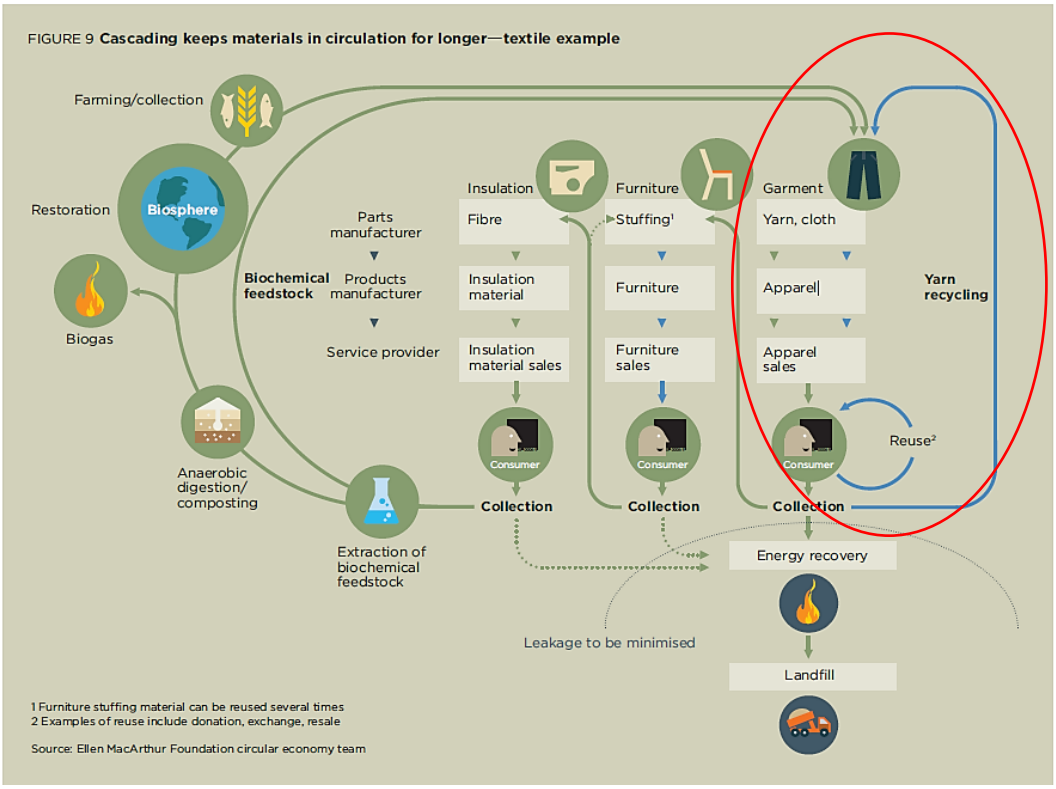

Figure 3: Circular Economy in the textile supply chain (Ellen MacArthur Foundation, 2015)

The circular strategy of recycling will be highlighted as a case to researching the potential of CBM implementation in this thesis for the following three reasons; 1. because of the current fast fashion trends, the quality of available apparel is rather low (Barnes & Lea-Greenwood, 2010). The items, therefore, lack added value for reusing or repairing. It is considered residue material and recycling of the material would be the best opportunity to create extra value from this product and is generally considered to be waste. Textile waste is currently sent out to landfill and/or incinerated which causes environmental pollution (GFA & BCG, 2017; Park & Evans, 2017). Recycling of textile is, therefore, a more sustainable method for waste treatment in order to generate new resource material. 2. The apparel industry is resource intensive and the generation of new material through recycling can reduce the pressure on resource depletion (Woolridge et al., 2006) as well as addition to fulfil the needs of an expected higher future demand (BoF & McKinsey, 2017) for apparel while diminishing compromising the environment through, for example, a water and chemical-intensive cotton production (Chapagain et al., 2006). 3: Textile recycling is done at this moment, but mostly in the terms of downcycling (e.g. creating cleaning towels, using textile for stuffing car seats or as insulation material) whilst recycling and upcycling methodologies are uprising and developing (Leal Filho et al., 2019). Hence, mainstreaming the implementation of recycled materials within the apparel supply chain can be a reasonable step towards CBM diffusion. This means that this thesis will focus on the CBM 'extending resource value' as this corresponds with recycling.

2.2. Innovation Phases and Transition Model

Comprehension for the development and diffusion of business models in an industry can be gained by innovative theories (de Jesus & Mendonça, 2018). The innovation phases are the core of innovation studies and explain the development of an innovative concept within a certain time frame as shown in figure 3. Transition normally takes about a generation to develop as it is never a quick change, but a gradually developing event (Rotmans et al., 2001).

In the first phase, the predevelopment phase, there are no changes to be seen yet in the business as usual. An innovation is in development and not yet implemented. In the next phase, a shift can be seen, and take-off of the innovation is recognized. This means that scattered companies are taking the first step for the implementation of this innovation. If this phase has been successful, the innovation often enters the acceleration phase where it enters the mainstream market, is used throughout the industry and eventually finds a stable position there and a transition is completed (Rotmans et al., 2001).

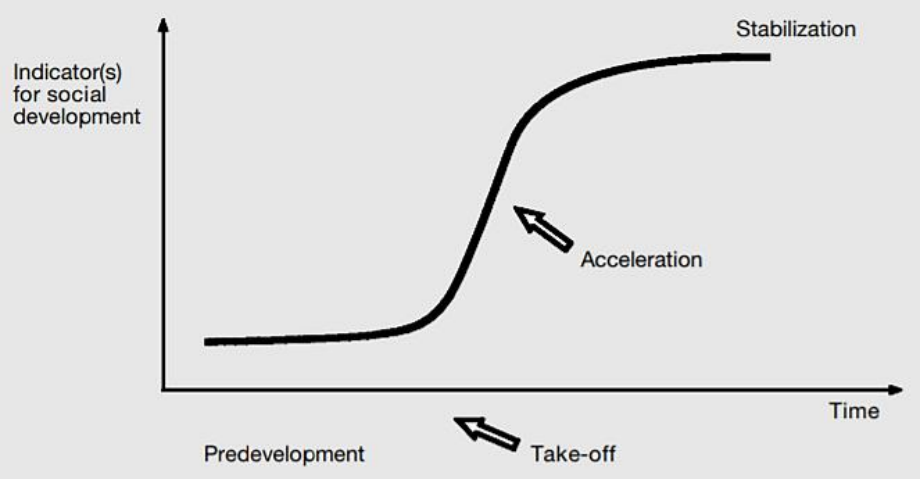

Figure 4: Innovation Phases (Rotmans et al., 2001)

CBM are rarely thoroughly implemented in industries (Kirchherr et al., 2018), including in the textile industry. However, there is progress towards adaption of CBM observed niche markets which position this transformation in the predevelopment and take-off phase.

2.3. The Multi-Level Perspective and Strategic Niche Management

To understand how an innovation in the niche market can develop along the different phases of Rotmans et al. (2001) the Multi-Level Perspective framework is shortly introduced. While being a complex theory, for this research it is important to know that this theory shows what lines technological diffusion of an innovation will follow, addressed by influences and developments from the overall society (landscape), industrial commodities and business as usual (socio-technological regime) and the areas where innovations are initiated (technological niches) (Geels, 2002).

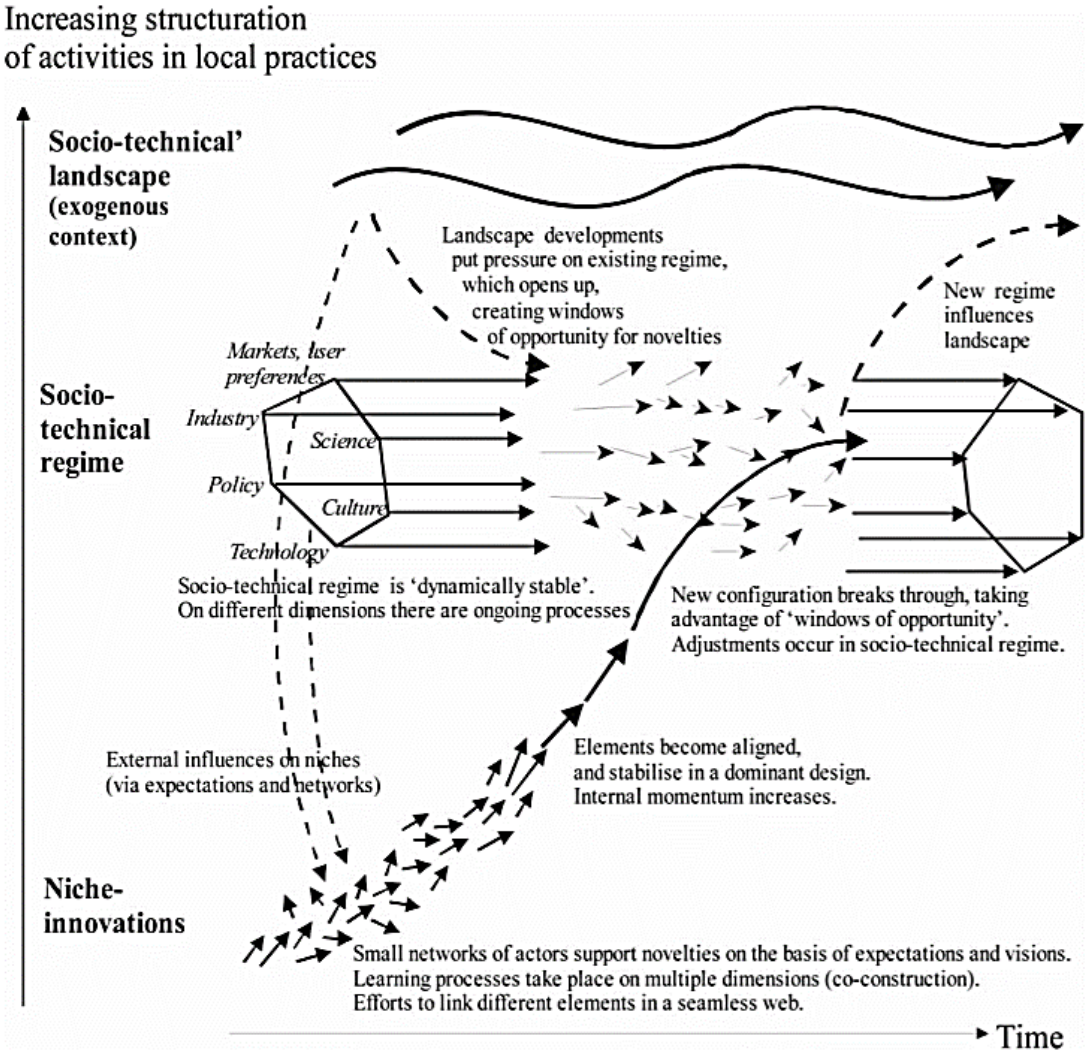

Figure 5: Multi-Level Perspective (Schot & Geels, 2008)

To explain how an innovation can get outside of the technological niches and into the socio-technological regime the theory of Strategic Niche Management (SNM) was introduced by Schot, Hoogma, and Elzen in 1994 and Kemp, Schot, and Hoogma in 1998 to bridge the gap between Research and Development and introduction of a new development on the market (Schot & Geels, 2008). SNM is built upon the idea that innovations developed in niches can eventually codevelop towards a more mainstream market. According to Schot and Geels (2008), the SNM indicates the facilitation of sustainable innovation pathways through niches. Niches are separate spaces in which the innovations can codevelop with user practices, technology, and governing structures. These innovations therefore not directly enter the market and are still preserved from co-existing with mainstream rivalling technologies. SNM assumes that these niches are also used for maturing the innovation for cohesion with rivalling technologies and societal developments. Therefore, the niches do not only protect the innovation but also mediate between the innovation and actors dealing with these technologies, demand and societal issues (Schot & Geels, 2008).

Even though SNM tends to approach innovation diffusion from the technological development side (Schot & Geels, 2008), in practice there are influences on these kinds of innovations to develop into the mainstream areas of production. Different scholars argue that types of drivers and barriers can contribute to an understanding of the conditions under which innovations develop. In this thesis, the drivers and barriers from the socio-technological regime(s) are highlighted in order to see how CBM can get out of the niches it is in at this moment and into the socio-technological regime.

2.4. Drivers and Barriers for Circular Business Model Diffusion

A transition of an innovation from a niche to the socio-technological regime is consistent with overcoming barriers and enhancing drivers as the lock-ins, path-dependencies, and inertia are main characteristics of the socio-technological regime (Markard et al., 2012). Academic literature defines drivers and barriers for the transition towards circular business strategies (e.g. de Jesus & Mendonça, 2018). For a more systematic approach, these drivers and barriers are often categorized, as will be done in this thesis as well. CBM diffusion is complex and multiple drivers and barriers can often be found when looking at a case. Therefore, a framework is established in table 2, which is developed upon the framework for CE drivers and barriers developed by Tura et al. (2019).

As mentioned in the introduction, studies on drivers and barriers for the transition towards CBM or towards sustainability in the textile sector are diverse. For a systematic and comprehensive approach, a literature overview combining relevant topic-specific and in-depth articles on drivers and barriers is given in table 2. Although Tura et al. (2019) include an overview of drivers and barriers for CBM implementation, most studies only cover the subject partially. These studies, for example, only focus on barriers for CE (e.g. Kirchherr et al., 2018; Ritzén & Ölundh Sandström, 2017), consider company internal barriers and company external drivers (e.g. Zhu & Geng, 2013) or elaborate on one type of driver and barrier (e.g. Levering & Vos, 2019). Most of the studies are focussing on specific cases (e.g. Levering & Vos, 2019), sectors (e.g. Zhu & Geng, 2013) or innovation strategies (e.g. de Jesus & Mendonça, 2018). Insights of all these studies were used to create the conceptual framework for this thesis with eight different categories of drivers and barriers. This is the basis of the interviews and the coding system. The separate categories are explained next.

First, the attitudinal drivers and barriers encompass the perception towards circularity and the willingness to take risks, participate and work towards the implementation of CBM. This perception can either be company external, in terms of the view or scrutinizing or norms of potential customers (Planing, 2015), the opinion of business partners (Zhu & Geng, 2013) or other environmental awareness in society (de Jesus & Mendonça, 2018). Also, a company internal perception should be considered in terms of the perception of the owners, the management and the opinion of co-workers (e.g. Caniato et al., 2012; Chesbrough, 2010). The willingness to take risks is also an internal factor that should be highlighted as innovation is grounded in the willingness to take certain risks (Ritzén & Ölundh Sandström, 2017).

Economic drivers and barriers concern all factors corresponding to finance and market conditions. Amongst these are considered; profitability and revenue (Ritzén & Ölundh Sandström, 2017), cost-efficiency and price validation (Andersen, 2007), market dynamics and competitiveness (Zhu & Geng, 2013), and investments and costs (Boiten et al., 2017).

The environmental drivers and barriers are based on the reduction of environmental impact. Although these environmental factors are mainly seen as a driver for transition towards CBM implementation (Tura et al., 2019), a conflicting reasoning can also be found. The solution towards abating environmental damage in one way could be the cause for the increase of unwanted impact in another way. Meaning that one problem can be solved, however at the same time, it is switched to another area (Murray et al., 2017). If the implementation of a CBM practice for sustainability would cause environmental damage in another way, this could be seen as an environmental barrier (Howe et al., 2014).

Moreover, institutional factors should be considered when looking at CE (Moreau et al., 2017). This category takes into consideration the laws, policies, and regulations from either national or international prospection (de Jesus & Mendonça, 2018). Drivers and barriers respectively based on the influence of governmental institutions, Public-Private Partnerships and (private) certification organisations will be considered under this category (Ranta et al., 2018).

The operational category corresponds to the situation within the operations within the supply chain. These factors are about the available resources, the quality of the relationship with supply chain actors, the potential for integration of the new business model within the whole supply chain and the flexibility to change a company's supply chain if this is required in order to shift towards CBM (Caniato et al., 2012).

Organisational drivers and barriers are company internal characteristics in terms of the functioning of the organisation (Levering & Vos, 2019). It should be noted that the meaning of organisational drivers and barriers in this thesis does not mean an organisational perspective in which drivers and barriers can be discussed (e.g. (Ritzén & Ölundh Sandström, 2017). In this thesis, the organisational category accounts for company internal factors. These characteristics are closely related to the internal social characteristics (discussed above) and internal structural characteristics (as discussed below). However, the organisational category is more focused on company internal cooperation and support, and company learning. Hence, this category will rather account for the 'action' side than the 'perception' side within the company (Tura et al., 2019).

Additionally, structural drivers and barriers are factors of influence in terms of information exchange and responsibility diffusion. These factors determine how knowledge flows through an organisation and how information is retrieved from through external actors or sources and who is responsible for what tasks (Ritzén & Ölundh Sandström, 2017). This category is closely aligned with the category of organisational drivers and barriers.

Ultimately, the technological drivers and barriers are based on the technological developments and skills that are required to pursue the adoption of a new business model (Mathews & Tan, 2011). In this thesis drivers and barriers in this field will be focused on textile recycling technologies, which are further elaborated on in chapter 4.3.

2.5. Coherence of the literature review for the theoretical framework

The theoretical framework of this thesis can be outlined in the following way. This thesis contributes to sustainable development in the Dutch textile section through mapping the drivers and barriers for the Dutch textile industry for adopting CBM in a better way. First, the characteristics of CE are used as the fundament of the theoretical framework (Ellen MacArthur Foundation, 2013). The subsequent CBM form the basis for companies and their supply chains to adopt circular strategies within their business practices (Bocken et al., 2016; Cramer, 2017). From the previously explained CBM, 'extended resource value', is taken as a case study in this thesis based on textile recycling.

The development of a newly introduced business model can be understood to adhere to the introduction of an innovation (de Jesus & Mendonça, 2018). Hence, the innovation theory has been introduced (Rotmans et al., 2001). It is expected that an innovation starts within a niche market and through influencing factors within the niches and from the outside environment potentially reach a more mainstream scenery (socio-technical regime and socio-technical landscape) (Geels & Schot, 2007; Schot & Geels, 2008). These influencing factors can be understood through drawing the drivers and barriers which represent eight different categories of potential influences (attitudinal, economic, environmental, institutional, operational, organisational, structural, technological) based on the framework presented in Tura et al. (2019) complemented with additional literature. Connections and interdependencies between different drivers and barriers should be taken into consideration.

Category	Explanation	Examples of Sources
Attitudinal Drivers	Positive perception of circularity (either throughout the organisation or organisation external) Risk taking / willingness	Caniato et al., 2012; de Jesus & Mendonça, 2018; Zhu & Geng, 2013; Chesbrough, 2010
Attitudinal Barriers	Negative perception of circularity Risk reluctance / lack of willingness	de Jesus & Mendonça, 2018; Ritzén & Ölundh Sandström, 2017; Planing, 2015; Chesbrough, 2010
Economic Driver	Cost efficiency, new revenue streams, gaining profit New market opportunities Mimicking of competitors / competitive advantage	Ritzén & Ölundh Sandström, 2017; Chesbrough, 2010; Caniato et al., 2012; de Jesus & Mendonça, 2018; Zhu & Geng, 2013; Chesbrough, 2010; Boiten et al., 2017
Economic Barriers	trade-off between economic growth and environmental damage High costs / investments	Kirchherr et al., 2018; Ritzén & Ölundh Sandström, 2017; Geissdoerfer et al., 2017; de Jesus & Mendonça, 2018; Boiten et al., 2017
Environmental Drivers	Reduce negative impacts from resource uptake and current ways of production	Ghisellini et al., 2016; Ellen MacArthur Foundation, 2015; Baffes, 2018; Beton et al., 2014; Boiten et al., 2017
Environmental Barriers	Trade-off between economic growth and environmental damage	Ghisellini et al., 2016; Geissdoerfer et al., 2017
Institutional Drivers	Supportive regulations and policy requirements Supportive funds and taxes	Caniato et al., 2012; de Jesus & Mendonça, 2018; Zhu & Geng, 2013; Ranta et al., 2018
Institutional Barriers	No support from the government Complex and unsupportive regulation	de Jesus & Mendonça, 2018; Zeng et al., 2016; Ranta et al., 2018; Boiten et al., 2017
Operational Drivers	Options for reducing supply chain dependency Options for collaborations and communication with stakeholders Increased availability of resources	Zeng et al., 2016; Ghisellini et al., 2016; Ellen MacArthur Foundation, 2013; Boiten et al., 2017
Operational Barriers	No supportive partners Lack of resources Industrial focus on linear models	Caniato et al., 2012; Ritzén & Ölundh Sandström, 2017; Ellen MacArthur Foundation, 2013
Organisational Barriers	Lack of internal cooperation Lack of management support Lack of interorganisational learning on circular business skills	Levering & Vos, 2019; Chesbrough, 2010
Structural Drivers	Structured information exchange Clear responsibility diffusion Clear knowledge management	Caniato et al., 2012; Boiten et al., 2017
Structural Barriers	insufficient information exchange undefined responsibility diffusion	Ritzén & Ölundh Sandström, 2017;
Technological Drivers	New technological developments Chances for improvement of operations	Rudolphi, 2018; de Jesus & Mendonça, 2018; Mathews & Tan, 2011
Technological Barriers	Lack of technological skills Insufficient technological developments	de Jesus & Mendonça, 2018; Ritzén & Ölundh Sandström, 2017; Kirchherr et al., 2018; Boiten et al., 2017; Mathews & Tan, 2011

Table 2: Literature review on drivers and barriers for circular business model transition

3. Methodology

This section will describe how the research for this thesis was scoped and conducted and how the results were analysed through explaining the research design and approach. Furthermore, the methods of sampling, data collection, and way of analysis are portrayed, and the means for ensuring research quality are indicated.

3.1. Research Design

The research design adopted is based on a case study (Yin, 1994) of the Dutch apparel industry focused at the level of adoption of CBM. Qualitative data was gathered through semi-structured interviews and analysed with secondary literature to build new empirical evidence on how diffusion of CBM in the apparel industry could take place through identifying drivers and barriers and their underpinnings. As a result, this thesis contributes to the literature on mapping the key factors driving or hindering sustainable business model diffusion with a focus on the new issue of circularity. As such, this study contributes to guiding companies seeking to improve their business' sustainability as well as to policy makers on fostering sustainable business models.

This case study focuses on the level of adoption of recycled materials by companies as recycling is a currently developing subject and diminishes two main environmental effects of the apparel industry, namely waste production and resource depletion (the choice for this case study is described in chapter 1.4., page 12 and 2.1., page 13). In terms of material recycling at this moment three items are differentiated by the interviewees: First, in terms of the resources used for apparel production, the main materials are cotton (43%) and polyester (16%) (Beton et al., 2014). Recent technological developments increase the potential of recycling for these two fabrics (Wang, 2010). However, there is potential for recycling of other materials as well. Second, there are different kinds of recycling technologies available, which are further elaborated on in chapter 4.3. (page 31). Third, there are two main textile waste streams to be distinguished and discussed. One is the post-consumer waste stream, the waste of textiles that are bought and worn by consumers and the other is post-industrial waste, namely the of rest materials derived from textile production factories (Domina & Koch, 1997). Post-industrial waste exists as cutting rest through production, rejected items and overstock (Rupa, 2009). The choice for waste-stream, technology and material are interdependent and therefore varies amongst the interviewees. The division of materials, techniques, and waste mentioned and/or used by the interviewees is presented in table 3. Hence, following the results of the interviews, this thesis also discussed recycled wool, recycled nylon and the recycling of PET into polyester fibres.

	I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	IA	IB	IC	%[4]
Material														
Polyester	X	X		X	X		X	X	X	X		X	X	77%
Cotton	X	X			X	X		X			X		X	54%
Wool	X			X	X									23%
Nylon (polyamide)			X				X				X			23%
Techniques														
Own techniques[5]			X					X					X	23%
Recycled PET (to polyester)	X				X		X			X		X		38%
Chemical recycling									X					8%
Mechanical recycling	X	X			X	X					X			38%
Waste shredded to felt										X				8%
Waste stream														
Post-Consumer (textile) waste		X				X			X	X				31%
Post-Industrial (textile) waste								X			X		X	23%
Other waste as a resource			X		X		X			X		X		38%

Table 3: Types of material, methodologies, and waste (used as a resource) discussed by interviewees[6]

3.2. Methods of Data Collection

Semi-structured interviews (Longhurst, 2010) were conducted to gather the data on drivers and barriers for diffusion of recycled materials in Dutch apparel companies. The data collection was carried out in three steps. First, a literature review and secondary data analysis were conducted in order to structure the interviews. The semi-structured interview protocol (Appendix B) is conducted based on the from literature derived drivers and barriers for business model diffusion gathered in the literature review as shown in table 2 (page 22) and chapter 2.4. (page 19). Considering the duration of the interview a condensed version of the framework is used and follow-up questions were constructed to ensure the coverage of all potential categories.

Second, before the interviews, the interviewees and the respective companies they represented for this research were studied through desk research of sustainability reports and other grey literature available to give a more comprehensive background for the interview.

Henceforth, the interviews were undertaken with two groups of respondents. The first group represents the Dutch apparel industry and consists of 10 respondents. The second group represents the supplier side in Sri Lanka and India and consists of 3 respondents. The questions for both groups were therefore slightly different, however following the same interview protocol. The reason for this is that in this way there is a possibility to consider the results of the first group within the questions for the second group and align the potential for problem solving between these two parties. The choice for including the second group was made to link the results from the first group of respondents to another layer of the supply chain and create a more profound overview of drivers and

[4] Percentage of number of interviewees mentioning the same recycling characteristic.
[5] Technique of I3 is based on bringing the fibres back to molecular level. Technique of I8 and IC (same technique) is based on enzyme treatment.
[6] Materials, Techniques and waste-streams that have not been specified by interviewees were left blank.

barriers within the industry by considering different business dynamics between brands and recyclers. This follows the idea that the inclusion of different stakeholders is important to consider in sustainability transitions (Bocken et al., 2014).

3.3. Operationalization

The interviews were done through calls or face-to-face conversations according to the geographical location and preference of the interviewee. The interviews were expected to take approximately 30 minutes as can be seen in Appendix B. The actual duration of the interviews differed per interviewee and took between 21m and 1h06m. An overview of the duration and medium of each interview can be found in Appendix A.

3.4. Sampling strategy

Marshall (1996) describes three approaches for a sample selection for qualitative research. These are the convenience sample (the least thorough technique selecting the best accessible samples), the judgement sample (a technique to select a sample that will answer the research question best) and the theoretical sample (based on theoretical arguments). It is pointed out that a sampling strategy with overlap between these different methods often creates the best balance between a study's convenience and trustworthiness considering the influential, spatial and temporal context of the research (Marshall, 1996).

Following the characteristics of a *convenience sample* and considering the contextual situation of the host organisation for this research, the interviewees were chosen out of the network of MVO Nederland. Considering the *judgement sample* a selection is done for individuals with specific experiences and expertise, which is the affinity with and/or expertise on circular business practices and sustainability within their company. Also, a heterogeneous selection of companies was considered to be able to give a strategic overview of possibilities for textile recycling in different companies (Robinson, 2014). The basis of the theoretical framework (table 2, page 22) for this research is in coherence with a *theoretical sample* (Marshall, 1996).

To allow for comparability, all interviewees are experienced and knowledgeable about sustainability, circularity and/or recycling within the apparel supply chain and hold the following functions; 1. CEO's, CSR managers, sales or buying representatives of Dutch (divisions of) apparel companies (fashion and workwear) with international supply chains who are engaged with sustainability efforts in this supply chain. 2. Managers and experts of recycling for cotton and polyester within or with reference to the European-South-Asian supply chain.

The names and company names of the interviews were not mentioned in this thesis, as the interviewees to allow for anonymity requested by some of the interviewees. Yet, some characteristics are mentioned to be able to present the differences amongst interviewees and give the potential to disclose nonconformity amongst results. The overview of certain relevant characteristics of the interviewees can be found in table 4. The practical strategy for the sampling of the two groups of interviewees is given below.

Dutch apparel companies

MVO Nederland has a broad network of between 50-80 different experts and companies on textiles. This database includes a range of multinational companies and start-ups. 10 interviews were conducted with these experts.

Sri Lankan and Indian recyclers

To present this research in a more inclusive context of the case study, two experts on textile recycling from Sri Lanka and one expert on textile recycling from India were interviewed. The reasons for choosing these countries are that both countries export textiles to the EU, they have a prevailing textile industry (IBEF, 2018; Park & Evans, 2017) and the International MVO team has tight connections with key players the Sri Lankan textile industry (as pointed out in chapter 1.4., page 12). More information on the textile industry in these countries is pointed out in chapter 4.3. (page 31).

Interview	Function	Located	Specialisation	Size[7]	Market (B2B /B2C)
Interview 1	Social Compliance Coordinator	NL	Fashion	LE	B2C
Interview 2	Owner / Sales Responsibility	NL	Workwear	SME	B2B
Interview 3	Owner/Director	NL	Fashion	SME	B2B / B2C
Interview 4	Owner/Expert	NL	Fashion	SME	B2C
Interview 5	CSR Manager	NL	Fashion	LE	B2C
Interview 6	Denim Expert	NL	Fashion	N/A	N/A
Interview 7	Material Specialist	NL	Fashion	LE	B2C
Interview 8	CEO	NL	Fashion / Recycling	SME	B2B/B2C
Interview 9	Brand manager	NL	Fashion	SME[8]	B2C / B2B
Interview 10	Manager product manager purchasing	NL	Workwear	SME[8]	B2B
Interview A	Managing Director	SL	Recycling	SME	B2B
Interview B	Senior Manager	SL	Recycling	SME	B2B
Interview C	Venture Builder	I	Recycling	N/A	B2B

Table 4: Interviews and characteristics of interviewees and/or the companies they represent

[7] Small and Medium-sized Enterprise (SME) < 250 employees, Larger Enterprise (LE) > 250 employees (OECD, 2019)
[8] Part of an umbrella organisation

3.5. Data Analysis

The transcriptions of the interviews were analysed by utilizing a coding procedure by hand. This choice is made as the questions were asked in a way that diverse answers could be given. Also, the interviews were conducted in Dutch and translated to English. The coding scheme followed the literature review from table 2 (page 22). The coding of the results aimed for both the conceptualisation of underlying patterns and the construction of links between different coding categories. The coding and analysis of the codes had been done in the following steps inspired by an article from Saldana (2009):

I. The interviews were transcribed, and Dutch interviews were translated into English.
II. Relevant sentences of the interviews were grouped into the eight categories of the theoretical framework (table 2, page 22)
III. These relevant sentences were given a code to summarise the main idea of the relevant sentences. It should be noted that some codes could cover different categories but were to put into one category for a better understanding. Table 6 gives argumentation for the chosen categorisation.
IV. All codes that were structured in the categories for a complete and comprehensive overview.
V. Coded sentences that were mentioned by different interviewees were put together to make visible which codes were mentioned by different interviewees.
VI. The codes were ranked in order of importance
    a. High: Mentioned by multiple interviewees and emphasized on by at least one of the interviewees.
    b. Medium: Mentioned by at least two interviewees and/or clearly emphasized by one interviewee.
    c. Low: Mentioned only once throughout the interviews and never emphasized on by an interviewee.
VII. The importance was scored to importance along the order as shown in table 5:

Rank	Score
High	3
Medium	2
Low	1

Table 5: Scoring of the importance of the codes

VIII. Codes that were related to each other were summarized within sub-categories (as divisions of the eight main categories).
IX. The combined score of each sub-category was used to give an indication of the importance of each sub-category.
X. The most important sub-categories and connections found between these categories were examined according to relevant academic literature and grey literature. Both academic literature and grey literature was used for the analysis to be of both academic and practical relevance. Furthermore, the categorisation was checked with two experts in the field for reliability.

A complete overview of the coding structure and (sub-)categorisation of the codes can be found in Appendix D. The importance of all separate codes is given in the database in Appendix E.

Drivers / Barrier	Possible Categories	Chosen category	Explanation
Consumer demand	Attitudinal and Economic	Attitudinal	The consumer demand comes forward from the interest in recycled materials and is therefore placed in a sub-category with consumer interest and consumer perception
Taxes and subsidies	Economic and Institutional	Institutional	It would be an institutional decision before creating economic impact
Future expectations	All	Attitudinal	The attitude towards the future expectations is highlighted by interviewees and will be described
Chemicals	Technological and Environmental	Environmental	The environmental effect of chemicals is emphasized on by the interviewees

Table 6: Categorisation of drivers and barriers that could be included in multiple categories

It should be noted that during the coding of the interviews, drivers and barriers are framed given the current situation. This means that if an interviewee mentioned something in terms of; "there should be…" or "we should do…" the code of the driver or barrier will be "lack of…" or "no…" to give an understanding overview of the current state-of-the-art within the transition towards CE. During the analysis the emphasis is laid on what explanations and examples were supported and repeated by the interviewees and on what subjects the interviewees disagreed (Marshall, 1996).

From this analysis of the case study some case study specific conclusions were drawn. However, in order to answer the research question, general conclusions were drawn upon this case study for the potential diffusion of CBM in general. Even though the results of the case study and the answer to the research question are not mutually exclusive, conclusions can be drawn. Common agreement in results amongst heterogeneous cases can provide evidence for the generalisation of the results into the wider context of the research than the case study itself (Robinson, 2014).

3.6. Research Quality Indicators

In order to establish the qualitative value of this thesis, the following aspects have been taken into consideration. First, one company does not represent an industry (Shen, 2014), which is why different companies from the Dutch apparel sector will be interviewed. Furthermore, thematic saturation is reached during the interviews, which means that subsequent interviews do not generate new answers anymore. When thematic saturation is reached depends on the subject and knowledge of the interviewees (Baker & Edwards, 2012).

To be able to compare and analyse the interviews for the same case study, there needs to be consistency in the interviews. Hence, the interviews were conducted along the same protocol and with people that have comparable knowledge about the current sustainable developments within the apparel industry and their respective companies.

Furthermore, data is more valid when originated from multiple sources. Therefore, both primary data and secondary data is used to conduct and analyse this research (Denzin, 2012). Primary data will be verified with the use of secondary data from both academic and grey literature. Finally, expert elicitation within the industry was done through visiting multiple events and attending presentations from experts (e.g. The launch of Dutch Circular Textile Valley, the Copenhagen Fashion Summit 2019, the European Clothing Action Plan (ECAP) event "Circular textiles – Ready to market"), and furthermore discussing the results with experts and colleagues. These discussions validated the research results and pointed to interesting future research avenues.

4. The case of textile recycling in the apparel industry

This chapter sets the basis of understanding the diffusion of CBM in the textile industry by showing an overview of the current state-of-the-art of textile recycling to put the interviews and results in context. First, a general overview of the currently ongoing sustainability transition within the fashion industry will be given. Second, the role of the supplier countries within this research will be highlighted. Finally, the currently available and developments of textile recycling technologies will be described.

4.1. Taking stock and looking ahead

As mentioned in the introduction, the implementation of sustainability measures in the textile industry is essential. Sustainability may not be a crucial topic yet as the industry faces all kinds of other challenges that have a contradictory goal, such as the fast production of a new cycle, commodification of fashion items and a raising demand through growing and wealthier population (BoF & McKinsey, 2017). The global textile industry has grown at an annual rate of by 5.5%, which outperforms the yearly global GDP growth of the six largest economies and could be considered as the seventh-largest economy in the world if counted as a country (BoF & McKinsey, 2017). This makes fashion one of the largest economic sectors in the world.

As the economy and companies are growing, also innovative business models gain market share over more traditional business models (Nidumolu et al., 2009). At the same time, the pressure on brands to work on sustainability and transparency is also mounting (BoF & McKinsey, 2017). The industry is thus on the one hand flexible (e.g. fast fashion) as it is on the other hand dependable (e.g. on raw materials and labour), which can create both opportunities and challenges for sustainable and circular changes to enter the industry.

Different sustainable initiatives have been established over time. This mainly happened after the Rana Plaza disaster in Bangladesh where an apparel complex collapsed and 1134 people, mostly female apparel workers, lost their lives on the 24th of April, 2013 (Hoskins, 2015). Mainly Multinational textile companies also initiated corporate social responsibility (CSR) tracks within their production chains (Shen et al., 2010; Sinkovics et al., 2016). However, sustainable supply chain innovations are more complicated and more time consuming to launch in multinationals

than start-ups (Hockerts & Wüstenhagen, 2010). Incumbent firms are not able to reshape their entire supply chains at once but rather focus on incremental products and process improvements (Caniato et al., 2012).

4.2. Sustainability developments in the textile supplier countries: India and Sri Lanka

The textile industry in both India and Sri Lanka is prevailing. The sector has a high impact on their local economies and global trade and the sector keeps expanding (Rupa, 2009). To understand the economic situation of these two countries and the place of the textile industry generic economic data of both countries can be found in table 7.

	India (CIA, 2018a)	**Sri Lanka (CIA, 2018b)**
Population (2018)	1,3 billion	22,5 million
GDP (2017)	$9.474 trillion	$275.8 billion
GDP/Capita (2017)	$7,200	$12,900
GDP Growth (2017)	6.7%	3.3%
% GDP provided by industry	23% (2016)	30.5% (2017)
Industrial production growth rate (2017)	5.5%	4.6%
Unemployment rate (2017)	8.5%	4.4%
Export	$304.1 billion	$11.36 billion
Export partners (in order of importance)	US, UAE, Hong Kong, China	US, UK, India, Singapore, Germany, Italy

Table 7: General economic data and statistics of India and Sri Lanka

The Indian textile industry has an estimated value of 150 billion US$ in 2017, which contributes with 2% to the GDP and generates labour possibilities for 45 million people (IBEF, 2018). India is the world's second biggest manufacturer of textile products, after China. The Indian manufacturing of textiles covers almost the whole supply chain. From the growth of cotton until the Cut-Make-Trim (CMT) process of the clothing. Moreover, the industry covers a wide range of textile products and apparel (Seyoum, 2007). Also, in India, this sector is expected to grow with a forecast of an industry worth 250 billion US$ in 2019 (IBEF (India Brand Equity Foundation), 2018).

In Sri Lanka the textile industry is the biggest economic driver which generates 44% of the GDP (Park & Evans, 2017) and 30% of the employment (Jha, 2018). The business focuses on a higher price segment and more specialised brands, such as lingerie and sportswear. Manufacturing is a bit more expensive in Sri Lanka than it is in other South-East Asian countries. However, the incorporation of better working conditions, higher wages, and CSR standards generate a competitive advantage and moreover a workforce that is more productive and skilled (Jansson & Persson, 2015). In the early years of the development of the Sri Lankan textile industry, Sri Lanka mainly entered the market as having a (General System of Preferences) GSP status that made a trade with the European Union easier. Even though they lost their status, Sri Lanka still exports a high amount of textile to the EU (Jansson & Persson, 2015), although the United States (US) is the biggest importer of Sri Lankan apparel (Jha, 2018). Hirdaramani Group, MAS Holdings, and Brandix are the top textile companies of Sri Lanka and responsible for approximately half of the production. The Sri Lankan government aims to a growth of the Sri Lankan textile industry that can match with the top 10 of the world, which is led by China and followed by India (statista.com,

2017). The industry generates at least 44.100 tonnes of waste per year and increases every year. The waste is now exported, mostly to India or burnt for energy generation with low efficiency (Park & Evans, 2017).

In both countries, the textile industry keeps expanding. This is a result of the global growth in the textile industry, which is predominantly caused by the increase of wealth and purchasing power by countries with developing economies and a worldwide population and consumption increase (BoF & McKinsey, 2017). Subsequently, the waste production will grow along. There will be the need to handle this waste in better ways and recycling is one of the solutions to do so.

4.3. Textile recycling

Textile recycling is the process to recover material for reuse from old clothing and textiles. This practice has been in existence since the 18th century when wool scarcity was caused by the Napoleonic War. Regeneration of existing wool fibres for new product was therefore unavoidable. Textile recycling has remained and improved ever since (Hawley et al., n.d.).

The life cycle of the recycling process generally contains the collection of waste material, sorting, processing and sending it to the clients to turn it back into new apparel (Leblanc, 2019). Within this process, several methods for recycling exist. Bocken et al (2016) created an overview of recycling methodologies in terms of descending recapturing of material value, which can be seen in table 8 and which will be shortly discussed.

Method	Explanation
Primary recycling (closed-loop recycling)	Mechanically reprocessing the material into a product with comparative properties
Secondary recycling (downgrading or downcycling)	Mechanically reprocessing the material into a product with deceased properties
Tertiary recycling (chemical or feedstock recycling)	Chemical reprocessing the material by breaking the structure down to the original components (chemical compounds)

Table 8: Recycling methodologies adopted from Bocken et al. (2016)

The technological procedures for textile recycling are complicated and require multiple steps. Only understanding of the basic difference for this thesis is required as in-depth technological expertise is not within the scope of this research. Mechanical recycling for textiles means that the textiles are shredded and turned back into fibres that can be used as the ground material for a new product. It is not always the case that this material is of the same quality as the ground material, which can be called downcycling. Also, the application of the fibre can therefore also differ. When fibres get chemically recycled, they are turned back into their original components with the use of chemical methods. The quality of this method will mostly be preserved (Bocken et al., 2016; Hawley, 2006; Wang, 2010).

Although this thesis is scoped mainly within textile-to-textile recycling, other trends to create new textile without using virgin material can also be found and are mentioned by the interviewees. The most recognized examples

nowadays are PET-waste can be turned into polyester fibres (Shen et al., 2010) and fishing net waste can be reprocessed into nylon materials (Shukla et al., 2006).

5. Results and Analysis

This chapter consists of three parts. First, the interviews will be described, and a general overview of the results is given. Second, the results will be described and analysed per category in which the three most important categories (economic, attitudinal and structural) and relatively most important drivers and barriers are analysed most extensively. Third, an overall analysis is given in which the most important links and most surprising results are indicated

5.1. Interviews

The implementation of new business models is a fundamental change and therefore a challenge for companies. One way to make the diffusion of CBM more comprehensive is to identify drivers and barriers for the diffusion of a circularity practice within the industry. The drivers and barriers for CBM diffusion in terms of making it more mainstream to use recycled materials in a companies' supply chain is researched in this thesis. This is done through semi-structured interviews with representatives of 10 Dutch apparel companies. The findings were linked to 3 interviews conducted within the textile recycling industry in India and Sri Lanka. An overall overview of the results (the codes conducted from the interviews) is presented in Appendix D and E. The drivers and barriers found during the interviews are discussed according to the categories presented in table 2 (page 22) and the sub-categories created through the coding scheme. The analysis is done by linking the results with corresponding literature. This analysis will dive deeper into what would be needed to take a step towards implementing recycled materials and therefore a step closer to the transition towards CBM implementation. A complete overview of the codes with the function driver or barrier found with reference to the representative interviews they were mentioned in, is added in Appendix D. Corresponding characteristics of the interviewees/their companies is shown in table 4 (page 26).

In total, 409 individual factors of influence were identified during the interviews. Amongst these, 173 drivers and 185 barriers were identified. Also, 51 factors were identified by the interviewees as neither a driver or a barrier or containing signs of being both and enhancing and restraining factor. Figure 6 shows the division of drivers and barriers.

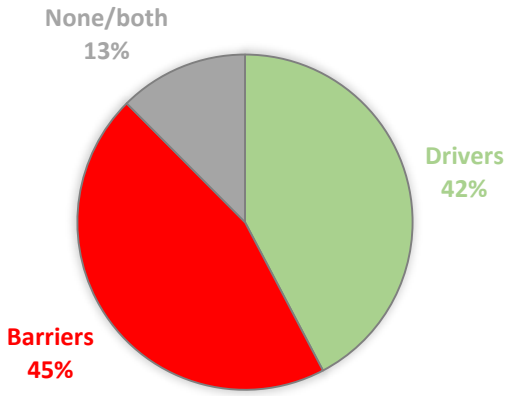

Figure 6: Division of codes in the functions of drivers and barriers

Furthermore, the factors found were counted per category, which is shown in figure 7. It can here be seen that the structural category contains the most factors (71). The economic and attitudinal category follow up with respectively 70 and 63 factors.

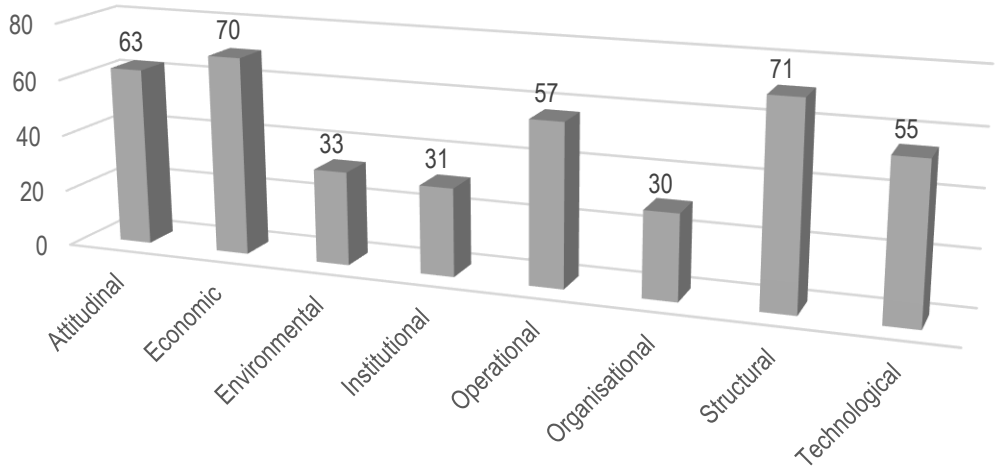

Figure 7: Division of the quantity of codes found amongst the eight categories

As mentioned before, the individual drivers and barriers were scored to importance with a 1, 2, or 3. The scores used to create the figures calibrated to importance score (figure 8 - 17) are laid out in Appendix F. In figure 8 the codes per category calibrated to importance score are mentioned. Although there is consistency between figure 7 and 8, in figure 8 the economic category shifts to the first place and is followed up by the attitudinal and structural category on a shared second place. As a result, these three categories will be described more extensively in this chapter.

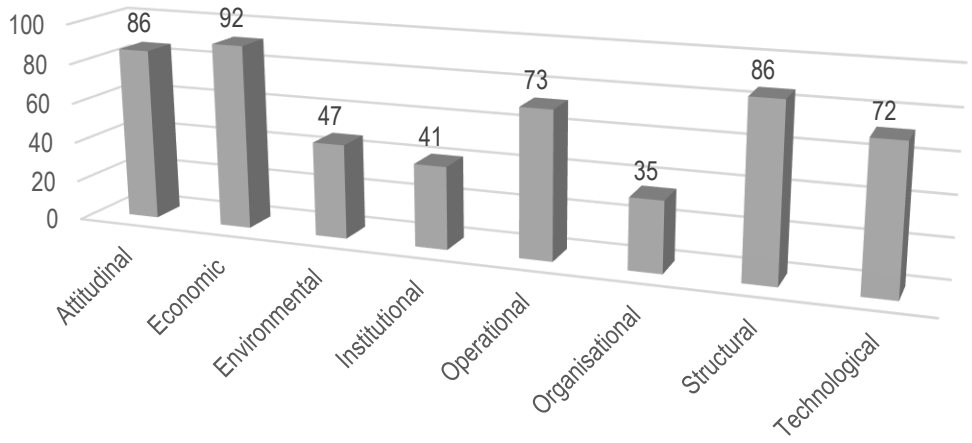

Figure 8: Division of codes per category calibrated to importance score

Figure 9 shows the division of drivers and barriers found per category and calibrated to importance score. This graph shows that the attitudinal category accounts for the most drivers, followed up by the structural category. The operational and economic category account for the most barriers, however, it should be noticed that the gap between the amounts of drivers and barriers in the economic category is smaller than in the operational category.

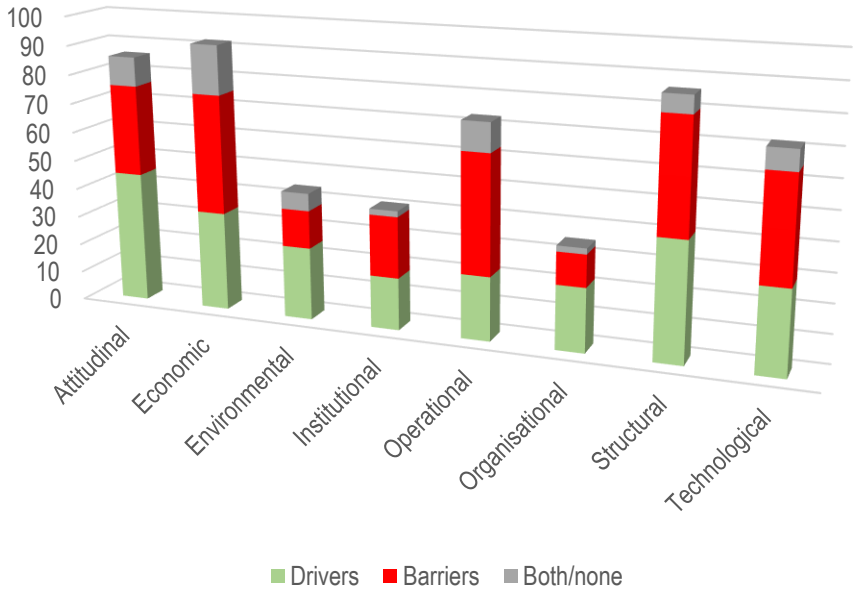

Figure 9: Division of drivers and barriers calibrated to importance score per category

5.2. Attitudinal drivers and barriers

The category of attitudinal drivers and barriers is based on perceptions towards CBM and sustainability and the willingness to act and take risks. This category was highlighted by all interviewees and tends to be one of the most important aspects to take into consideration, which is highlighted by literature as well (Moreau et al., 2017). The sub-categories and the complementary examples from interviews can be found in table 9. The importance amongst the sub-categories is shown in figure 10.

One of the most important drivers is the internal perception within a company. If company internally there is no willingness to change something, it will not happen. The interviewees highlight the fact that change started from within the company (e.g. I1, 2019) and mostly with the owners and strategic management of these companies (e.g. I2, 2019; I3, 2019). As interviewee 2 stated to express their attitude towards sustainability within the sector:

"'I was very happy with my job, but I heard that every t-shirt I produced is actually an attack on the environment, I find that horrible!" (I2, 2019)

It is important to notice that a company's high managers or owners are the ones that can make a CBM implementation happen as they take the crucial decisions (I1, 2019; I7, 2019). It is therefore of high importance that their attitude towards CBM and sustainability is a positive one. In this way, they can influence their employees as well. For example, interviewee 1 states the following: I1:

"If the CEO/CPO would say, we are doing recycled materials, the buyers will look for it. However, this is not yet happening. The CEO and CPO still need to be persuaded as they have the final saying" (I1, 2019)

A top-down approach for the implementation of recycled materials is a more effective way than a bottom-up approach as the people that take the decisions are mostly situated in the top layer of the company. However, this does not mean that employees do not have any influence on the process. They can undertake sustainability practices themselves within their function profile within the company. Moreover, they should be supported to do so (I4, 2019). One example from the interviews was the use of recycled content in the men jackets as the buyer of men jackets was interested in sustainability (I1, 2019).

The additional factor of willingness to take risks is crucial to implement a certain strategy as leaving the comfort of an existing business model is always a risk. To reach this, the risk should be worth it as risk takers tend to value the difficulty for implementation as well as the probability for success (Atkinson, 1957). The risk should, therefore, be in line with the benefits gotten out of it and perceived as a successful implementation. These benefits for business are mainly found in the economic category. However, this may not be the case in the short term. Looking from a short-term perspective to a change with a long-term goal is one of the major pitfalls within environmental change (Oreg, 2003).

Oreg (2003) mentions that the endeavour for organisational change can be linked to individual change resistance theories from a psychological perspective. The ideas of an individual decision maker for change are linked to their personal behaviour towards change. Hence, limiting factors like routine seeking, emotional reaction to imposed changed, short-term focus and cognitive rigidity need to be overcome when making these decisions (Oreg, 2003). Through these theories, it can be understood that devotion towards change is a hard process even though the internal perception is there.

Therefore, it is needed to look at other benefits than economic ones with a short-term focus. These can be satisfactory benefits (I2, 2019; I3, 2019) or appreciation from the outer world (I2, 2019; I7, 2019; I3, 2019), speaking for the attitudinal category, but the benefits can also lie in the environmental, economic or structural categories (which will be explained later). The owners, and/or decision makers, should at least consider the value of implementing the CBM which does not have to be of economic value in the short term, but can be of economic value in the long term considering future expectations on the developments. Appreciation of peer companies and the outer world could, therefore, be a major driver to keep going on with the implementation of CBM in the short run.

Still, there are attitudinal barriers found. A factor that does not enhance the implementation of recycled textiles in the industry is another perception of clothing than a potential for sustainability. First, there is a perception of waste that does not encourage the re-use of waste and we need to get rid of this perception in order to be able to make recycling happen (I8, 2019). Companies have hard times finding the value in textiles waste (Leal Filho et al., 2019). Another factor is the hype of sustainability. Interviewees have been highlighting the fact that CBM change should only be done when “done for the right reasons”. Apparel companies are regularly scrutinized for forms of window-dressing and greenwashing (e.g. Gijzel, 2016). Another point made is the perception of material and more specifically the perception of how this material should be and how it is used. Amongst the interviewees, there is consensus on the need for a change in perspective.

Another attitudinal barrier seen by the interviewees is the fact that people (and therefore companies as well) like to distantiate themselves from the problem (I3, 2019; I4, 2019). Carmi and Kimhi (2015) explain the perception of the ‘environmental threat’ by the concept of ‘psychological distance’. This means that events that are perceived as ‘closer’ are events that are either closer in time, closer in probability and closer for personal harm. The threat for environmental damage does not contain any of these characteristics at this moment and is therefore not perceived as immediate danger (Carmi & Kimhi, 2015). They also highlight that as the more distanced the threat is, the less influence actual knowledge can have in changing the attitude towards that threat. This means that simple education would not change any behaviour, but more psychological characteristics should be changed (Carmi & Kimhi, 2015).

Yet, the interviewees have high hopes about the future and the changes that are about to come (I3, 2019; I7, 2019; I8, 2019). They perceive a change in attitude from the consumer and from other companies as more knowledge gets available and technology is improving.

The most important sub-category is the influence of stakeholders. Consumers are considered amongst the most important stakeholder for apparel companies, although there are few agreements on what their actual influence is. It can be noted that no direct pressure is felt on the consumer side. According to the interviewees, this has to do with a couple of things. First, there is a gap between consumer interest and consumer behaviour. Consumers tend to express their interest in sustainability and sustainable materials, but when deciding on their purchase, this tends to be a factor that they do not consider (I8, 2019; I5, 2019, I9, 2019). This is underlined by a study amongst Finnish consumers (Niinimäki, 2009). Interviewee 8 introduced a theory of decision making by consumers in the mainstream market:

"First, it needs to be affordable and second it needs to be convenient and that is what creates awareness. When you have a mainstream market you take into account the three H's, first is head, to be able to afford it, the second is heart, if you can afford it, but you find it really ugly, you would not do it. And the third is hara, which means to grant. Do I grant this money to this article?" (I8, 2019)

It can be said that sustainability on itself does not sell to consumers, there always need to be an extra incentive for the consumption of a sustainable consumer good than just sustainability itself (I9, 2019).

Another popular statement is that it is old-fashioned to expect from your consumers to ask for sustainable materials and that the moment is there that the consumers can expect from the companies to be as ethical and sustainable as they can be (I8, 2019; I7, 2019). As for example interviewee 4 mentions:

"The consumer should be able to assume that the company takes responsibility for sustainability and produce good products. You need to make it easy for them because their focus is to buy clothes. They would not go to a store 'because they have recycled materials in their products. The industry should comply with their obligations" (I4, 2019)

A few interviewees wished that consumers would be more engaged within sustainability and ask for recycled materials, as it would be a great driver for the company to work into this direction (I1, 2019, I5, 2019). However, the perception of recycling is still a factor that can hold back the use of recycled material. Recycled material is believed to be ugly (I6, 2019) and the perception of waste as 'waste' instead of a potentially new resource can be a barrier (I8, 2019).

	Sub-Categories	Example (from the interviews)
Drivers	Internal perception	Satisfaction in being sustainable (I2)
	Dedication	In the end, hard work will pay off (I3)
	View of outer world	Brand identity is aligned with sustainability (I9)
Barriers	Negative perception towards recycling	Waste is negatively perceived (I8)
	Distantiation	"far away" problems (I4)
Fuzzy[9]	Prioritizing	Not compromising quality (I5)
	Perception of influential actors	Lack of consumer interest (I3, IA, I7, I9)
	Future expectations	Positive future expectations (I3, I7, I8)

Table 9: Summary of the attitudinal drivers and barriers

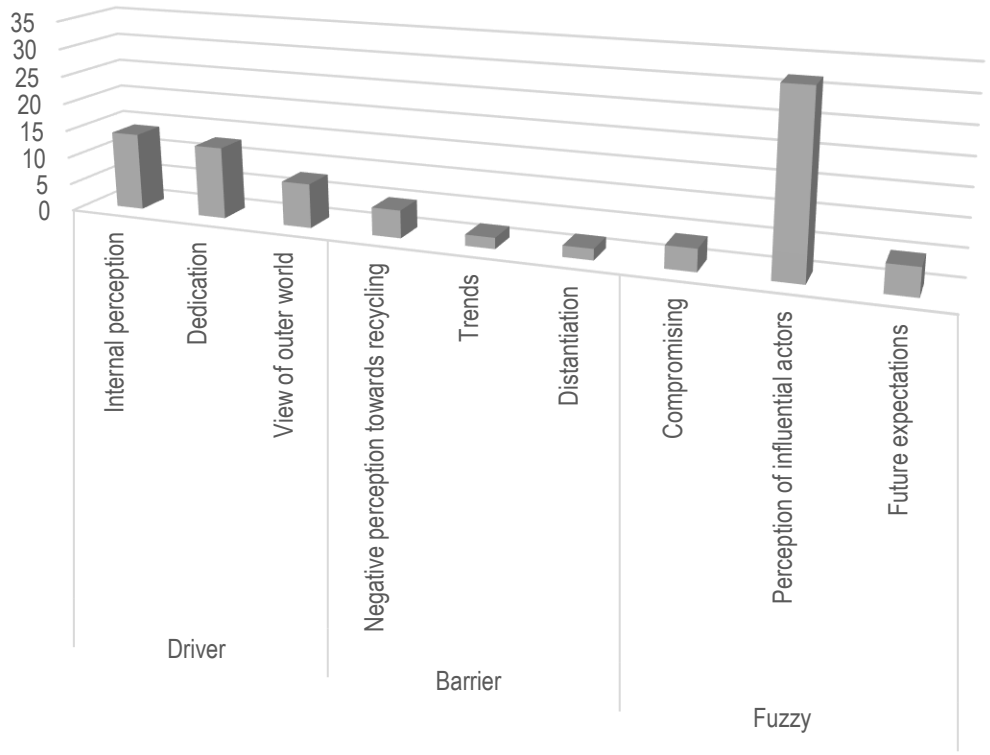

Figure 10: Sub-categories of the attitudinal drivers and barriers calibrated to importance score

[9] This sub-category is neither identified as a driver nor as a barrier as different aspects of the category were mentioned in the interviews.

5.3. Economic drivers and barriers

Economic drivers and barriers are based on market developments and financial indicators. The interview results bring about a variety of economic factors that influence the implementation of recycled materials within a company's supply chain. The economic category of drivers and barriers is most emphasized on by the interviewees and one of the most important ones. A summary of the results in sub-categories and examples from interviewees are mentioned in table 10 and figure 11 and are discussed below.

One of the most mentioned characteristics in the economic category is that the implementation of recycled materials is dependent on the development of the market. At this moment, the prices of recycled materials are generally higher than the prices of virgin materials (I1, 2019; I2, 2019; I3, 2019; I4, 2019; I5, 2019; I7, 2019; I8, 2019). Next to the fact that more expensive processing and technologies are used (I3, 2019), these prices are linked to the volume of the demand. Demand for low volume of recycled materials results in a high price per unit of recycled material. Therefore, it is only considered affordable to order big volumes as this makes the prices per amount of volume drop. Small companies have issues with finding small supplies for an affordable price. To take away this barrier, Interviewee 9 chose to combine powers with companies under the same umbrella company to be able to purchase higher quantities of recycled materials. The company, however, faced the difficulty of finding access to material to create sample collections (I9, 2019).

The price of apparel is dependent on raw materials and labour prices (BoF & McKinsey, 2017). This means that the products will also get more expensive when working with recycled materials (e.g. I10) Interviewees working in the B2B market often notice collaboration with and demand from their clients in terms of sustainability and can pass on the price to those clients (e.g. I2, 2019; I10, 2019). However, it is generally not accepted by B2C companies to pass the price on to the consumer for which two main reasons were identified. First, there is a dominant agreement that the price for sustainability should not be paid by the consumer and the 'price of sustainability' is an old-fashioned concept. As interviewee 8 states:

"We need to stop saying that 'this is the price of sustainability. There are a lot of people that need to make other choices because they don't have enough money for daily things. whether this is the price for sustainability becomes a discussion for the elite" (I8, 2019)

Second, the price elasticity is high for apparel (I8, 2019), which means that a certain percentual increase in the price of a piece of apparel results in a higher percentage of decrease in the demand for that piece. This is a consequence of the extensive choice for a consumer in low-costs fashion products. With a price rise of one of those products, the consumer is easily tempted to get a comparable option in a lower price segment.

The profit margins, however, need to be considered and spending more money on sustainability is not a standard. Interviewees mention options for the creation of financial space within the company to manage the higher prices

for recycled materials. For example, they claim the extra costs as marketing costs (I9, 2019), blend recycled material with cheaper virgin material (I7, 2019) or generate a higher margin for other pieces of apparel in their collection (I5, 2019; I3, 2019). A key to the problem is the high price elasticity of the demand for apparel (I8, 2019). Also, there are developments going on that include recycled fibres that can financially and qualitatively compete with virgin materials (I8, 2019). Furthermore, prices are expected to increase from another side as well as the importance of living wage for textile workers is increasing as well (I7, 2019).

In general, companies need to make profit and enhance their competitiveness in the market. This is also seen as a requirement to be able to look at sustainability within a company (I10, 2019). Although the interviewees do not feel any competition in the field of sustainability within the other companies, the apparel industry is competitive, and the companies feel the need to keep their position in the market. It is a repeatedly asked question in the literature how competitiveness can be enhanced even though including sustainability initiatives in the business practices (Larney & van Aardt, 2010). The economic factor is therefore seen as one of the biggest barriers (I6, 2019). There is amongst the interviewees no agreement on the added value of the implementation of recycled material (I2, 2019; I9, 2019). This makes it harder to use the material for competitive products. The addition of another quality than just sustainability and recycling is therefore required (I9, 2019).

There are positive expectations of a drop in the price for recycled materials based on the following outlook. In 2018, the cotton prices were 15% higher than a year before (Baffes, 2018) and are expected to severely increase from 80.440 USD/pound today to 116.853 UDS/pound in 5 years (walletinvestor.com, 2018). As the price for cotton as a common resource might increase. Recycling of cotton may become a more attractive option.

Finally, investments are required to further develop new technologies and bring them to the market. In this case, the Dutch respondents tend to highlight the need for investments (e.g. I7, 2019), while the recycling companies from India and Sri Lanka generally have the possibility to invest or know investors, but lack knowledge on what are good technologies to invest in and therefore need technological expertise (IA, 2019). Interviewee C highlights that manufacturing companies in India want to invest in their recycling technologies. They are pushed by their clients (i.e. European and American companies) to investigate sustainability. This is according to interviewee C the main reason they are willing to do this. Waste has a price in the south of India and can also be sold to other waste treaters that downcycle the waste. The price would be approximately the same. Therefore, the idea that these companies want to invest in the technologies that interviewee C works with make it clear that there is another advantage to it.

	Sub-Categories	Example (from interviews)
Drivers	Financial space	Passing on the price to clients (I10, I3)
Barriers	Costs	Extra costs and missing discounts when switching suppliers (I6)
	Competitiveness	Lack of commercial value (I3)
	Profit Margin	Counting with margins is important (I9)
Fuzzy	Investments	Capital available for investment (IA), Need for investors (I7)
	Potential for business opportunities	Creating a new business model for suppliers (I5), rejecting business opportunities that do not want to work with our sustainability goals (I2)
	Prices	Creation of the same price for recycled material (I8), slightly higher price (I2), high price (e.g. I1)
	Market developments	Enhanced revenue streams for suppliers (IC), lack of defined market (I8)
	Product value	Marketing value (I2), sustainability itself does not sell (I9)

Table 10: Summary of the economic drivers and barriers

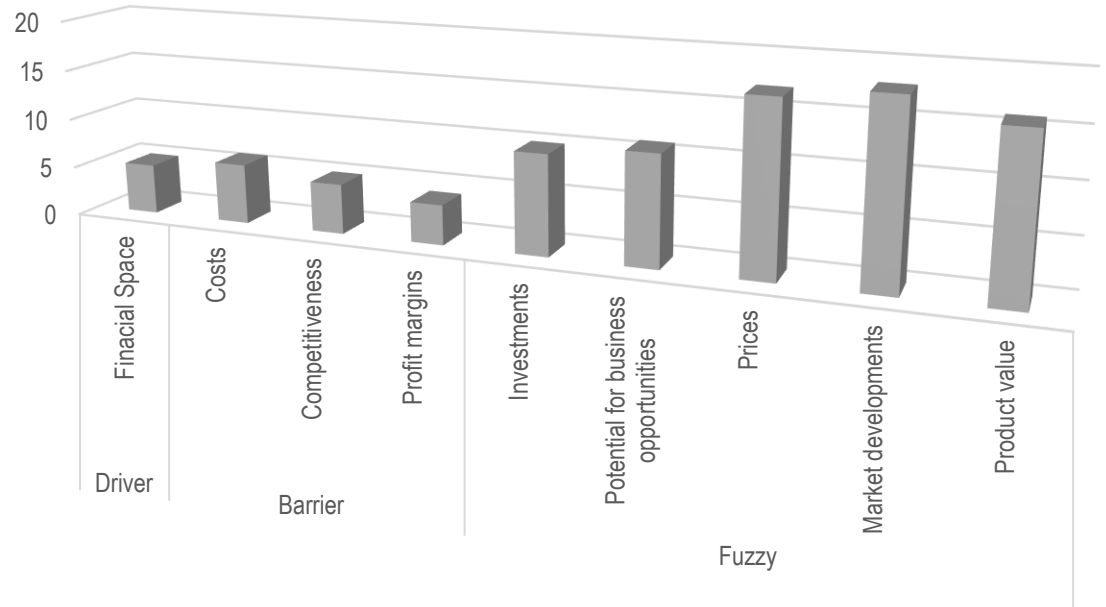

Figure 11: Sub-categories of the economic drivers and barriers calibrated to importance score

5.4. Environmental drivers and barriers

Environmental drivers and barriers are based on creating or diminishing the environmental impact of a company. The in the interview found drivers and barriers are summarized in table 11 and the division in sub-categories is shown in figure 12.

The goal to create a smaller environmental impact is mentioned multiple times by the interviewees. Within this category, interviewees mention to be keen on the use of environmentally sound materials (I2, 2019), avoid the use of fossil resources (I4, 2019), find a balance in people, planet and profit (I3, 2019), and knowing the origin of to be recycled materials (I4, 2019).

However, the positive environmental effect of recycled material has more than once been scrutinized by the respondents. For example, the recycled material origin can be both a driver and a barrier for the implementation of recycled material as it depends on what that origin exactly is.

Furthermore, interviewees highlight that they would only work with recycled material if it is proven to be more environmentally friendly than virgin material (I1,2019) and if it used as a change in the current production line instead of an addition to the current production line. The latter would conclude in even a bigger waste stream (I4, 2019).

The importance of research – Life Cycle Assessments (LCA's) in specific - in this field (I1, 2019). Some LCA's on recycled textiles have been done. LCA's on textile recycling are more common for Nordic countries and the UK (Sandin & Peters, 2018). Although the Dutch situation is comparable, studies with a focus on the Netherlands have not been found.

Scholars predominantly agree on the environmental benefits of the use of recycled textiles over the use of virgin textiles (e.g. Muthu et al., 2012; Rani & Jamal, 2018; Woolridge et al., 2006). Mainly in the field of energy consumption and climate change. However, these studies have been scrutinized for the assumptions they work with, which is a common point of criticism on LCA's (Weidema, 2000).

One of the biggest issues regarding knowing what the actual environmental benefit of the use of recycled materials is knowing what quantity of virgin material that is avoided by using recycled material. Additionally, looking at the consumer demand side, it is not known whether a piece of clothing created from recycled material does replace the purchase of a piece created from virgin material (Woolridge et al., 2006). In LCA's on recycled materials, often the assumption of a 1:1 replacement is made. However, as the real replacement rate is yet to be researched, the results of these LCA's is probably somewhat optimistic (Sandin & Peters, 2018). The potential that the use of recycled material is not replacing the conventional ways of production but added to the conventional way of

production is a risk within the growing industry of apparel and would furthermore account for an even bigger waste stream (I4, 2019).

Such research could encounter the insecurities about the impact that companies made. A potential trade-off is often doubted about in companies (I4, 2019; I5, 2019). This trade-off can exist between the impact on several environmental factors (Howe et al., 2014). Furthermore, environmental progress through circularity can go hand in hand with unwanted economic consequences (Andersen, 2007). Also, the trade-off between environmental effects and social standards have been scrutinized in literature thoroughly (Moreau et al., 2017). Therefore discussion exists about the place of circularity within the field of sustainability (Geissdoerfer et al., 2017). A balance between the three pillars of sustainability (people, planet and profit) can be seen as a precondition for CBM to pull through (Ghisellini et al., 2016). As interviewee 5 says:

"There are quite a lot of innovations, but they are not scaled yet. but if you are looking at commercial brands, there is not a lot happening yet, while they do a lot of marketing about it. Marketing and creating impact should be balanced out." (I5, 2019)

Furthermore, the environmental impact also depends on where the to-be-recycled material is coming from. Interviewee 4 gives the following example:

*"*a brand we sell* uses fishing nets, which is a bit dubious. If it is collected out of the ocean by e.g. African countries, you're doing something well. But it can also come from the fish industry that has the nets already offshore. Then it might be better if they recycle it themselves. This brand uses both (ocean material more than industry material) and this difference plays a big role in improving the world." (I4, 2019)"*

It is seen as important that the recycling of textiles diminishes the waste stream (I2, 2019) and therefore prevents textile waste from incineration (Sandin & Peters, 2018). According to the Sri Lankan interviewees, all material they recycle came from a post-industrial waste stream that would otherwise be incinerated (IA, 2019; IB,2019). 75% of the textile waste still is not recycled and ends up in landfill and/or is eventually incinerated (Elander et al., 2017; Park & Evans, 2017). Two of the respondents from the recycling industry explain the following:

"They (the companies we work with) did not have a solution for fabric waste and at that time, most of the fabric waste was going into incineration." (IA, 2019)

"We do not only have a huge impact on the fact of what we save but also on the fact of what we do not let happen." (IC, 2019)

	Sub-Categories	Example (from interviews)
Drivers	Creating a (more) positive impact	Avoiding the use of fossil resources (I4, I7); Prevention from incineration (IA, IB, I10, IC, I6)
Fuzzy	Uncertainty about impact	Solution for waste (IB) vs. the potential for new waste creation (I4)
	Trade-off	Micro plastics (I8)

Table 11: Summary of the environmental drivers and barriers

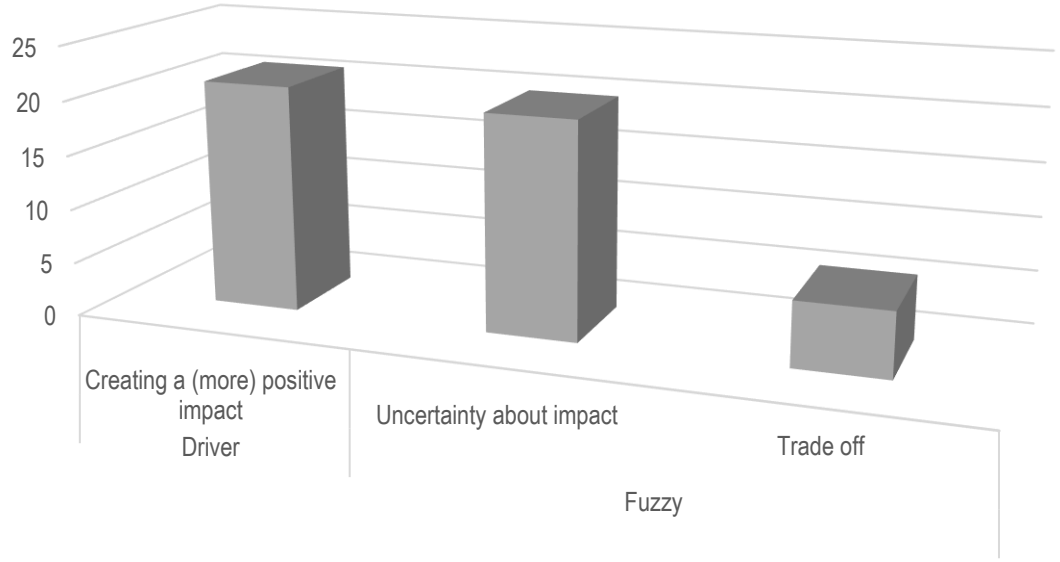

Figure 12: Sub-categories of the environmental drivers and barriers calibrated to importance score

5.5. Institutional drivers and barriers

Institutional drivers and barriers are based on regulations, policies, governmental operations and private instances. A summary of the characteristics that have been found in the interviews is given in table 12. The division of the drivers and barriers in the sub-categories calibrated to importance is shown in figure 13.

The opinion on institutional influence differs amongst the interviewees. While one group says that the government is important and governmental decisions would be a precondition for change (e.g. I4, 2019), another group says that the government would not influence change by intervening in this as it should be purely market development what will happen (I3, 2019; I7, 2019).

All interviewees agree that the current political environment in the Netherlands is not beneficial for the implementation of recycled materials. There are even counteracting regulations experiences, for example as interviewee 2 states:

"import/export rules need to comply with douanier regulation. Now it is very hard to export clothes to recycle, you cannot get a permit and it is hard to communicate with e.g. the embassy/government, etcetera. " (I2, 2019)

Pricing policies are favoured (I1, 2019; I2, 2019; I7, 2019; I8, 2019, I9, 2019). The relevance for the acceleration and mainstreaming of CE of a sustainable tax policy or a tax preference for renewable and recycled resources is confirmed by academic research (Stahel, 2012).

Most of the interviewees agree that governmental actions would be beneficial for a speed up in the implementation of CBM. As interviewee 4 states:

"It (implementing recycled materials) should be made obligatory because if we just wait for all small initiatives added up, you would not change the big world problems that are here." (I4, 2019)

Governmental laws and legislation would also be appreciated by the interviewees (I2, 2019; I4, 2019). The potential that action will follow from the governmental side is doubted. There is a lack of trust in the government (I5, 2019) and politicians (I8, 2019) and there is no feeling that the government supports sustainable development (I5, 2019, IA, 2019). Furthermore, the government should not act if technological developments do not yet have the potential to replace conventional production (I1, 2019). The lobbying of big companies against sustainability measured is marked as one of the reasons there is not enough governmental support yet (I5, 2019). It is argued that lobbying companies have only power to a certain extent and the power decreases with loss of their public legitimacy as a policy actor (Fuchs, 2008). As it is believed (as stated in chapter 5.2., page 35) that the sustainability awareness of consumers will increase, the support for less sustainable companies might decrease. If an environmental or ethical scandal would be highlighted in media, the power of companies that stand against sustainable policies might be limited. This gives a hopeful future prospect in line with the argument of Bell and Hindmoor (2014) on the position of the institutional influence of a business: "*Whether and in what circumstances business will be able to secure a favourable policy environment will depend upon the prevailing ideas of other actors and the broader economic, political and institutional environment in which those ideas arise*." Furthermore, a government could influence the diffusion of CBM through focussing public procurement on circularity instead of the price (Witjes & Lozano, 2016) to for example require items made from recycled material (I8, 2019).

At this point, there is a Dutch target to reuse all resources in 2050 (Rijksoverheid, n.d.). Also, within the EU there are directions on CE and waste reduction (EC, 2019). These targets are however not acknowledged by the interviewees and tend to lack presence in companies. Strict regulation on the banishment of single-use plastics has been adopted lately and single-used plastic should be abandoned in 2025 (EC, 2019). Following the developments towards this deadline could give an interesting guideline on how regulations for circularity in the apparel industry might develop or should be different.

The knowledge of governmental organisations about the apparel sector and sustainability in general is criticized (I1, 2019). Therefore, public-private collaborations are recommended as a potential for collaboration with the government and industries. Also, the use of private certification schemes could be one of the options. However, it should be taken into account that effectiveness is only enhanced by taking into account several factors and

transparency is key for the legitimacy and accountability of such certification schemes and they should be checked thoroughly (Auld & Gulbrandsen, 2010; Kalfagianni & Pattberg, 2013).

To this end, it can be concluded that the Dutch government does not have governmental policies towards the implementation of CE. France adopted an extended producer responsibility (EPR) policy in 2007 that makes textile producers responsible for the after-use phase of their products (Bukhari et al., 2018). In Sweden, an impact assessment of potential policy implementations was done. EPR came out as one of the policy implementations with the best impact. Also, a Refunded Virgin Payments (RVP) system was introduced. This policy measure obliges buyers of virgin material to pay a charge over the virgin materials that afterwards are refunded to producers that use recycled material within their production chain. RVP is also recommended but should need complementary policy measures to enhance transparency, improved design and prevention of hazardous chemicals (Elander et al., 2017). A quick scan for the potential impact on EPR in the Netherlands has been executed in 2018 (KplusV, 2018) and the results of this research can give further supporting empirical evidence for implementation of such policies.

In the Netherlands however, a recent change has been noticed by the introduction of a law making companies committed to stand up against child labour (Eerste Kamer der Staten-Generaal, 2019). It would be interesting to follow what changes companies experience as it could (mainly in terms of price increase for products) be comparable to the introduction of regulation for material recycling.

There is also a difference to notice in the respondence from the interviewee from India who declared a proactive government in the country as a result of multinational companies pushing for sustainability in the production countries. As the textile sector is one of the main industries enhancing the economic status of the country, it is important that companies work towards the demands from their consumers (IC, 2019).

A final point stated by the interviewees is the potential for the obligation of a percentage of recycled material in each product or at each company (I4, 2019). As the state of the quality at this moment requires the recycled fibres to be blended with virgin material at this moment. Furthermore, the impact of 100 companies producing their fabrics with 10% recycled material is far more than one company manufacturing with 100% of recycled fabrics (this will be further elaborated on in the chapter 5.8., page 53). However, it should be noted that a percentage might not be the way to measure this and companies can find their way around looking good in numbers but doing nothing in practice. For example, when the France beauty company L'Oréal bought the British company The Body Shop in 2006, both companies needed to deal with criticism. The Body Shop was accused of failing in their ethical and sustainable standards and L'Oréal showed to have a higher market share of natural and sustainable products but was scrutinized for not taking an action towards sustainability change within their own company (de Waard, 2006; Purkayastha & Fernando, 2007).

	Sub-Categories	Example (from interviews)
Drivers	Existing public policies	Dutch Climate Agreement (I4)
	Private parties	Certification (I2)
Barriers	Lack of governmental policies	Lack of pricing policies (I1, I2, I7, I8, I6, I9)
	Lack of trust	Not supporting politicians (I8)
	Counteracting circumstances	Lobbying by other companies (I5)
Fuzzy	Governmental task	Legislation will be the main driver (I5); No governmental task (I3, I7)

Table 12: Summary of the institutional drivers and barriers

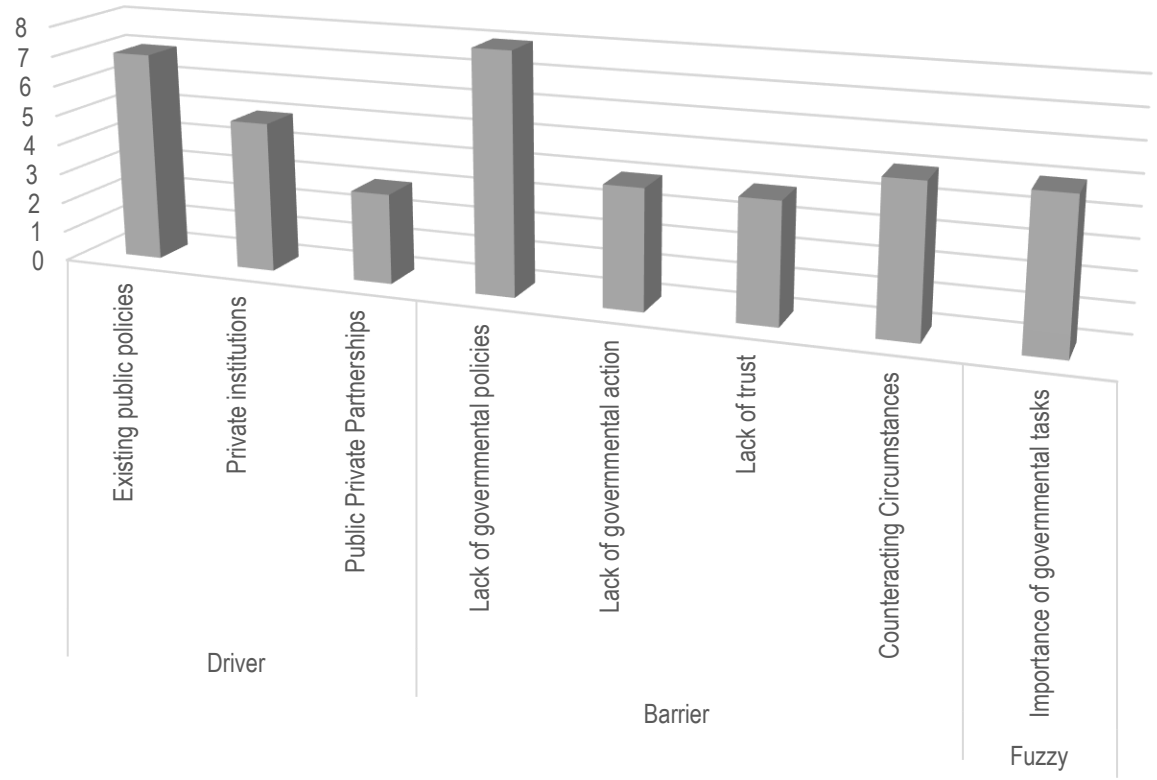

Figure 13: Sub-categories of the institutional drivers and barriers calibrated to importance score

5.6. Operational drivers and barriers

Operational drivers and barriers are concerned with the operations within the full (international) supply chain. The characteristics found in the interviews are mentioned in table 13 and the division of the importance of the sub-categories is mentioned in figure 14.

One of the barriers identified is the potential to find other sustainable materials than recycled materials as they are easier to find and work with, for example, BCI cotton or organic cotton. As interviewee 1 states:

"the use of BCI cotton and organic cotton is way easier than recycled cotton. This is the case as the quality is better, colouring is easier, and the price is better. This is all more difficult with recycled cotton" (I1, 2019)

These markets are increasing enormously (Textile Exchange, 2018) but would not be a solution for synthetic materials that are still used often.

Traceability is, however, a new barrier when using recycled materials - and would not be taken away when a company purchases organic materials (Lakhal et al., 2008) - as companies want to know where their material came from and whether the information they share is true. It is hard to trace the whole supply chain of recycled material. Recyclers state that they do not always know where the recycled material they produce ends up (IA, 2019) and companies try to track whether the information they have is true (I9, 2019). As companies that use recycled materials also like to share information on their ways of production and use its marketing value and in order to understand the decrease of environmental impact better, transparency should be enhanced in the supply chain of recycled material (Caniato et al., 2012).

Although apparel companies are often criticized on being locked-in their supply chain, almost all respondents mentioned that they would be flexible in terms of adding new suppliers or changing suppliers to their supply chain (I1, 2019; I2, 2019; I4, 2019; I5, 2019; I7, 2019). Even in the second tier, it would often not be a problem to introduce new suppliers to their suppliers. It is however also mentioned that working with different suppliers is not always seen as an act of sustainability as more impact is created if companies can convince their own suppliers to participate in sustainability (I9, 2019). Furthermore, it can be hard to find these suppliers (I4, 2019). This is also the reason why some of the respondents tend to not share information on who they work with competitional companies. They want to create an impact amongst different suppliers instead of a big switch in suppliers within the industry (e.g. I2, 2019). It is, however, hard to create an impact on the side of your supplier for brands that are only a small share of the production of their supplier (I9, 2019).

The main barrier that is encountered currently is the scale of production. At this moment, only big volumes would be affordable, but the technologies are not scaled yet, which is necessary in case of a take-off of diffusion for recycled materials. Interviewee 6 mentions:

“Innovations, no matter how cool they are, are only economically relevant if they are scaled-up.” (I6, 2019)

The more people that would use these technologies, the less expensive it will become to produce and purchase recycled materials (I4, 2019).

Related to the scale is the fact that a constant supply is required by the Dutch companies in order to buy recycled materials. A vicious circle within this was mentioned by interviewee A, who mentions that indeed there is a lack of

constant supply. The reason for this is that recycling companies are dependent on the waste stream from apparel suppliers. The waste streams of these apparel suppliers are variable because they depend on the orders from brands. These orders are irregular and rapidly change in colour, material, and style, which is why a homogenous stream of waste and thus recycled materials is not a possibility. These brands are the same brands that require a constant supply of recycled materials (IA, 2019). A constant supply is generated by interviewee C by partnering up with the biggest spinning mills and apparel production companies (IC, 2019).

In order to get waste streams ready for recycling a collection and separation process needs to step in. The view on how well this collection and separation process is organised at this moment was divided amongst the interviewees. As some interviewees mention that this is poorly organised (I6, 2019; I7, 2019), collection schemes are established by one of the interviewed recyclers (IA, 2019) and B2B collaborations on the collection of discarded apparel were established (I10, 2019). Collection and separation of waste is a pre-condition for technological processing. As interviewee 8 states: *"Rubbish in is rubbish out" (I8, 2019).*

	Sub-Categories	**Example (from interviews)**
Barriers	Scale	Business is based on large volumes (I6)
Fuzzy	Logistics	Distance between recycler and production plant (I5, I9)
	Collection and separation	Good working collection and sorting system created (IA)
	Alternatives	Use of alternative materials (Bio, Fairtrade and organic) (I1, I8, I6, I9)
	Constant supply	Lack of guaranteed supply (I5, I7, IA)
	Tracing supply chain	Control over production partner (I10); Lack of influence on further supply chain (IA, I8)
	Flexibility	Potential for reorganisation (I4), contracts with suppliers (I6)
	Accessibility	Local office near suppliers (I9), low availability of good materials (I1, I2)

Table 13: Summary of the operational drivers and barriers

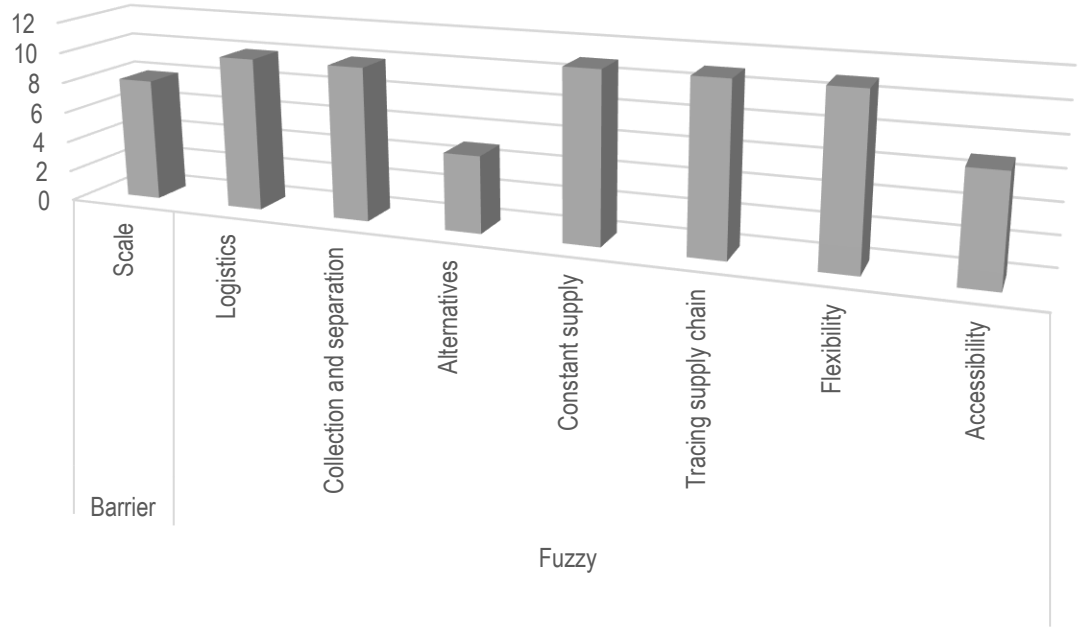

Figure 14: Sub-categories of the operational drivers and barriers calibrated to importance score

5.7. Organisational drivers and barriers

Organisational drivers and barriers are based on organisational internal actions to create a positive company internal environment for sustainability initiatives to develop. The organisational characteristics were generally not considered the most important ones for implementation of recycled material. Furthermore, there is no line of consensus amongst the interviewees on drivers and barriers within this category. The category tends to be more important for interviewees whose company is part of a mother organisation or umbrella organisation than for the other companies. The sub-categories of organisational drivers and barriers are mentioned in table 14 and the division is shown in figure 15.

Within the umbrella organisation of interviewee 9 one brand is taken as the frontrunner for sustainability initiatives. This brand develops and tests the implementation of sustainable materials and in case of success, these materials can be implemented in other brands as well. The company goal of this one brand is clearly directed towards sustainability (I9, 2019).

A company ambition, such as goal development for the implementation of recycled materials is a major incentive to increase the company internal interest and willingness to work on this. It can be noticed that the Interviewees who mentioned a company goal for recycling or CE were also the ones that were most engaged with recycling and circularity at this moment (e.g. I2, 2910). With strategies like this, the whole company can more easily be engaged. Engagement within the company is an important factor in pursuing CSR strategies (Mirvis, 2012). Informing

employees and colleagues on the ongoing developments can be a challenge if the developments are going fast (I2, 2019). On the other hand, interviewee 7 mentions to *"take small steps and make it quite simple",* which provides for better understanding of ongoing developments within the company.

It is furthermore relevant to not lose your core business when working on the implementation of recycled materials. Interviewee 10, who has been looking for an output for recycled felt created from the waste material of their used and resend workwear collections said:

"We are a company that produces clothes and we do not want to create bags. We want to stay with our core activities" (I10, 2019)

	Sub-Categories	**Example (from interviews)**
Fuzzy	Ambition	Afterlife story dominant in CSR strategy (I10)
	Engagement	Lack of inclusion designers (I4)
	Company composition	Young age personnel (I1)
	Pace of development	Easy and clear pace of development (I7)

Table 14: Summary of the organisational drivers and barriers

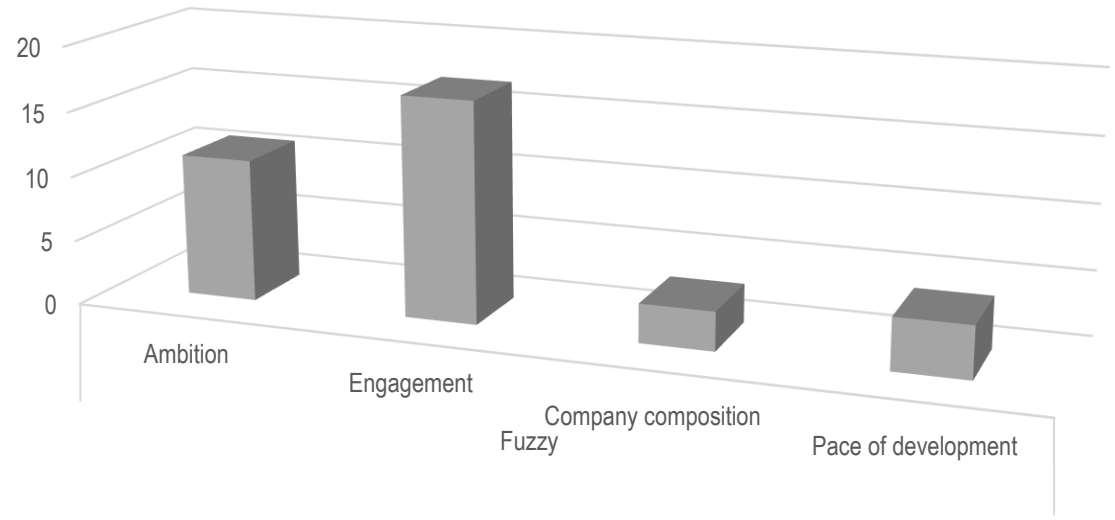

Figure 15: Sub-categories of the organisational drivers and barriers calibrated to importance score

5.8. Structural drivers and barriers

The structural drivers and barriers are based on the sharing and availability of information and action corresponded with that knowledge. The summary of these drivers and barriers is given in table 15 and the division into sub-categories calibrated to importance is shown in figure 16. These drivers and barriers are ranked as the most important category. There is, however, little consensuses on whether the current state-of-the-art is enhancing the implementation of recycled materials or whether there is more communication and information sharing needed.

First, there is one general driver, which is the communication value of the implementation of recycled material in reports (I4, 2019) and marketing statements (I6,2019). There is a need to communicate about this, however, the transparency and traceability of this information are needed (I8, 2019). Information on recycled materials can be found through multiple resources about which some respondents are positive (I3, 2019) and others think that information overload is a hindering factor (I5, 2019). The way of framing the message and source of the information should be evaluated critically by the reader. (I8, 2019; I9, 2019). There is a need for useful information from an independent source.

One example highlighted often (and therefore sub-categorised separately) is the confusion on the definition of recycled fabric (I8, 2019). As interviewee 10 states:

> "In the market, there is a lot of variation within how much recycled PET is within this clothing. If you have a piece with 65% polyester and 35% lyocell, you can already call it recycled when 2% of this polyester comes from recycled PET. We know that our supplier replaced the full 65% with recycled PET." (I10, 2019)

Small percentages of recycled material can already be marketed as 'recycled material'. Researching for institutions that define this concept did not conclude in an answer to the furthest extent of knowledge of the thesis writer. In the Netherlands a workgroup established to form a NTA (translated to Dutch Technical Agreement) on the term recycled textiles (Tricorp BV, 2019).

A 2015 report from the branch organisation of recycling in the Netherlands states that the adaptation of a minimum recycling percentage for synthetics in some applications is currently researched (NRK Recycling, 2015). Interviewees often mention that companies should step away from 'the higher percentage, the better it is' (I6, 2019). More impact could be generated with the use of a percentage of recycled material as mentioned before. This could also be more in line with the current technological developments on recycling that do not yet foster a high quality for recycled material when a fabric consists of 100% recycled fibres (see chapter 5.9, page 55).

The sub-categories of *information sharing and transparency* and *collaborations* are well aligned and considered important. The main difference considered in the establishment of two sub-categories is that with collaboration two or more players are working towards the same end-goal, although information sharing and transparency is logically included in a well-working collaboration. There are however comparisons in drivers and barriers between the two

sub-categories. Interviewees mention to value both and there is no direct competitional feeling towards the collaboration in the field of sustainability. Competition is still a sensitive field in terms of collaboration (e.g. I2, 2019) and it is considered important that collaborative partners have the same values regarding sustainability (IC, 2019). The information sharing between the apparel companies and their suppliers could result in an easier process for recycling as information in terms of material content is for example known and could be put in a database (I8, 2019, IC, 2019). Recyclers see influence from apparel companies as a high driver for manufacturers to consider recycling of materials (IA, 2019; IC, 2019).

Outside of apparel companies or the supply chain, there could be some changes made as well. It is considered important that knowledge is shared on educational level to make students more aware of the current environmental situation and NGO's could participate in sharing transparent information and promoting the process of recycling (I4, 2019).

A final point that needs to be mentioned is the protection of intellectual property that can hinder the diffusion of technologies. Although it is a barrier for diffusion of textile recycling, it is understandable that the creator of such techniques is rewarded for the work done. There should be made considerations to outbalance these two things (I8, 2019).

	Sub-Categories	**Example (from interviews)**
Drivers	Communication value	Marketing story line (I6)
Barriers	Lack of action	Lack of motivation on industry level (I4)
	Lack of knowledge	Lack of research (I4, I5)
	Intellectual property	Protecting intellectual property (I8)
Fuzzy	Information availability	Way of framing the message (I8, I9)
	Information exchange and transparency	Lack of information exchange with colleague companies (I5)
	Collaborations	Potential for international collaborations (IA)
	Focus on percentage recycled material	increasing the percentages of sustainable material (I3)

Table 15: Summary of the structural drivers and barriers

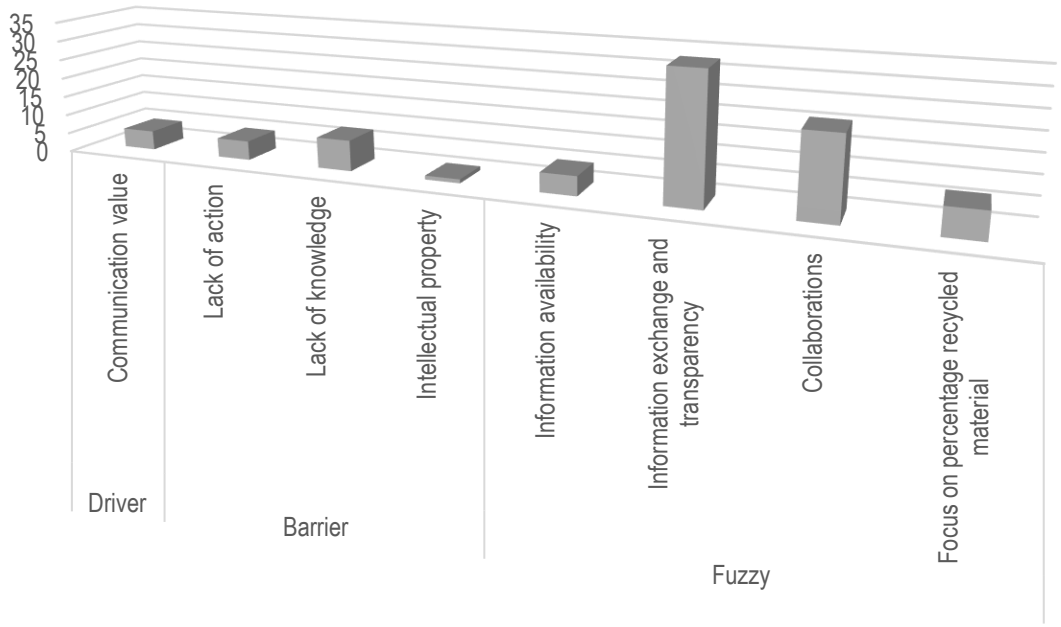

Figure 16: Sub-categories of the structural drivers and barriers calibrated to importance score

5.9. Technological drivers and barriers

Technological drivers and barriers are based on technological developments and possibilities. The characteristics mentioned in the interviews are stated in table 16 and the division amongst the categories is shown in figure 17.

At this moment, there are important barriers to be highlighted in the technological category. The most important barrier highlighted by almost all interviewees is the lagging quality of the recycled materials (I1, 2019; I2, 2019; I4, 2019; I5, 2019; IA, 2019; I7,2019; I8, 2019). The reason for this is the fact that recycling damages the fibres and shorten them, which result in a lower strength. The lower durability of recycled fabric is also found in research (Inoue & Yamamoto, 2004). However, there are potential solutions for enhancing the quality of a fabric. First, there is potential to blend the recycled materials with virgin materials to blend short with long fibres to create a more qualitative fabric. The environmental potential of blending recycled and virgin materials is highlighted in chapter 5.7. (page 50). Second, chemical recycling is often perceived to not damage the quality of the fibre and enhance quality (I2, 2019; I4, 2019). Third, there are multiple ongoing developments that are received positively and the potential for qualitative fibres is therefore believed in. Most developments are still in laboratory or development phase, but the current test seems promising (I7, 2019; I8, 2019).

There is a side note to make with the demand for qualitative fibres. Seen the current fast production and consumption cycles of apparel the question occurs whether qualitative fibres are needed when products are used for a short term. Interviewee 6 raised the question of whether quality is demanded by individuals or whether it is has become a societal normative (I6, 2019).

What is furthermore scrutinized by the interviewees is the lack of potential to recycle blends. A high quantity of products exists of blended materials, for example, elastane blended with cotton to create a stretch in cotton clothing (I2, 2019). A recycling technology for blended material would be appreciated. Research on this is ongoing (e.g. De Silva et al., 2014), but a scalable solution has not yet been found. As interviewee 7 states:

"If you can recycle a blend and you do not need a specific separation system for this, you have a scalable system very fast." (I7, 2019)

Short-term solutions could lie in the field of specific fibres and items that can already be recycled to a wider extent. The example of recycled material in jackets has been given twice amongst the interviewees (I1, 2019; I4, 2019). Furthermore, the recycling of wool is considered developed (I5, 2019). There is potential to produce labels from recycled material (I5, 2019), however, in terms of items, some item specifications are not yet possible to reach with recycled materials. For example, dying can more difficult when using recycled materials (I1, 2019).

	Sub-Categories	**Example (from interviews)**
Drivers	Specific fibres	Wool recycling goes well (I5)
Barriers	Diminished potential for recycling	Blends cannot be recycled (I1, I2, I4, IA, I7, I10)
Fuzzy	Specific items	Inside of jackets is a good option (I1, I4)
	Tests and development	Successful pilots (I8), Lack of technological expertise (IA)
	Quality	Quality of chemically recycled materials is good (I2, I4), Recycling is downgrading (I3)

Table 16: Summary of the technological drivers and barriers

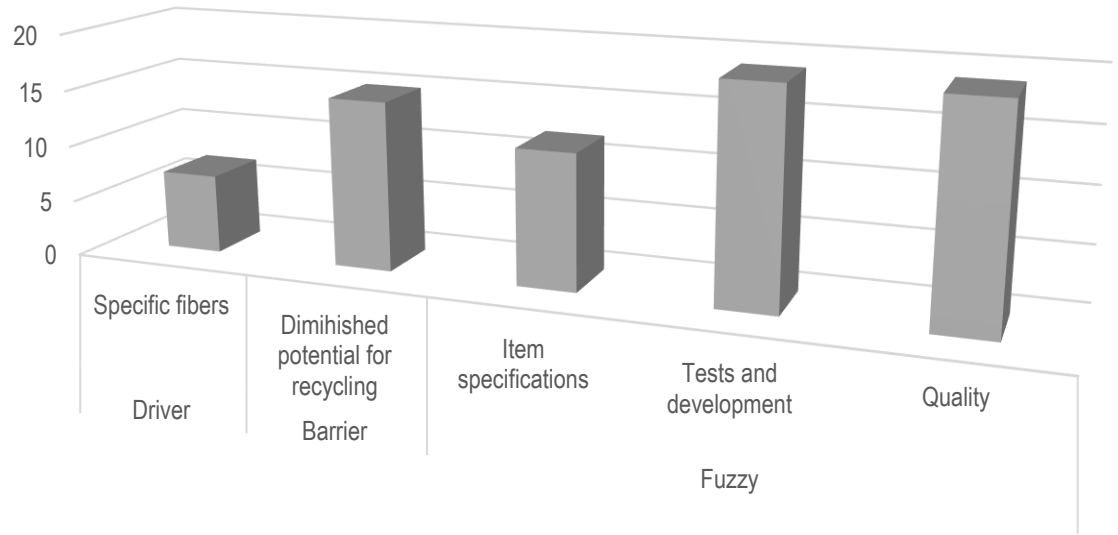

Figure 17: Sub-categories of the technological drivers and barriers calibrated to importance score

5.10. Summary: relations and divergence

After analysing the interviews, 409 coded factors of influence were found. 42% of these were 45% of these were barriers. The categories of drivers and barriers that are of main importance are the economic, attitudinal and structural category. When looking at de division drivers and barriers within these categories calibrated to importance score, the main drivers can be found in the attitudinal category and the main barriers can be found in the economic and operational category. Per category, the drivers and barriers were discussed within sub-categories. While summarising these results, relations can be found and should be highlighted. Although quite some relations have been described in chapter 5.2. to 5.9. (page 35-55), some important ones are highlighted here.

The attitudinal category is the main driver and furthermore of high importance. The willingness to develop a CBM needs to be present in the company in order to implement the business model. Economic or institutional incentives could, however, be created to increase this willingness to act on circularity. Furthermore, in terms of the structural category, information sharing and collaboration are important and should be done in a transparent and clear way. This could increase the availability of useful information and include to the extension of willingness of companies to act on the implementation of CBM as they could make better educated decisions. The sharing of information on the environmental and economic impacts would be useful. Next to that, there is a potential for the inclusion of new suppliers in the production chain, however, that is not always perceived as being the most sustainable solution as collaboration within the supply chain and taking the suppliers along with the companies' developments is considered important.

Furthermore, in terms of economic drivers and barriers, it is interesting to see how there is little competitional feeling on collaborations in the field of CE, while the apparel sector is a highly competitional sector. This could be related to the willingness to work on sustainability; however, it could also be related to the disagreement on whether recycled material has added value or commercial value. The willingness – and potential for collaboration as there is few competition noticed – could therefore be major drivers for CE.

The price remains a major economic barrier and scale and constant supply are major operational barriers. These barriers are connected and therefore uneasy to solve. The price of recycled materials is higher than the price of virgin materials. The technologies are currently expensive and not scalable yet, while scale could lower the prices for recycled materials. A constant supply is also required. However, this can yet not be generated and is the result of an unending loop of supply and demand as described in chapter 5.6. (Page 47).

Differences can be noticed in the responses from the different interviewees. There are two main differences that can be noticed between the drivers and barriers mentioned by the recyclers in India and Sri Lanka and the Dutch apparel companies. First, the Dutch companies feel a need for more investors, while the recyclers in India and Sri Lanka show potential for investment, but do not always know what technologies to invest in. Furthermore, while

Dutch respondents claim a need for a collection and separation system, the respondents from India and Sri Lanka show the existence of a good working system already.

Also, the difference between Dutch respondents can be noticed as the sample is rather heterogeneous. There are two main examples of this. First, there is a relatively higher importance in organisational drivers and barriers for larger companies than for smaller companies. Second, being flexible with margins is a more important barrier in big companies than in small companies.

6. Discussion

Within the discussion of this thesis, three core points of discussion are mentioned. First, the implication of the results is given within the academic and corporate context. Second, the limitations of this research are drawn upon. Furthermore, avenues for further research are indicated.

6.1. Implications of results

Drivers and barriers for sustainability have been thoroughly discussed in the literature. Although multiple drivers and barriers described in this thesis correspond with other research, there are differences that can be highlighted.

In literature, there is no consensus over what drivers and barriers are the most important ones. As the development of an innovation is dependent on many drivers and barriers, the drivers and barriers are different in specific cases as they depend on the type of innovation, sector, supply chain structure etcetera. For example, Walker et al. (2008) mentions the need for exploration of diverse drivers and barriers in the public and private sector. Also, on the order of importance of several categories of drivers and barriers there is rarely agreement. Where one academic article highlights the importance of willingness and interest (Larney & van Aardt, 2010), another academic article mentions that change will not happen without institutional (Fischer & Pascucci, 2017) incentives. This study tried to contribute by gathering empirical evidence on what categories of drivers and barriers are considered more important than others for the apparel industry. It should be noted that also this study does not give exclusion on this subject as there is no strict consensus amongst the interviewees, however, better insights are gained. Larney & van Aardt (2019) highlight the importance of willingness, however, that willingness is created through institutional and economic incentives. Empirical evidence for this is found within this thesis in case of the apparel industry.

Furthermore, literature research in drivers and barriers is conducted by Govindan & Hasanagic (2018) that specifies roles for important drivers and barriers for CE, like profit generation and awareness creation. Their research required more empirical evidence on their proposed framework and a country-specific approach. Although in this thesis a different framework has been used, empirical evidence for their proposed drivers and barriers is found and an in-depth case study of an industry within a specific country can add to these findings. As a case study

is adopted in this thesis, more detailed empirical evidence is given, and smaller drivers and barriers are highlighted that could be valuable for the industry.

Moreover, most studies that research drivers and barriers tend to focus on a certain category of drivers and barriers (Levering & Vos, 2019; Ranta et al., 2018) where this research compares several categories of drivers and barriers with each other and highlights linkages and connections. As this study works with an extended version of a prescribed framework established by Tura et al. (2019) other dimensions of drivers and barriers have been highlighted. Furthermore, connections between the drivers and barriers found are of high importance and thoroughly discussed in this study. It can be found that all categories are interlinked, and vicious circles were found that need a breakthrough point. Furthermore, studies on drivers and barriers tend to sketch the need for future pathways, while this is relevant, the current state-of-the-art is not often investigated which is where this research contributes. Because of this, academic literature does not extend on the existence of fuzzy factors, which are included in this research and are important to consider as there is often a two-sided story on influential factors.

It is, furthermore, important to notice that both the apparel industry and CBM are dynamic and developing currently. It needs to be noted that the results of this research are framed within the currently given circumstances. Furthermore, this research highlights the importance of the potential for these dynamics to co-develop more. For example, more and more polyesters are used for fibre production. Although the use of fossil resources for clothes is scrutinized for micro fibres, it is the expected trend (as shown in figure 18). Going with the flow of this expected trend and using recycled materials to diminish the use of fossil resources and the waste stream could be a sustainable option. However, it should be mentioned that CE is not the only pathway of solving sustainability issues in the textile industry. For example, waste diminishing can also occur through a more sustainable product design (Subic et al., 2012). It should be noticed that CE has the potential to eliminate more than one of these externalities at once recently gains attention by industries and academic research.

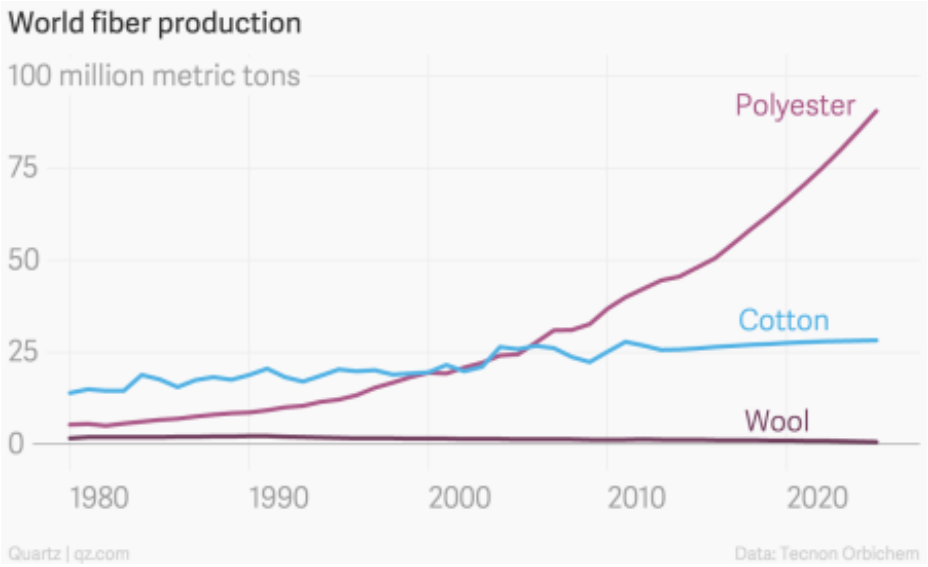

Figure 18: World fibre production (Bain, 2015)

In the last years, business reports on sustainable fashion came out that generally followed a similar line of acknowledging the need for change towards sustainability and circularity (Buchel et al., 2018; GFA, 2019; GFA & BCG, 2018; ten Wolde & Korneeva, 2019) circularity. This research follows the line of these reports, however, encounters some differences. For example, within the Ecopreneur.eu report, the pathway for policy implications is investigated (ten Wolde & Korneeva, 2019). One of their outcomes is a need for innovation policies that give subsidies for technological developments and innovation. The need for these kinds of policies has not been highlighted in this research, in fact, the results of this research imply that technological developments are happening at this point and mainly come forth from market development. The implementation of a tax incentive for implementation of recycled material would increase demand and technological developments could enhance as a response to market dynamics. Furthermore, this research adds to the Pulse of the Fashion industry report that includes a chapter on textile recycling explaining promising techniques and collaborations. This thesis would add by explaining more viewpoints (in terms of several categories of drivers and barriers for textile recycling) and highlights additional factors like the importance of company internal drive, that is not mentioned in the Pulse of the Fashion industry report (GFA & BCG, 2018).

6.2. Limitations

Qualitative research always faces limitations. First, this study is done by just one person and bias is one of the highest risks of qualitative research. As coding is done for qualitative analysis, the analysis might have been slightly different in case the research was done by a collaboration of several researchers or by another researcher. The risk of having a single sighted look is however diminished by discussing the results with experts in the field and comparing it to the existing literature on drivers and barriers. There are also other ways of categorizing drivers and barriers, for example, the division between ‘soft’ and ‘hard’ categories (de Jesus & Mendonça, 2018), which could result in a slight difference in the results. The sub-categorisations could be scrutinized to be chosen randomly, however structuring the results is needed for a better overview and potential for clear analysis (Saldana, 2009). Combining qualitative and quantitative analysis is the best way to eliminate the biased risk for qualitative analysis (Onwuegbuzie & Leech, 2005). Although it is a basic method, the ranking of the codes between the categories ‘high, ‘medium’ and ‘low’ contributed slightly to a more quantitative approach.

As a second limitation, the sample is quite small, and it is not necessarily known whether these range of interviewees represents the industry in general. Most interviewees are contacted through the network of MVO Nederland, which represents companies that are engaging in sustainability activities. Even though it is known that there are still apparel companies in the Netherlands are not necessarily engaged with sustainability initiatives. However, as from all the companies I was able to talk to people with expertise in the field of sustainable and circular clothing and fabrics, the results are more in depth. It could, however, be the case that the results are even a bit more either scrutinized or positive as for the view of the respondents. There is no perfect way of sampling for qualitative research, wherefore defections in the sample should be acknowledged (Marshall, 1996)

Furthermore, the scope of this research is a limit as well. This research did not look at cross-sectoral uses or recycled material, while for CBM diffusion this would be a considerate option. Social sustainability is outside of the research scope, which is often scrutinized for in CE research.

It is often scrutinized that CE should include social aspects of sustainability more (Moreau et al., 2017). Also, this study does not include the social dimension of sustainability thoroughly. For example, the social effects of using less raw materials are outside of the scope of this research and should sincerely be considered in case of mainstreaming recycled materials. A three-dimensionally approach – in terms of people, planet, profit – could shed a new light on the sustainability developments of CE (Lozano, 2008).

6.3. Avenues for further research

First, it can be mentioned that each of the categories could use more extensive research to truly understand their influence on the potential for diffusion of CBM, however, it should be noticed that links between the categories should always be considered in further research.

Furthermore, the two described vicious circles could be covered in research and pathways for breaking through these cycles could extensively contribute to transformational change. The meaning of the influence of 'scale' is of high importance and not extensively understood as there were multiple heterogeneous responses on this factor.

In terms of attitudinal drivers and barriers, which are of high importance, there is a need for further research on psychological analysis that can lead to an attitude towards implementing change. The development of a methodology to convince company owners and CEO's about the need for CBM , CE, and other sustainability implementations.

The attitudinal category is a main driver; however, research is needed to define economic an environmental benefit of the implementation of CBM. The interviewees mention several pathways for research that would help them make better decisions in the field of CBM implementation. For example, there is a need to know what methodology is the most sustainable and whether the use of recycled materials is truly more sustainable than any other option of production.

Last, the case study in this thesis could also be interesting for CE developments in other industries. Although drivers and barriers are different per situation, a similar methodology could be applied for other research or the database could be extended to gain a more comprehensive overview for diffusion of CE practices amongst several industries.

7. Conclusion

The goal of this master thesis was to identify drivers and barriers for CBM diffusion within the Dutch apparel industry. This contributes to academic research through a holistic and structural approach with the focus on a specific industry. Furthermore, the research provides further directions and comprehension for industry factors by highlighting the connection between several categories of drivers and barriers and linking drivers and barriers from the Dutch apparel industry to the drivers and barriers from actors in the recycling industry in India and Sri Lanka for a more inclusive approach.

7.1. Answer to the research question

With the above goal, the research question '*What are the drivers and barriers for circular business model diffusion in Dutch apparel companies?'* is answered. This has been done through a qualitative case study for recycled textiles. A database of 409 individual factors was created for the case study on how recycled textiles can be diffused within the Dutch apparel industry. This data was gathered through conducting semi-structured interviews with 10 actors in the Dutch apparel industry and 3 experts on textile recycling in India and Sri Lanka. Through categorisation and sub-categorisation of the data, a generalised answer on the research question is constructed.

It is important to acknowledge that the most influential factors can be found in the attitudinal, economic and structural category. Moreover, the attitudinal category contains relatively the most drivers and relatively the most barriers can be found in the operational and economic category. Examples of main and/or the most interesting drivers and barriers found through this case study can be found in table 17.

Main drivers	**Main barriers**	**Main fuzzy factors**
Internal values of a company	Quality	Environmental Trade-off and uncertainties
Collaboration	Constant supply	Investments
Transparency and information exchange	Price	Focus on the percentage recycled material
Technological developments	Lack of consumer interest	Market development

Table 17: Examples of important drivers and barriers for CBM[10]

As all categories are interlinked, it seems that one fundamental change can create a system transition. It needs to start with one actor and according to market developments. In this case, it would either be a technological disruption or a financial policy change from the government. Although economic factors are the most important for a company to perform, attitudinal drivers and barriers seem to take the lead in considering the implementation of recycled material. For example, the main economic driver 'financial space' is created out of willingness and consensus on

[10] NOTE: In table 17 the labels 'driver', 'barrier', and 'fuzzy' might not completely correspond with the described sub-categories in table 9-16 (page 39-56). These tables describe the results gathered from the interviews in terms of the respondence of the interviewees. Table 17 gives a comprehensive conclusion and summary of the current state-of-the-art of the most interesting or most mentioned drivers and barriers after the analysis.

the belief that companies should create space for sustainability. If there is no willingness for change, the economy in institutions should do their work. Therefore, for mainstreaming a circularity approach, like recycling, governmental and economic incentives should arise. For now, it seems that implementing CBM is mainly an attitudinal decision taken by the highest management of an organisation.

As both the apparel industry and sustainability are dynamic fields, it is important to keep considering the drivers and barriers within the current developments and keep track of the constant changes. This research has found a balanced figure of drivers as barriers whereas current changes in attitude and ongoing technological developments stand the most positive prospects for CBM diffusion. CBM can become important assets for enhancing business practices in the long run. However, the way towards actual implementation requires a critical reconsideration of current business practices.

7.2. Recommendations

Although the dynamics in the field of CBM are positively developing, there are recommendations to make to corporate actors and policy developers. In the long-run CBM can become important assets for enhancing business practices. It needs to be considered that current developments are held back by intertwined processes keeping themselves in place.

First, it is recommended to stop the focus on creating 100% recycled materials and start enhancing the implementation of a certain percentage of recycled material. In this way, good quality of the fabric can be maintained, and more impact is created in an easier way. There should not be the need to do everything at once. Although it would be a fundamental change to switch to circular practices within a company a step-by-step approach is advised. The main reason for this is that it is easier to inform and collaborate within the industry and business partners. In order to communicate in a relevant way, it is important to be transparent about the steps that are taken.

Next, it is important to carry along partners and suppliers within the developments. CBM can create opportunities for suppliers and lead to upscaling of circular practices. Include the suppliers in the willingness to change towards a circular system and communicate about existing options. Collaborations in general are important, so it is recommended to share knowledge and be transparent about the steps that are taken, and knowledge acquired. As an economic risk is encountered by collaboration with direct competitors, coalitions could be formed with companies (including multiple stakeholders within the supply chain) that are no direct competitors of each other. For example, a collaboration between companies that work with the same materials, however with different items or for a different market. In this way a pre-competitional environment for collaboration is created and sharing knowledge and being transparent can be considered easier. Furthermore, cross-sectoral collaborations should be enhanced as well. Although this research does not elaborate further on this, there might be options for the use of

recycled textiles in other sectors depending on the quality and consistency of the material. This potential should be approached with an open-minded view in order to form new product-market combinations.

For these collaborations, the clarity of information from independent information sources is required. It could, for example, be a task for NGO's or an independent company to take up an open-source database that includes research and reports for circular business practices.

At this point, companies make the decisions to work towards a certain sustainability goal voluntary. A true best practice has not yet been established on what sustainable methodology is more environmentally friendly than the other. There is, in general, no ranking of 'importance of environmental damage'. A company can choose what direction to go in, though should communicate on this clearly. If one company decides to use recycled polyester to decrease landfill and another company decides to create cellulose materials to diminish micro-plastics, they could, therefore, better encourage each other for taking responsibility for environmental externalities.

As the attitudinal driver is seen as the most important one in this research, it is necessary to inform and support owners and strategic managers of organisations on the transition towards CBM. This intrinsic value can be spread throughout the organisation. For example, by creating inspirational sessions on sustainability values within companies together with a corporate psychologist who is experienced in corporate thinking.

In terms of policy, this can be a driver on itself and institutional incentives are required and would be supported by key players in the industry. Pricing incentives in terms of tax advantages are the most mentioned pricing policies and could even encourage market development for recycled materials and recycling technologies.

As the last point, when looking to waste management, it should be noted that it is necessary to both treat post-consumer and pre-consumer waste and one is not necessarily better than the other as both waste streams are currently mostly incinerated. In order to create a better treatment of this waste, the developments of collection, sorting and separation systems are necessary. Although this is a hard process there are already organisations that take great steps in this (e.g. recycling companies in India and Sri Lanka). Through sharing information about this, these processes can be expanded.

The results of this research shed a light on the potential for the diffusion of CBM in the Dutch apparel industry. Either through market development, institutional change or a combination of both can be the main driver for change in this field. There are multiple developments going on in an ever-changing and dynamic industry.

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Appendix A: Interviews

This table provides an overview of the interviews that were conducted for this research.

Interview	Function	Located	Specialisation	Size[11]	Market (B2B /B2C)	Medium	Duration
I1	Social Compliance Coordinator	NL	Fashion	LE	B2C	Face-to-face	38 minutes
I2	Owner / Sales Responsibility	NL	Workwear	SME	B2B	Call	43 minutes
I3	Owner/Director	NL	Fashion	SME	B2B / B2C	Call	23 minutes
I4	Owner/Expert	NL	Fashion	SME	B2C	Call	25 minutes
I5	CSR Manager	NL	Fashion	LE	B2C	Call	41 minutes
I6	Denim Expert	NL	Fashion	N/A	N/A	Call	21 minutes
I7	Material Specialist	NL	Fashion	LE	B2C	Call	38 minutes
I8	CEO	NL	Fashion / Recycling	SME	B2B/B2C	Face-to-face	54 minutes
I9	Brand manager	NL	Fashion	SME[12]	B2C / B2B	Face-to-face	50 minutes
I10	Manager product manager purchasing	NL	Workwear	SME[12]	B2B	Face-to-face	65 minutes
IA	Managing Director	SL	Recycling	SME	B2B	Call	31 minutes
IB	Senior Manager	SL	Recycling	SME	B2B	Written correspondence[13]	-
IC	Venture Builder	I	Recycling	N/A	B2B	Call	38 minutes

[11] Small and Medium-sized Enterprise (SME) < 250 employees, Larger Enterprise (LE) > 250 employees (OECD (Organisation for Economic Cooperation and Development), 2019)
[12] Part of an umbrella organisation
[13] Written correspondence due to a Social Media ban after the terror attack in Sri Lanka on the 21st of April 2019.

Appendix B: Interview Protocol

General Information

Interviewees: Main players in the recycled textiles supply chain for apparel:

- CEO's, CSR managers, sales or buying representatives of Dutch (divisions of) apparel companies (fashion and workwear) with international supply chains who are engaged with sustainability efforts in this supply chain.
- Managers and experts of recycling for cotton and polyester within or with reference to the European-South-Asian supply chain.

Time period: March – May 2019
Duration: approx. 30 minutes
Medium: face-to-face, Skype conversation or phone call
Goal: What drivers and barriers do the interviewees encounter with respect to a transition towards circular business model implementation considering recycled textiles.

Before the interview

Before the interview desk research about the company and interviewee will be done (think about the LinkedIn page, company website, CSR Reports etc). This information is gathered to be up to date on the work and position of the interviewee and current projects running in the company on sustainability, circularity and recycling.

With this information more finetuned questions will be asked. The questions can therefore be adapted to the situation of the interviewee to trigger the enthusiasm of the interviewee and in-depth quality of the answers by being able to ask case specific questions.

Introduction to interviewees

This interview will be conducted with reference to my master's thesis of the MSc Sustainable Business and Innovation at Utrecht University and MVO Nederland/CSR Netherlands. This Master's thesis is a market development research to explore the opportunity and bottlenecks for implementation of CBM with respect to (post-industrial) recycled textiles. The thesis will get a step further in the direction of circularity within the textile sector and highlight enhancing and diminishing factors to see why implementation of recycled textiles at this moment is lagging and what is needed for acceleration. This is the first round of the interviews. A second round of interviews will follow with experts from textile companies in India and Sri Lanka to see their perspective on the drivers and barriers. A comparison between suppliers and buyers of their textiles/fashion companies can contribute to a more comprehensive and systematic overview why/why not to implement the CBM in fashion supply chains.

Interview

The questions were nuanced differently according to the (expertise of the) interviewees. In this interview I mainly asked questions about specific drivers and barriers. The outcome of the interviews will be treated confidentially as no (company) names are given but referred to with a code in random order.

Introductory questions (3 minutes)

- Could you describe your role within the company?
- On what scale are circular textiles in your company
    - Important?
    - Implemented?

Focused Questions (20 minutes)

Social/organisational/structural (Levering & Vos, 2019; Tura et al., 2019)

- How important is external stakeholder influence for the implementation of recycled textiles
    - Clients
    - NGO's
    - Business connections/network
    - Colleague companies
    - Competitive companies
    - Others?
- How important is the company internal pressure for the implementation of recycled textiles?
    - Colleagues
    - Colleagues from other departments
    - Management
    - CEO
    - Others?
- Which stakeholder is most important and why?
- How risky is the implementation of circular textiles (e.g. because it is a new material/other quality/colour etc.)?
    - What are considered important risks?
    - Who decides/who takes responsibility for the risks (e.g. management/buyers/recyclers/suppliers etc.)?
    - What are reasons to do or do not take the risk?
- What are your main sources for information about recycled textiles?
    - Supply/demand
    - News
    - Company relations
    - Government
    - Other?

Economic (Tura et al., 2019)

- How likely are you to pay more for recycled textiles?
- How much more and why?
- How important are rising prices for cotton/polyester? (Baffes, 2018)
    - How would this effect the implementation of recycled material?
- How important is the trade-off between environmental and financial benefits? (Andersen, 2007)
    - Why?

Institutional (Ranta et al., 2018)

- How influential are current measures taken by the government?
    - Laws
    - Taxes
    - Subsidies
    - Other regulations/options?
- Where lies the role of governmental organisations?
- What measures would influence your company to implement recycled textiles?

Technology (Leblanc, 2019; Tura et al., 2019)

- How likely is the use for you of the following materials with technological specifications?
    - Chemically recycled polyester
    - Chemically recycled cotton
    - Mechanically recycled polyester
    - Mechanically recycled cotton
    - Other?
        - Why?
- What future technological developments would you like to see (e.g. in terms of quality/sustainability/material use, etc.)?

Operational (Tura et al., 2019)

- How likely are the possibilities within your supply chain for recycled textiles?
- Is your existing supply chain holding you back or collaborate with you on recycled textiles?
- Would there be a possibility to work with different suppliers?
    - How?
- What agreements about circular textiles did you already make with your suppliers/demanding parties?

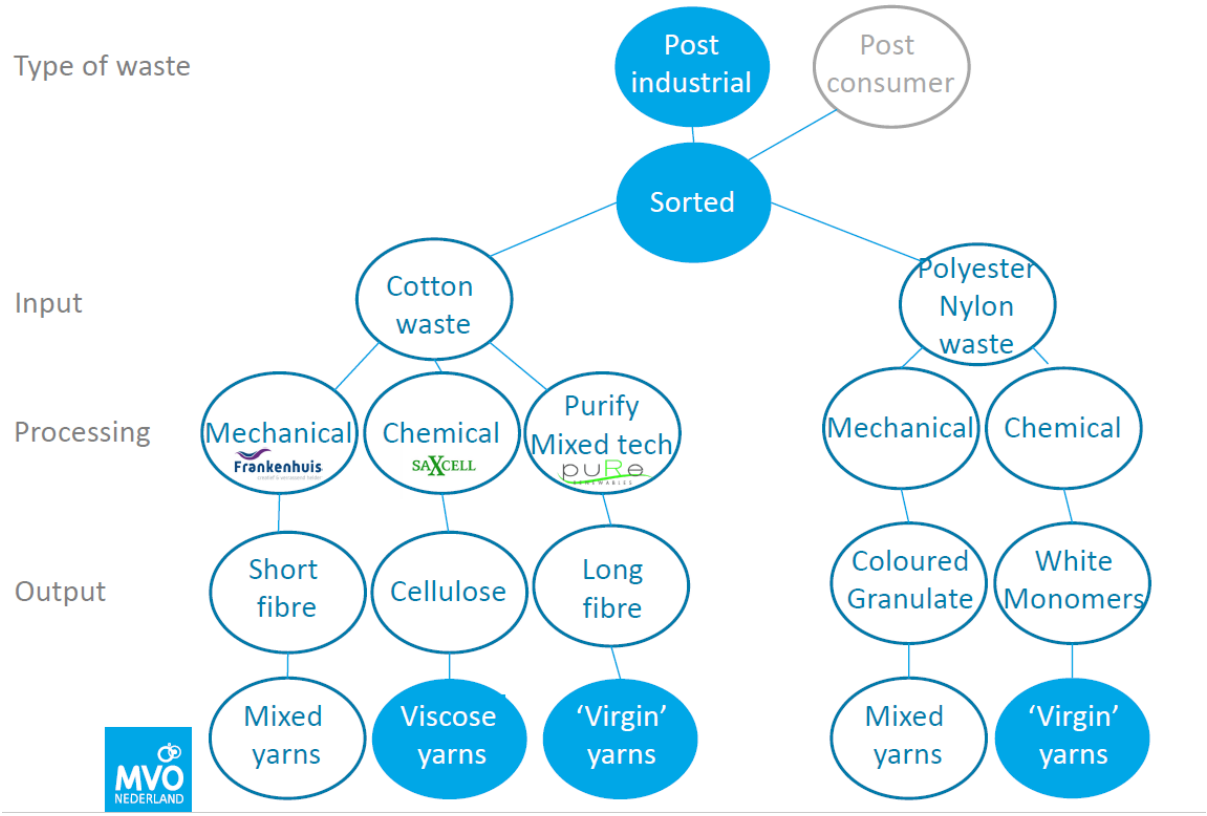
Finishing Questions (5 minutes)

- To what extend (in %) do you think recycled textiles/apparel will be part of your product portfolio/the product portfolio of your clients in the next future (in 1 year/5 years/10 years)?
- To what extend do you expect growing demand for circular textiles in next years?
- What is holding back circularity within the industry and what factors could accelerate circularity more?

Finishing (2 minutes)

- Check if all questions are answered
- Ask if interviewee wants to be kept updated on the research
- Ask if this information can be spread to MVO Nederland/the University and if there is any information that is sensitive for any further publication.
- Thank interviewee for their time and effort

Appendix C: Flow chart of technological possibilities for textile recycling by MVO Nederland



(van Yperen, personal communication, December 14, 2018)

Appendix D: Coding organised in sub-categories

In this Appendix the complete overview of the data gathered from the interviews and used for this research can be found. The data is categorised per literature category (these categories are ordered alphabetically). In the first column the label driver, barrier or fuzzy is given. In the second column the sub-categories can be found as they are also explained in chapter 5 (starting page 32). In the third column, the coding is presented with a reference to the respective interviews. Summaries of the found data per category are presented in table 9-16 (page 38-55).

Attitudinal

	Sub-category	Codes (+ reference to interview)		
Driver	Internal perception	Internal perception (I2, I3, I4, I7), Intrinsic values (I3, I8, I9), Satisfaction (I2), Aiming for the greenest version (I10), Company internal initiative (I10), internally made decisions (I5, I9), out of the box thinking (I3), internal awareness (I9), moral obligation (I8)		
	Dedication	Risk taking (I2), Covering risks in pre-trajectory (I7), Pragmatic view (I5); Time investment (I8); Willingness (I1, I2, I3, I5), Hard work pays off (I3), taking a step further with post-consumer materials (I9), Believe (I9), overcoming frustrations (I9), Fun (I9), Commitment of brands (I9)		
	View of outer world	Frontrunner (I2, I3, I7, I10, I9), Inspirational role (I3), no competitional feeling (I7), Personality (I2, I3), Brand identity (I9)		
Barrier	Negative perception towards recycling	Perception of material use (I8), Perception of waste (I8), Recycled perceived as luxury (I4), Perception of quality (I6), throwaway society (I9)		
	Trends	Keeping up with style and colour trends (I1), Too much hyping of sustainability (I5)		
	Distantiation	"far away" problems (I4), Followers (I3)		
Fuzzy		**Drivers**	**Barriers**	**Both/None**
	Compromising	Willingness to compromise on colour (I7)	Not compromising quality (I5), extra benefits needed clothing (I9)	Compromising to a certain extend (I7)
	Perception of influential actors	Consumer expectations (I7), Demand from client for sustainability (I10, I2), brand influence (IA, IC, IB), governments are influenced by willingness of companies (IC)	Lack of consumer interest (I3, IA, I7, I9); Lack of interest of buyers (I1), Lack of (enough) consumer demand (I1, I5, IA, I6, I9), Lack of demand from the brands (I6), Consumers do not care about saving water (I6), lack of governmental engagement (IC), lack of supplier engagement (IC), lack of sustainability awareness (IC), lack of interest (IA), hard to present for retailers (I9), No consumer decision (I9), lack of consumer understanding (I9)	Consumer awareness (IA), Brand Influences (IA); Expectations of Consumer demand (I1, IA), Costumer shift (I3), Lack of alignment between consumer interest and consumer behaviour (I5, I8), different framing of sustainability in India (IC), make it easy for consumers (I4), buying children's clothing is emotional choice (I9)
	Future Expectations	Positive future expectations (I3, I7, I8)	Different view needed for positive future (I6)	

Economic

	Sub-category	Codes (+ reference to interview)		
Driver	Financial Space	Switching material blend (I7), Passing on price to clients (I10, I3), space to shift margin around between products (I5), no problem to spend more money on sustainability (I3)		
Barrier	Costs	Expensive technology (I3), No intention to pass on costs (I5, I7), higher material costs (I10), Extra costs and missing discounts by switching suppliers (I6), validating the extra costs (I9)		
	Competitiveness	Lack of competitional recycled products (I8), Lack of defined market (I8), Lack of upcycling as a strong business case (I5), Lack of commercial value (I3), competition of cheaper brands with multiple collections(I9)		
	Profit margins	Low profit generation per item (I1), need for profit (I10), counting with margins (I9), margin cannot go down (I7)		
Fuzzy		**Drivers**	**Barriers**	**Both/None**
	Investments	Investors found (I8), partners want to invest (IC), Capital available for investments (IA)	Lack of investments (I4), Need for investors (I7), potential for investments from big chemical companies (I7)	
	Potential for Business opportunities	Business opportunities (IA), Creating a new business model for suppliers (I5), active retailers (I10), huge demand for recycled material (IC), 360 deals (IC), adapting to customer needs (IC)	Reject business opportunities (I2), passive retailers (I10), losing clients (I3)	Creating a market for our recycled material (I10), creating supply and demand by taking your suppliers along (I9)
	Prices	Same price for recycled material (I8, IC), Price for recycled labels (I5), pushing all affordable opportunities (I1), waste has a price (IC)	Higher price (I1, I3, I4, I7, I8, I9, I10), High price elasticity (I8), Staying realistic with pricing (I5), Price aware consumers (I9)	Slightly higher price (I2), ongoing feasibility study with potential for same price (IC), high price no problem as there is a huge demand (IB), expectations for lower cost price (I7)
	Market developments	Market development (IA), enhanced revenue streams for suppliers (IC), high importance of textile industry (IC)	Lack of defined market (I8), Increasing world population with mid-level income (I8), need for a new market for felt (I10),	Need for demand creation (I6), development within economic possibilities (I6), dependency on market developments (I2, I5, I7), Market development can be pushed by big companies (I1), online shopping search function for sustainability (I9)
	Product value	Cost-effectiveness of nylons and polyesters (I8), Marketing value (I2), Uniqueness (I5, I8), increased product value (IC)	Lack of balance between marketing and impact creation (I5), Lack of paying true costs (I4), Non-valuable products (I8), Low cost-low quality product (IA), Lack of enough value addition (IA), commercialisation (I10), sustainability itself does not sell (I9)	Add extra value than just sustainability (I6, I9)

Environmental

	Sub-category	Codes (+ reference to interview)		
Driver	Creating a (more) positive impact	Avoidance of fossil resources (I4, I7), Environmentally sound materials (I2), Prevention from incineration (IA, IB, I10, IC, I6), Impact (I2, I5, IA, I8, I9), Using less water (I10, IC), Decrease demand for virgin cotton (I6), reduce use of virgin material (IB), Enzyme-based processes (IC), Eliminate down-cycling (IC), No use of harmful chemicals (IC, I8), less energy use (IC), save carbon emission (IB), save visual pollution (IB), reduce soil degradation (IB)		
Fuzzy		**Drivers**	**Barriers**	**Both/None**
	Uncertainty about impact	Solution to waste (IA, IB, IC), Bluesign certificate for security on chemicals (I7)	New waste creation (I4), Economic model for overstock creation (I4), consumer does not know the impact (I6), Single sighted view (I5), not knowing what is in there (I9), Still dependent on fossil fuels (I7); use of chemicals (I10, I8)	Uncertainty about impact (I1, I5), Recyclable material origin (I4, I5, I8), Balance in people, planet, profit (I3), safety of products (I9), effect on climate change vs. effect of climate change (I8)
	Trade-off		Trade-off between environmental and economic effects (I5), Trade-off between environmental effects (I5), plastic microfibres (I4, I8), using more water for chemical recycling of polyester (I9)	Boomerang effect (I8)

Institutional

	Sub-category	Codes (+ reference to interview)		
Driver	Existing public policies	Dutch Climate Agreement (I4), Dutch Covenant (I1, I2), Subsidies available (IC), basic rules (IC), Polluter Pays Principle Sri Lanka (IB), Design for environment concept (IB)		
	Private institutions	Certification (I2), Industry Standards (I2), creating a certification system (I6), Environmental qualities are registered (IA), Bluesign certificate (I7)		
	Public Private Partnerships	ECAP project (I5, I1, I9)		
Barrier	Lack of governmental policies	Lack of a waste ban (I4), Lack of obligations (I2, I4), Lack of pricing policies (I1, I2, I7, I8, I6, I9), Lack of a mandatory percentage for recycled material (I4)		
	Lack of governmental action	Lack of communication and education (I2), Lack of governmental purchases based on circularity (I8), Lack of institutional incentives (I6), Lack of international support (I9)		
	Lack of trust	Lack of trust in the government (I5), Unsporting politicians (I8), Lack of governmental support (I5, IA)		
	Counteracting circumstances	Lobbying by other companies (I5), unbeneficial trade agreements (I2, I9), Douanier costs (I9), municipalities making money from clothing containers (I8, I9)		
Fuzzy		**Drivers**	**Barriers**	**Both/None**
	Importance of governmental tasks	Legislation will be the main driver (I5), government should initiate (IC), lot of potential governmental instruments (I9)		No governmental task (I3, I7)

Operational

	Sub-category	Codes (+ reference to interview)		
Barrier	Scale	Only big volumes affordable (I1), Only small volumes/operations available in Spain and Italy (I2), Lack of scale (I5, I7, I8), business is based on large volumes (I6), Big volumes are a problem for sample collections (I9), Demand is too low for suppliers (I9)		
Fuzzy		**Drivers**	**Barriers**	**Both/None**
	Logistics	Geographical location of Sri Lanka (IA), Low storage capacity suppliers (IA)	Logistics (I7, I8), Distance between recycler and production plant (I5, I9), bad abroad reverse logistics (I2, I9)	Recyclable material destination (I4), Location is important (I8)
	Collection and separation	Good working collection and sorting system (IA), Sorting process with partner (I10), possibility of logistic trajectory for collection and separation (I8, I10)	Lack of good working collection and sorting system (I7, I8), Poorly organised reverse supply chain (I6), limitations for import and export post-consumer materials (I2, I9)	Developments on chemical separation of cotton and polyester (I7)
	Alternatives	Few supply of alternative materials (I8)	Ease of alternative materials, (like Bio, Fairtrade and Organic) (I1, I8, I6, I9), ease of downcycling (I8)	
	Constant supply	Possibility of constant supply through collaboration with big parties (I8), Continuous process (IB), Volume caters existing demand (IB)	Lack of guaranteed constant supply (I5, I7, IA), big volume of waste needed (I10), lack of consistent material stream (I7)	Potential for big recycling units in India and Sri Lanka (IC), Partnering with big spinning mill (IC), potential creation of an unending closed loop with chemical recycling (I7)
	Tracing supply chain	Control over production partner (I10), being picky on partners (IC), personal checks and visits (I9)	Unorganized sector (IA), only handling part of the process (IA), poor auditing (IC), traceability should advance (IC), lack of influence on further supply chain (IA, I8)	Recyclable material destination (I4), awareness that tracing can go wrong (I9)
	Flexibility	Flexibility in adding suppliers (I1, I2, I4, I5, I7), Potential for reorganisation (I4), opportunities within existing supply chain (I1), Flexibility in use of different fabrics for production company (I10), recommending yarn suppliers is possible (I7)	Lack of flexibility within running lines (I2), contracts with suppliers (I6)	Taking along your own suppliers in the process creates more impact (I9), risk of too tight contract with suppliers (I8)
	Accessibility	Easily accessible because of local office (I9), own supplier (I3)	Lack of accessibility (I4), Low availability (of good materials) (I1, I2), single supplier for recycled yarn (I2), lack of visibility by suppliers (I6)	

Organisational

	Sub-category	Codes (+ reference to interview)		
		Drivers	**Barriers**	**Both/None**
Fuzzy	Ambition	Company goal/ambition (I2, I7), Core business (I8), Setting goal for industry (I3), Afterlife story dominant in CSR strategy (I10), sustainability on the agenda (I9)	Lack of company goal (I1), Lack of core business (IA), moving away from core business (I10), intention to create a strategy, but hard because of ongoing developments (I5)	Do not lose your core business (I9)
	Engagement	Active engagement (I2), Internal collaboration (I2, I4, I5), push from sustainability department (I1, I7), Considerate and inclusive story in our company (I10), Company internal support (I5), interested CPO (I5), buyer experience of CSR manager (I5), No interruptions in work of other colleagues (I9), supporting management (I7, I9)	Lack of active engagement buyers (I1), lack of inclusion of designers (I4), Lack of inclusion of whole company (I4)	Importance of buyers, CPO and CEO (I1)
	Company composition	Young age personnel (I1)	Company Hierarchy (I1), Cumbersome mother organisation (I10)	
	Pace of development	Easy pace of development (I7), company learning through workshops (I9)	Fast pace of development (I2), Slow pace of sustainability developments in Germany (I10)	

Structural

	Sub-category	Codes (+ reference to interview)		
Driver	Communication value	Reporting value (I4), marketing statements (I6), marketing story line (I6), storytelling (I7, I9)		
Barrier	Lack of action	Undefined responsibility (I4), Lack of motivation on industry level (I2), Lack of actions instead of talking (I5), Acting on available knowledge (I8), Lack of active engagement within the supply chain (I1)		
	Lack of knowledge	Lack of knowledge at company level (I1), Lack of knowledge at consumer level (I2), Lack of knowledge at supply chain level (I7), Lack of knowledge at governmental level (I1), Lack of research (I4, I5), Lack of LCA's (I1)		
	Intellectual property	Protecting intellectual property (I8)		
Fuzzy		**Drivers**	**Barriers**	**Both/None**
	Information availability	Information availability (I7), multiple information sources (I3), Internet (I9)	Information overload (I5)	Way of framing a message (I8, I9)
	Information exchange and transparency	External information exchange (I1, I2, I7, I8), sharing all knowledge (I3), Transparency (I8), Information exchange with fashion companies (I2) Conversations on high level (I3), Direct business with supply chain (I5), information exchange with suppliers (I10, I5, I9), Communication and market orientation with our clients (I10), promoting to clients (I10), Finding out that a supplier already had recycled materials (I1), communication with consumers (IB), Collaboration between different brands under an umbrella organisation (I9), bundling of powers (I9), engaging suppliers in the process (I9)	Lack of external information exchange (I4, I6), Lack of communication and education (I2), Lack of information exchange on educational level (I4), Lack of transparency (I8), Lack of promotion (I6), Lack of information exchange with colleague companies (I5), only certain information exchange with other companies (I1), lack of transparency between brands and suppliers (IC), Lack of information exchange of production factories (I4), lack of promotion by NGO's (I4), need to be careful with giving too much information (I9), lack of knowledge on consumer level (I9)	Wish to create a QR label to show complete supply chain (I10), need for information exchange on material specifics (I8)
	Collaborations	External Collaborations (I1, I2, I8, I10), Collaborations with suppliers (I5), Projects (I7), meetings with suppliers (I2, I9), B2B customer collaborations (I2), Pilot from client (I10), Collaboration with collector (I10), local collaborations (I10), collaboration with circular party (I7)	Lack of full market collaborations (I7), Lack of community building (I4), Lack of supply chain internal collaborations (I4, IC), More collaborations needed (I6, IC) No direct collaboration with colleague companies (I2)	Supplier support (I5), potential for international collaborations (IA)
	Focus on percentage recycled material	Working towards mixing recycled and virgin material for impact and quality (I5), increasing the percentages of sustainable material (I3)	Companies are aiming for a high percentage (I6), no clarity on when to call something recycled (I8), rules to call a low percentage recycled (I10), weak material needs blending (I8)	

Technological

	Sub-category	Codes (+ reference to interview)
Driver	Specific fibres	Availability recycled polyester (I2), Mechanical recycling of cotton (I7), Nylon recycling (I4), Quality recycled polyester (I4), Wool recycling (I5), tread composition (IA), quality of chemically recycled cotton and polyester (I1)
Barrier	Diminished potential for recycling	Blends cannot be recycled (I1, I2, I4, IA, I7, I10), Not willing to use chemicals (I8, I10), Coatings cannot be recycled (I2, I8), Colouring is hard (I1, I2), Colours can be different (I7), Only able to recycle black and white (I8), Yarns are not always designed for recycling (I2), No flexibility in fabric weight (I10), contamination (IB), not all materials can be used for recycling (I7)

		Drivers	Barriers	Both/None
Fuzzy	Item specifications	Item specifications (I4), Working on the level of elements (I5), Labels of recycled PET (I5), Yarns from recycled polyester and cotton (I5), Inside of jackets (I1, I4)	Specifications for client companies (I2), Look of the items (I4, I9)	Chemical recycling (only) for synthetic fibres (I5), attractive technologies for suppliers (I5), leaving denim recycling to the experts (I9)
	Tests and development	Successful pilot (I8), Technological developments (I7, I9, I10), Own unique technology (I3, I8), proven technology (IC), India is far on recycled materials (I9), covering risks in pre-trajectory (I7), not far yet on chemical recycling of cotton (I7)	Slow developments (I2, I8), Lagging of chemically recycled cotton (I4), Lack of technological expertise (IA)	Ongoing/numerous developments (I5, I7), ongoing feasibility study (IB), Creating an unending closed loop through chemical recycling (I7)
	Quality	Quality of chemically recycled (I2, I4), production of felt (I10), Quality as good as virgin yarn (IC, I8), no difference in quality for recycled polyesters (I9)	Quality (I1, I2, I4, I5, IA, I7, I8), few options for material application (I4), Mix of recycled and virgin material (I8), Downgrading (I3), different benchmarks for quality (IA), Downcycling (I10), lower performance and strength (I10), Short fibres lead to weaker yarns (I6), demands for high quality (I6), lack of possibilities with long and strong fibres (I5), destroying filament (I8)	

Appendix E: Data base - Coding interviews and importance score

This Appendix presents a complete overview of the data. The first column presents the literature category related to the conceptual framework from table 2 (page 22). The second column presents the found codes established from date from the interviews presented in the third column. Column four presents the sub-category after the grouping of the codes. The fifth column describes the function of the sub-category (driver, barrier of fuzzy) and the sixth column describes the function of the code in case the code belongs to a fuzzy category. Column seven and eight present the ranking of the codes as described in chapter 3.5. and table 5 (page 27). The data is presented on alphabetical order of the categories.

Category	Code	Interviews	Sub-category	Function (Sub-category)	Function (code)	Importance (Code)	Score (Code)
Attitudinal	Internal perception	I2, I3, I4, I7	Internal perception	Driver		High	3
Attitudinal	Intrinsic values	I3, I8, I9	Internal perception	Driver		High	3
Attitudinal	Satisfaction	I2	Internal perception	Driver		Low	1
Attitudinal	Aiming for the greenest version	I10	Internal perception	Driver		Low	1
Attitudinal	Company internal initiative	I10	Internal perception	Driver		Low	1
Attitudinal	Internally made decisions	I5, I9	Internal perception	Driver		Medium	2
Attitudinal	Out of the box thinking	I3	Internal perception	Driver		Low	1
Attitudinal	Internal awareness	I9	Internal perception	Driver		Low	1
Attitudinal	Moral obligation	I8	Internal perception	Driver		Low	1
Attitudinal	Risk taking	I2	Dedication	Driver		Low	1
Attitudinal	Covering risks in pre-trajectory	I7	Dedication	Driver		Low	1
Attitudinal	Pragmatic view	I5	Dedication	Driver		Low	1
Attitudinal	Time investment	I8	Dedication	Driver		Low	1
Attitudinal	willingness	I1, I2, I3, I5	Dedication	Driver		High	3
Attitudinal	Hard work pays off	I3	Dedication	Driver		Low	1
Attitudinal	taking a step further with post-consumer materials	I9	Dedication	Driver		Low	1
Attitudinal	believe	I9	Dedication	Driver		Low	1
Attitudinal	overcoming frustrations	I9	Dedication	Driver		Low	1

Attitudinal	fun	I9	Dedication	Driver		Low	1
Attitudinal	commitment of brands	I9	Dedication	Driver		Low	1
Attitudinal	Frontrunner	I2, I3, I7, I10, I9	View of outer world	Driver		High	3
Attitudinal	Inspirational role	I3	View of outer world	Driver		Low	1
Attitudinal	No competitional feeling	I7	View of outer world	Driver		Low	1
Attitudinal	Personality	I2, I3	View of outer world	Driver		Medium	2
Attitudinal	Brand identity	I9	View of outer world	Driver		Low	1
Attitudinal	Perception of material use	I8	Negative perception towards recycling	Barrier		Low	1
Attitudinal	perception of waste	I8	Negative perception towards recycling	Barrier		Low	1
Attitudinal	recycled perceived as luxury	I4	Negative perception towards recycling	Barrier		Low	1
Attitudinal	perception of quality	I6	Negative perception towards recycling	Barrier		Medium	2
Attitudinal	throwaway society	I9	Negative perception towards recycling	Barrier		Low	1
Attitudinal	keeping up with style and colour trends	I1	Trends	Barrier		Low	1
Attitudinal	too much hyping of sustainability	I5	Trends	Barrier		Low	1
Attitudinal	"far away" problems	I4	Distantiation	Barrier		Low	1
Attitudinal	followers	I3	Distantiation	Barrier		Low	1
Attitudinal	willingness to compromise on colour	I7	Compromising	Fuzzy	Driver	Low	1
Attitudinal	Not compromising quality	I5	Compromising	Fuzzy	Barrier	Low	1
Attitudinal	extra benefits needed	I9	Compromising	Fuzzy	Barrier	Low	1
Attitudinal	compromising to a certain extend	I7	Compromising	Fuzzy	Both/None	Low	1
Attitudinal	consumer expectations	I7	Perception of influential actors	Fuzzy	Driver	Low	1
Attitudinal	demand from client for sustainability	I10, I2	Perception of influential actors	Fuzzy	Driver	Medium	2
Attitudinal	brand influence	IA, IC, IB	Perception of influential actors	Fuzzy	Driver	High	3
Attitudinal	governments are influenced by willingness of companies	IC	Perception of influential actors	Fuzzy	Barrier	Medium	2
Attitudinal	Lack of consumer interest	I3, IA, I7, I9	Perception of influential actors	Fuzzy	Barrier	High	3
Attitudinal	Lack of interest of buyers	I1	Perception of influential actors	Fuzzy	Barrier	Low	1

Attitudinal	Lack of (enough) consumer demand	I1, I5, IA, I6, I9	Perception of influential actors	Fuzzy	Barrier	High	3
Attitudinal	Consumers do not care about saving water	I6	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	Lack of governmental engagement	IC	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	Lack of supplier engagement	IC	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	Lack of sustainability awareness	IC	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	Lack of interest	IA	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	hard to present for retailers	I9	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	no consumer decision	I9	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	lack of consumer understanding	I9	Perception of influential actors	Fuzzy	Barrier	Low	1
Attitudinal	Consumer awareness	IA	Perception of influential actors	Fuzzy	Both/None	Low	1
Attitudinal	Expectations of consumer demand	I1, IA	Perception of influential actors	Fuzzy	Both/None	Medium	2
Attitudinal	Costumer shift	I3	Perception of influential actors	Fuzzy	Both/None	Low	1
Attitudinal	Lack of alignment between consumer interest and consumer behaviour	I5, I8	Perception of influential actors	Fuzzy	Both/None	Medium	2
Attitudinal	different framing of sustainability in India	IC	Perception of influential actors	Fuzzy	Both/None	Low	1
Attitudinal	make it easy for consumers	I4	Perception of influential actors	Fuzzy	Both/None	Low	1
Attitudinal	buying children's clothing is emotional choice	I9	Perception of influential actors	Fuzzy	Both/None	Low	1
Attitudinal	Positive future expectations	I3, I7, I8	Future expectations	Fuzzy	Driver	High	3
Attitudinal	Different view needed for positive future	I6	Future expectations	Fuzzy	Barrier	Medium	2
Economic	Switching material blend	I7	Financial Space	Driver		Low	1
Economic	Passing on price to clients	I10, I3	Financial Space	Driver		Medium	2
Economic	space to shift margin around between products	I5	Financial Space	Driver		Low	1
Economic	no problem to spend more money on sustainability	I3	Financial Space	Driver		Low	1
Economic	expensive technology	I3	Costs	Barrier		Low	1
Economic	No intention to pass on costs	I5, I7	Costs	Barrier		Medium	2
Economic	higher material costs	I10	Costs	Barrier		Low	1
Economic	Extra costs and missing discounts by switching suppliers	I6	Costs	Barrier		Low	1

Economic	validating the extra costs	I9	Costs	Barrier		Low	1
Economic	Lack of competitional recycled products	I8	Competitiveness	Barrier		Low	1
Economic	Lack of defined market	I8	Competitiveness	Barrier		Low	1
Economic	Lack of upcycling as a strong business case	I5	Competitiveness	Barrier		Low	1
Economic	Lack of commercial value	I3	Competitiveness	Barrier		Low	1
Economic	Competition of cheaper brands with multiple collections	I9	Competitiveness	Barrier		Low	1
Economic	Low profit generation per item	I1	Profit margins	Barrier		Low	1
Economic	need for profit	I10	Profit margins	Barrier		Low	1
Economic	Counting with margins	I9	Profit margins	Barrier		Low	1
Economic	Margin cannot go down	I7	Profit margins	Barrier		Low	1
Economic	Investors found	I8	Investments	Fuzzy	Driver	Medium	2
Economic	Partners that want to invest	IC	Investments	Fuzzy	Driver	Medium	2
Economic	Capital available for investments	IA	Investments	Fuzzy	Driver	Medium	2
Economic	Lack of investments	I4	Investments	Fuzzy	Barrier	Low	1
Economic	Need for investors	I7	Investments	Fuzzy	Barrier	Medium	2
Economic	Potential for investments from big chemical companies	I7	Investments	Fuzzy	Barrier	Low	1
Economic	Business opportunities	IA	Potential for business opportunities	Fuzzy	Driver	Low	1
Economic	Creating a new business model for suppliers	I5	Potential for business opportunities	Fuzzy	Driver	Low	1
Economic	active retailers	I10	Potential for business opportunities	Fuzzy	Driver	Low	1
Economic	huge demand for recycled material	IC	Potential for business opportunities	Fuzzy	Driver	Low	1
Economic	360 deals	IC	Potential for business opportunities	Fuzzy	Driver	Low	1
Economic	Adapting to customer needs	IC	Potential for business opportunities	Fuzzy	Driver	Low	1
Economic	reject business opportunities	I2	Potential for business opportunities	Fuzzy	Barrier	Low	1

Economic	passive retailers	I10	Potential for business opportunities	Fuzzy	Barrier	Low	1
Economic	losing clients	I3	Potential for business opportunities	Fuzzy	Barrier	Low	1
Economic	creating a market for recycled material	I10	Potential for business opportunities	Fuzzy	Both/None	Low	1
Economic	creating supply and demand by taking your suppliers along	I9	Potential for business opportunities	Fuzzy	Both/None	Low	1
Economic	Same price for recycled material	I8, IC	Prices	Fuzzy	Driver	High	3
Economic	price for recycled labels	I5	Prices	Fuzzy	Driver	Low	1
Economic	pushing all affordable opportunities	I1	Prices	Fuzzy	Driver	Low	1
Economic	waste has a price	IC	Prices	Fuzzy	Driver	Medium	2
Economic	higher price	I1, I3, I4, I7, I8, I9, I10	Prices	Fuzzy	Barrier	High	3
Economic	high price elasticity	I8	Prices	Fuzzy	Barrier	Low	1
Economic	Staying realistic with pricing	I5	Prices	Fuzzy	Barrier	Low	1
Economic	price aware consumers	I9	Prices	Fuzzy	Barrier	Low	1
Economic	slightly higher price	I2	Prices	Fuzzy	Both/None	Low	1
Economic	ongoing feasibility study with potential for same price	IC	Prices	Fuzzy	Both/None	Low	1
Economic	high price no problem as there is a huge demand	IB	Prices	Fuzzy	Both/None	Low	1
Economic	Expectations for lower cost price	I7	Prices	Fuzzy	Both/None	Low	1
Economic	Market developments	IA	Market development	Fuzzy	Driver	Medium	2
Economic	Enhanced revenue streams for suppliers	IC	Market development	Fuzzy	Driver	Medium	2
Economic	lack of defined market	I8	Market development	Fuzzy	Barrier	Low	1
Economic	increasing world population with mid-income level	I8	Market development	Fuzzy	Barrier	Low	1
Economic	need for new market for felt	I10	Market development	Fuzzy	Barrier	Medium	2
Economic	online shopping search function for sustainability	I9	Market development	Fuzzy	Both/None	Low	1
Economic	need for demand creation	I6	Market development	Fuzzy	Both/None	Low	1
Economic	development with economic possibilities	I6	Market development	Fuzzy	Both/None	Medium	2

Economic	dependency on market developments	I2, I5, I7	Market development	Fuzzy	Both/None	High	3
Economic	High importance of textile industry	IC	Market development	Fuzzy	Driver	Medium	2
Economic	market development can be pushed by big companies	I1	Market development	Fuzzy	Both/None	Low	1
Economic	cost-effectiveness of nylons and polyesters	I8	Product value	Fuzzy	Driver	Low	1
Economic	Marketing value	I2	Product value	Fuzzy	Driver	Low	1
Economic	Uniqueness	I5, I8	Product value	Fuzzy	Driver	Medium	2
Economic	Increased product value	IC	Product value	Fuzzy	Barrier	Low	1
Economic	Lack of balance between marketing and impact creation	I5	Product value	Fuzzy	Barrier	Low	1
Economic	Lack of paying true costs	I4	Product value	Fuzzy	Barrier	Low	1
Economic	non-valuable products	I8	Product value	Fuzzy	Barrier	Low	1
Economic	Low cost-low quality product	IA	Product value	Fuzzy	Barrier	Low	1
Economic	Lack of enough value addition	IA	Product value	Fuzzy	Barrier	Medium	2
Economic	Commercialisation	I10	Product value	Fuzzy	Barrier	Low	1
Economic	Sustainability itself does not sell	I9	Product value	Fuzzy	Barrier	Low	1
Economic	Add extra value than just sustainability	I6, I9	Product value	Fuzzy	Both/None	High	3
Environmental	Avoidance of fossil resources	I4, I7	Creating a (more) positive impact	Driver		Medium	2
Environmental	environmentally sound materials	I2	Creating a (more) positive impact	Driver		Low	1
Environmental	prevention from incineration	IA, IB, I10, IC, I6	Creating a (more) positive impact	Driver		High	3
Environmental	impact	I2, IA, I8, I9	Creating a (more) positive impact	Driver		High	3
Environmental	using less water	I10, IC	Creating a (more) positive impact	Driver		Medium	2
Environmental	decrease demand for virgin cotton	I6	Creating a (more) positive impact	Driver		Low	1
Environmental	reduce use of virgin material	IB	Creating a (more) positive impact	Driver		Low	1
Environmental	enzyme-based processes	IC	Creating a (more) positive impact	Driver		Low	1

Environmental	eliminate down-cycling	IC	Creating a (more) positive impact	Driver		Low	1
Environmental	no use of harmful chemicals	IC, I8	Creating a (more) positive impact	Driver		Medium	2
Environmental	less energy use	IC	Creating a (more) positive impact	Driver		Low	1
Environmental	save carbon emissions	IB	Creating a (more) positive impact	Driver		Low	1
Environmental	save visual pollution	IB	Creating a (more) positive impact	Driver		Low	1
Environmental	reduce soil degradation	IB	Creating a (more) positive impact	Driver		Low	1
Environmental	solution to waste	IA, IB, IC	Uncertainty about impact	Fuzzy	Driver	High	3
Environmental	new waste creation	I4	Uncertainty about impact	Fuzzy	Barrier	Low	1
Environmental	economic model for overstock creation	I4	Uncertainty about impact	Fuzzy	Barrier	Low	1
Environmental	consumer does not know the impact	I6	Uncertainty about impact	Fuzzy	Barrier	Low	1
Environmental	single sighted view	I5	Uncertainty about impact	Fuzzy	Barrier	Low	1
Environmental	not knowing what is in there	I9	Uncertainty about impact	Fuzzy	Barrier	Low	1
Environmental	still dependent on fossil fuels	I7	Uncertainty about impact	Fuzzy	Barrier	Low	1
Environmental	Uncertainty about impact	I1, I5	Uncertainty about impact	Fuzzy	Both/None	Medium	2
Environmental	recyclable material origin	I4, I5, I8	Uncertainty about impact	Fuzzy	Both/None	High	3
Environmental	balance in people, planet, profit	I3	Uncertainty about impact	Fuzzy	Both/None	Low	1
Environmental	safety of products	I9	Uncertainty about impact	Fuzzy	Both/None	Low	1
Environmental	effect on climate change vs. effect of climate change	I8	Uncertainty about impact	Fuzzy	Both/None	Low	1
Environmental	Trade-off between environmental and economic effects	I5	Trade-off	Fuzzy	Barrier	Low	1
Environmental	Trade-off between environmental effects	I5	Trade-off	Fuzzy	Barrier	Low	1
Environmental	plastic microfibres	I4, I8	Trade-off	Fuzzy	Barrier	Medium	2
Environmental	using more water for chemical recycling of polyester	I9	Trade-off	Fuzzy	Barrier	Low	1
Environmental	Boomerang effect	I8	Trade-off	Fuzzy	Both/None	Low	1
Environmental	Bluesign certificate for security on chemicals	I7	Use of chemicals	Fuzzy	Driver	Low	1

Environmental	Use of chemicals	I10, I8	Use of chemicals	Fuzzy	Barrier	Medium	2
Institutional	Dutch climate agreement	I4	Existing public policies	Driver		Low	1
Institutional	Dutch covenant	I1, I2	Existing public policies	Driver		Medium	2
Institutional	Subsidies available	IC	Existing public policies	Driver		Low	1
Institutional	Basic rules	IC	Existing public policies	Driver		Low	1
Institutional	Polluter pays principle Sri Lanka	IB	Existing public policies	Driver		Low	1
Institutional	Design for environment concept	IB	Existing public policies	Driver		Low	1
Institutional	Certification	I2	Private institutions	Driver		Low	1
Institutional	Industry standards	I2	Private institutions	Driver		Low	1
Institutional	Creating a certification system	I6	Private institutions	Driver		Low	1
Institutional	environmental qualities are registered	IA	Private institutions	Driver		Low	1
Institutional	Bluesign certificate	I7	Private institutions	Driver		Low	1
Institutional	ECAP project	I5, I1, I9	Public-private partnerships	Driver		High	3
Institutional	lack of a waste ban	I4	Lack of governmental policies	Barrier		Low	1
Institutional	lack of obligations	I2, I4	Lack of governmental policies	Barrier		Medium	2
Institutional	lack of pricing policies	I1, I2, I7, I8, I6, I9	Lack of governmental policies	Barrier		High	3
Institutional	lack of a mandatory percentage for recycled material	I4	Lack of governmental policies	Barrier		Medium	2
Institutional	Lack of communication and education	I2	Lack of governmental action	Barrier		Low	1
Institutional	Lack of governmental purchases based on circularity	I8	Lack of governmental action	Barrier		Low	1
Institutional	Lack of institutional incentives	I6	Lack of governmental action	Barrier		Low	1
Institutional	Lack of international support	I9	Lack of governmental action	Barrier		Low	1
Institutional	Lack of trust in the government	I5	Lack of trust	Barrier		Low	1
Institutional	Not supporting politicians	I8	Lack of trust	Barrier		Low	1
Institutional	lack of governmental support	I5, IA	Lack of trust	Barrier		Medium	2
Institutional	lobbying by other companies	I5	Counteracting circumstances	Barrier		Low	1
Institutional	unbeneficial trade agreements	I8	Counteracting circumstances	Barrier		Low	1
Institutional	douanier costs	I9	Counteracting circumstances	Barrier		Low	1
Institutional	municipalities making money from clothing containers	I8, I9	Counteracting circumstances	Barrier		Medium	2

Institutional	Legislation will be the main driver	I5	Importance of governmental tasks	Fuzzy	Driver	Low	1
Institutional	government should initiate	IC	Importance of governmental tasks	Fuzzy	Driver	Low	1
Institutional	lot of potential governmental instruments	I9	Importance of governmental tasks	Fuzzy	Driver	Low	1
Institutional	no governmental task	I3, I7	Importance of governmental tasks	Fuzzy	Both/None	Medium	2
Operational	only big volumes affordable	I1	Scale	Barrier		Low	1
Operational	only small volumes/operations available in Spain and Italy	I2	Scale	Barrier		Low	1
Operational	Lack of scale	I5, I7, I8	Scale	Barrier		High	3
Operational	Business is based on large volumes	I6	Scale	Barrier		Low	1
Operational	Big volumes are a problem for sample collections	I9	Scale	Barrier		Low	1
Operational	our demand is too low for suppliers	I9	Scale	Barrier		Low	1
Operational	Geographical location of Sri Lanka	IA	Logistics	Fuzzy	Driver	Low	1
Operational	Low storage capacity suppliers	IA	Logistics	Fuzzy	Driver	Low	1
Operational	Logistics	I7, I8	Logistics	Fuzzy	Barrier	Medium	2
Operational	Distance between recycler and production plant	I5, I9	Logistics	Fuzzy	Barrier	Medium	2
Operational	bad abroad reverse logistics	I2, I9	Logistics	Fuzzy	Barrier	Medium	2
Operational	Recyclable material destination	I4	Logistics	Fuzzy	Both/None	Low	1
Operational	Location is important	I8	Logistics	Fuzzy	Both/None	Low	1
Operational	Good working collection and sorting system	IA	Collection and separation	Fuzzy	Driver	Low	1
Operational	sorting process with partner	I10	Collection and separation	Fuzzy	Driver	Low	1
Operational	Possibility of logistic trajectory for collection and separation	I8, I10	Collection and separation	Fuzzy	Driver	Medium	2
Operational	Lack of good working collection and sorting system	I7, I8	Collection and separation	Fuzzy	Barrier	Medium	2
Operational	Poorly organised reverse supply chain	I6	Collection and separation	Fuzzy	Barrier	Low	1
Operational	limitations for import and export post-consumer materials	I2, I9	Collection and separation	Fuzzy	Barrier	Medium	2

Operational	Developments on chemical separation of cotton and polyester	I7	Collection and separation	Fuzzy	Both/None	Low	1
Operational	few supplies of alternative materials	I8	Alternatives	Fuzzy	Driver	Low	1
Operational	Ease of alternative materials (like bio, Fairtrade and organic)	I1, I8, I6, I9	Alternatives	Fuzzy	Barrier	High	3
Operational	ease of downcycling	I8	Alternatives	Fuzzy	Barrier	Low	1
Operational	Possibility of constant supply through collaborations with big parties	I8	Constant supply	Fuzzy	Driver	Low	1
Operational	continuous process	IB	Constant supply	Fuzzy	Driver	Low	1
Operational	volume caters existing demand	IB	Constant supply	Fuzzy	Driver	Low	1
Operational	lack of guaranteed constant supply	I5, I7, IA	Constant supply	Fuzzy	Barrier	High	3
Operational	big volumes of waste needed	I10	Constant supply	Fuzzy	Barrier	Low	1
Operational	lack of consistent material stream	I7	Constant supply	Fuzzy	Barrier	Low	1
Operational	Potential for big recycling units in India and Sri Lanka	IC	Constant supply	Fuzzy	Both/None	Low	1
Operational	Partnering with big spinning mill	IC	Constant supply	Fuzzy	Both/None	Low	1
Operational	Potential creation of an unending closed loop with chemical recycling	I7	Constant supply	Fuzzy	Both/None	Low	1
Operational	control over production partner	I10	Tracing supply chain	Fuzzy	Driver	Low	1
Operational	being picky on partners	IC	Tracing supply chain	Fuzzy	Driver	Low	1
Operational	personal checks and visits	I9	Tracing supply chain	Fuzzy	Driver	Low	1
Operational	unorganised sector	IA	Tracing supply chain	Fuzzy	Barrier	Low	1
Operational	only handling part of the process	IA	Tracing supply chain	Fuzzy	Barrier	Low	1
Operational	poor audits	IC	Tracing supply chain	Fuzzy	Barrier	Low	1
Operational	traceability should advance	IC	Tracing supply chain	Fuzzy	Barrier	Low	1
Operational	lack of influence on further supply chain	IA, I8	Tracing supply chain	Fuzzy	Barrier	Medium	2
Operational	recyclable material destination	I4	Tracing supply chain	Fuzzy	Both/None	Low	1
Operational	awareness that tracing can go wrong	I9	Tracing supply chain	Fuzzy	Both/None	Low	1
Operational	Flexibility in adding suppliers	I1, I2, I4, I5, I7	Flexibility	Fuzzy	Driver	High	3
Operational	Potential for reorganisation	I4	Flexibility	Fuzzy	Driver	Low	1
Operational	opportunities within existing supply chain	I1	Flexibility	Fuzzy	Driver	Low	1

Operational	flexibility in use of different fabrics for production company	I10	Flexibility	Fuzzy	Driver	Low	1
Operational	recommending yarn suppliers is possible	I7	Flexibility	Fuzzy	Driver	Low	1
Operational	lack of flexibility within running lines	I2	Flexibility	Fuzzy	Barrier	Low	1
Operational	contract with suppliers	I6	Flexibility	Fuzzy	Barrier	Low	1
Operational	taking along your own suppliers in the process creates more impact	I9	Flexibility	Fuzzy	Both/None	Low	1
Operational	risk of too tight contracts with suppliers	I8	Flexibility	Fuzzy	Both/None	Low	1
Operational	easily accessible because of local office	I9	Accessibility	Fuzzy	Driver	Low	1
Operational	Own supplier	I3	Accessibility	Fuzzy	Driver	Low	1
Operational	Lack of accessibility	I4	Accessibility	Fuzzy	Barrier	Low	1
Operational	Low availability of good materials	I1, I2	Accessibility	Fuzzy	Barrier	Medium	2
Operational	Single supplier for recycled yarn	I2	Accessibility	Fuzzy	Barrier	Low	1
Operational	Lack of visibility by suppliers	I6	Accessibility	Fuzzy	Barrier	Low	1
Organisational	company goal/ambition	I2, I7	Ambition	Fuzzy	Driver	Medium	2
Organisational	core business	I8	Ambition	Fuzzy	Driver	Low	1
Organisational	setting goal for industry	I3	Ambition	Fuzzy	Driver	Low	1
Organisational	afterlife story dominant in CSR strategy	I10	Ambition	Fuzzy	Driver	Low	1
Organisational	sustainability on the agenda	I9	Ambition	Fuzzy	Driver	Low	1
Organisational	lack of company goal	I1	Ambition	Fuzzy	Barrier	Low	1
Organisational	lack of core business	IA	Ambition	Fuzzy	Barrier	Low	1
Organisational	moving away from core business	I10	Ambition	Fuzzy	Barrier	Low	1
Organisational	intention to create a strategy but hard because of ongoing developments	I5	Ambition	Fuzzy	Barrier	Low	1
Organisational	Do not lose your core business	I9	Ambition	Fuzzy	Both/none	Low	1
Organisational	Active engagement	I2	Engagement	Fuzzy	Driver	Low	1
Organisational	internal collaboration	I2, I4, I5	Engagement	Fuzzy	Driver	High	3
Organisational	push from sustainability department	I1, I7	Engagement	Fuzzy	Driver	Medium	2
Organisational	considerate and inclusive story in our company	I10	Engagement	Fuzzy	Driver	Low	1
Organisational	company internal support	I5	Engagement	Fuzzy	Driver	Low	1

Organisational	interested CPO	I5	Engagement	Fuzzy	Driver	Low	1
Organisational	buyer experience of CSR manager	I5	Engagement	Fuzzy	Driver	Low	1
Organisational	no interruptions in work of other colleagues	I9	Engagement	Fuzzy	Driver	Low	1
Organisational	supporting management	I7, I9	Engagement	Fuzzy	Driver	Medium	2
Organisational	Lack of active engagement buyers	I1	Engagement	Fuzzy	Barrier	Low	1
Organisational	Lack of inclusion of designers	I4	Engagement	Fuzzy	Barrier	Low	1
Organisational	Lack of inclusion of whole company	I4	Engagement	Fuzzy	Barrier	Low	1
Organisational	Importance of CPO and CEO	I1	Engagement	Fuzzy	Both/None	Low	1
Organisational	Young age personnel	I1	Company composition	Fuzzy	Driver	Low	1
Organisational	Company hierarchy	I1	Company composition	Fuzzy	Barrier	Low	1
Organisational	Cumbersome mother organisation	I10	Company composition	Fuzzy	Barrier	Low	1
Organisational	Easy pace of development	I7	Pace of development	Fuzzy	Driver	Low	1
Organisational	Company learning through workshops	I9	Pace of development	Fuzzy	Driver	Low	1
Organisational	Facet pace of development	I2	Pace of development	Fuzzy	Barrier	Low	1
Organisational	Slow pace of sustainability developments in Germany	I10	Pace of development	Fuzzy	Barrier	Low	1
Structural	reporting value	I4	Communication value	Driver		Low	1
Structural	marketing statements	I6	Communication value	Driver		Low	1
Structural	marketing story line	I6	Communication value	Driver		Low	1
Structural	storytelling	I7, I9	Communication value	Driver		Medium	2
Structural	Undefined responsibility	I4	Lack of action	Barrier		Low	1
Structural	Lack of motivation on industry level	I2	Lack of action	Barrier		Low	1
Structural	Lack of actions instead of talking	I5	Lack of action	Barrier		Low	1
Structural	acting on available knowledge	I8	Lack of action	Barrier		Low	1
Structural	lack of active engagement within the supply chain	I1	Lack of action	Barrier		Low	1
Structural	Lack of knowledge at company level	I1	Lack of knowledge	Barrier		Low	1
Structural	lack of knowledge at consumer level	I2	Lack of knowledge	Barrier		Low	1
Structural	lack of knowledge at supply chain level	I7	Lack of knowledge	Barrier		Low	1
Structural	lack of knowledge at governmental level	I1	Lack of knowledge	Barrier		Low	1

Structural	lack of research	I4, I5, I8	Lack of knowledge	Barrier		High	3
Structural	Lack of LCA's	I1	Lack of knowledge	Barrier		Low	1
Structural	securing intellectual property	I8	Intellectual property	Barrier		Low	1
Structural	information availability	I7	Information availability	Fuzzy	Driver	Low	1
Structural	multiple information sources	I3	Information availability	Fuzzy	Driver	Low	1
Structural	internet	I9	Information availability	Fuzzy	Driver	Low	1
Structural	information overload	I5	Information availability	Fuzzy	Barrier	Low	1
Structural	way of framing a message	I8, I9	Information availability	Fuzzy	Both/none	Medium	2
Structural	External information exchange	I1, I2, I7, I8	Information exchange and transparency	Fuzzy	Driver	High	3
Structural	Sharing all knowledge	I3	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	Transparency	I8	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	Information exchange with fashion companies	I2	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	conversations on high level	I3	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	direct business with supply chain	I5	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	information exchange with suppliers	I10, I5, I9	Information exchange and transparency	Fuzzy	Driver	High	3
Structural	communication and market orientation with our clients	I10	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	promoting to clients	I10	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	finding out that a supplier already had recycled materials	I1	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	communication with consumers	IB	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	collaboration between different brands under an umbrella organisation	I9	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	bundling of powers	I9	Information exchange and transparency	Fuzzy	Driver	Low	1
Structural	engaging suppliers in the process	I9	Information exchange and transparency	Fuzzy	Driver	Low	1

Structural	Lack of external information exchange	I4, I6	Information exchange and transparency	Fuzzy	Barrier	Medium	2
Structural	Lack of communication and education	I2	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of information exchange on educational level	I4	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of transparency	I8	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of promotion	I6	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of information exchange with colleague companies	I5	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	only certain information exchange with other companies	I1	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of transparency between brands and suppliers	IC	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of information exchange of production factories	I4	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of promotion by NGO's	I4	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Need to be careful with giving too much information	I9	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	Lack of knowledge on consumer level	I9	Information exchange and transparency	Fuzzy	Barrier	Low	1
Structural	wish to create a QR label to show complete supply chain	I10	Information exchange and transparency	Fuzzy	Both/none	Low	1
Structural	Need for information exchange on material specifics	I8	Information exchange and transparency	Fuzzy	Both/none	Low	1
Structural	External collaborations	I1, I2, I8, I10	Collaborations	Fuzzy	Driver	High	3
Structural	Collaborations with suppliers	I5	Collaborations	Fuzzy	Driver	Low	1
Structural	Projects	I7	Collaborations	Fuzzy	Driver	Low	1
Structural	meetings with suppliers	I2, I9	Collaborations	Fuzzy	Driver	Medium	2
Structural	B2B customer collaborations	I2	Collaborations	Fuzzy	Driver	Low	1
Structural	Pilot from client	I10	Collaborations	Fuzzy	Driver	Low	1
Structural	collaboration with collector	I10	Collaborations	Fuzzy	Driver	Low	1
Structural	local collaborations	I10	Collaborations	Fuzzy	Driver	Low	1

Structural	collaboration with circular party	I7	Collaborations	Fuzzy	Driver	Low	1
Structural	Lack of full market collaborations	I7	Collaborations	Fuzzy	Barrier	Low	1
Structural	Lack of community building	I4	Collaborations	Fuzzy	Barrier	Low	1
Structural	Lack of supply chain internal collaborations	I4, IC	Collaborations	Fuzzy	Barrier	Medium	2
Structural	more collaborations needed	I6, IC	Collaborations	Fuzzy	Barrier	Medium	2
Structural	No direct collaborations with colleague companies	I2	Collaborations	Fuzzy	Barrier	Low	1
Structural	Supplier support	I5	Collaborations	Fuzzy	Both/None	Low	1
Structural	Potential for international collaborations	IA	Collaborations	Fuzzy	Both/None	Low	1
Structural	working towards mixing recycled and virgin material for impact and quality	I5	Focus on percentage recycled material	Fuzzy	Driver	Medium	2
Structural	Increasing the percentages of sustainable material	I3	Focus on percentage recycled material	Fuzzy	Driver	Low	1
Structural	Companies are aiming for a high percentage	I6	Focus on percentage recycled material	Fuzzy	Barrier	Low	1
Structural	no clarity on when to call something recycled	I8	Focus on percentage recycled material	Fuzzy	Barrier	Low	1
Structural	rules to call a low percentage recycled	I10	Focus on percentage recycled material	Fuzzy	Barrier	Low	1
Structural	weak material needs blending	I8	Focus on percentage recycled material	Fuzzy	Barrier	Low	1
Technological	Availability recycled polyester	I2	Specific fibres	Driver		Low	1
Technological	mechanical recycling of cotton	I7	Specific fibres	Driver		Low	1
Technological	nylon recycling	I4	Specific fibres	Driver		Low	1
Technological	quality recycled polyester	I4	Specific fibres	Driver		Low	1
Technological	wool recycling	I5	Specific fibres	Driver		Low	1
Technological	tread composition	IA	Specific fibres	Driver		Low	1
Technological	quality of chemically recycled cotton and polyester	I1	Specific fibres	Driver		Low	1
Technological	Blends cannot be recycled	I1, I2, I4, IA, I7, I10	Diminished potential for recycling	Barrier		High	3
Technological	Not willing to use chemicals	I8, I10	Diminished potential for recycling	Barrier		Medium	2

Technological	Coatings cannot be recycled	I2, I8	Diminished potential for recycling	Barrier		Medium	2
Technological	colouring is hard	I1, I2	Diminished potential for recycling	Barrier		Medium	2
Technological	Colours can be different	I7	Diminished potential for recycling	Barrier		Low	1
Technological	only able to recycle black and white	I8	Diminished potential for recycling	Barrier		Low	1
Technological	yarns are not always designed for recycling	I2	Diminished potential for recycling	Barrier		Low	1
Technological	no flexibility in fabric weight	I10	Diminished potential for recycling	Barrier		Low	1
Technological	contamination	IB	Diminished potential for recycling	Barrier		Low	1
Technological	not all materials can be used for recycling	I7	Diminished potential for recycling	Barrier		Low	1
Technological	Item specifications	I4	Item specifications	Fuzzy	Driver	Low	1
Technological	working on the level of elements	I5	Item specifications	Fuzzy	Driver	Low	1
Technological	labels of recycled PET	I5	Item specifications	Fuzzy	Driver	Low	1
Technological	Yarns from recycled polyester and cotton	I5	Item specifications	Fuzzy	Driver	Low	1
Technological	inside of jackets	I1, I4	Item specifications	Fuzzy	Driver	Medium	2
Technological	specifications for client companies	I2	Item specifications	Fuzzy	Barrier	Low	1
Technological	look of the items	I4, I9	Item specifications	Fuzzy	Barrier	Medium	2
Technological	chemical recycling (only) for synthetic fibres	I5	Item specifications	Fuzzy	Both/none	Low	1
Technological	attractive technologies for suppliers	I5	Item specifications	Fuzzy	Both/none	Low	1
Technological	leaving denim recycling to the experts	I9	Item specifications	Fuzzy	Both/none	Low	1
Technological	Successful pilot	I8	Tests and developments	Fuzzy	Driver	Low	1
Technological	Technological developments	I7, I9, I10	Tests and developments	Fuzzy	Driver	High	3
Technological	own unique technology	I3, I8	Tests and developments	Fuzzy	Driver	Medium	2
Technological	Proven technology	IC	Tests and developments	Fuzzy	Driver	Medium	2
Technological	India is far on recycled materials	I9	Tests and developments	Fuzzy	Driver	Low	1
Technological	covering risks in pre-trajectory	I7	Tests and developments	Fuzzy	Driver	Low	1

Technological	not far yet on chemical recycling of cotton	I7	Tests and developments	Fuzzy	Barrier	Low	1
Technological	slow developments	I2, I8	Tests and developments	Fuzzy	Barrier	Medium	2
Technological	lagging of chemically recycled cotton	I4	Tests and developments	Fuzzy	Barrier	Low	1
Technological	lack of technological expertise	IA	Tests and developments	Fuzzy	Barrier	Low	1
Technological	Ongoing/numerous developments	I5, I7	Tests and developments	Fuzzy	Both/none	Medium	2
Technological	ongoing feasibility study	IB	Tests and developments	Fuzzy	Both/none	Low	1
Technological	Creating an unending closed loop through chemical recycling	I7	Tests and developments	Fuzzy	Both/none	Low	1
Technological	quality of chemically recycled cotton and polyester	I2, I4	Quality	Fuzzy	Driver	Medium	2
Technological	production of felt	I10	Quality	Fuzzy	Driver	Low	1
Technological	quality is as good as virgin yarn	IC, I8	Quality	Fuzzy	Driver	Medium	2
Technological	no difference in quality for recycled polyesters	I9	Quality	Fuzzy	Driver	Low	1
Technological	Quality	I1, I2, I4, I5, IA, I7, I8	Quality	Fuzzy	Barrier	High	3
Technological	few options for material application	I4	Quality	Fuzzy	Barrier	Low	1
Technological	mix of recycled and virgin material	I8	Quality	Fuzzy	Barrier	Low	1
Technological	downgrading	I3	Quality	Fuzzy	Barrier	Low	1
Technological	different benchmarks for quality	IA	Quality	Fuzzy	Barrier	Low	1
Technological	downcycling	I10	Quality	Fuzzy	Barrier	Low	1
Technological	lower performance and strength	I10	Quality	Fuzzy	Barrier	Low	1
Technological	short fibres lead to weaker yarns	I6	Quality	Fuzzy	Barrier	Low	1
Technological	demands for high quality	I6	Quality	Fuzzy	Barrier	Low	1
Technological	lack of possibilities with long and strong fibres	I5	Quality	Fuzzy	Barrier	Low	1
Technological	destroying filament	I8	Quality	Fuzzy	Barrier	Low	1

Appendix F: Score per category and sub-category

Scores used for figure 8-17 (page 34-55)

Category	Function sub-category	Sub-category	Score
Attitudinal	Driver	Internal perception	14
Total score: 84		Dedication	13
		View of outer world	8
	Barrier	Negative perception towards recycling	5
		Trends	2
		Distantiation	2
	Fuzzy	Compromising	4
		Perception of influential actors	32
		Future expectations	5
Economic	Driver	Financial Space	5
Total score: 92	Barrier	Costs	6
		Competitiveness	5
		Profit margins	4
	Fuzzy	Investments	10
		Potential for business opportunities	11
		Prices	17
		Market developments	18
		Product value	16
Environmental	Driver	Creating a (more) positive impact	21
Total score: 47	Fuzzy	Uncertainty about impact	20
		Trade-off	6
Institutional	Driver	Existing public policies	7
Total score: 41		Private institutions	5
		Public Private Partnerships	3
	Barrier	Lack of governmental policies	8
		Lack of governmental action	4
		Lack of trust	4
		Counteracting Circumstances	5
	Fuzzy	Importance of governmental tasks	5
Operational	Barrier	Scale	8
Total score: 73	Fuzzy	Logistics	10
		Collection and separation	10
		Alternatives	5
		Constant supply	11
		Tracing supply chain	11
		Flexibility	11
		Accessibility	7
Organisational	Fuzzy	Ambition	11
Total score: 35		Engagement	17
		Company composition	3

		Pace of development	4
Structural	Driver	Communication value	5
Total score: 85	Barrier	Lack of action	5
		Lack of knowledge	8
		Intellectual property	1
	Fuzzy	Information availability	5
		Information exchange and transparency	33
		Collaborations	21
		Focus on percentage recycled material	7
Technological	Driver	Specific fibres	7
Total score: 72	Barrier	Diminished potential for recycling	15
	Fuzzy	Item specifications	12
		Tests and development	19
		Quality	19

Scores used for figure 6 and figure 7 (page 33)

	Drivers	Barriers	Both/none
Attitudinal	45	31	10
Economic	34	41	17
Environmental	25	13	6
Institutional	18	21	2
Operational	22	41	10
Organisational	22	11	2
Structural	41	39	6
Technological	29	36	7