SUPPLY CHAIN RELATIONSHIP MANAGEMENT FOR TEXTILE-TO-TEXTILE RECYCLING

– A QUALITATIVE INVESTIGATION FROM AN EUROPEAN PERSPECTIVE

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This is a one-year master thesis that is written for a master's degree with a major in Textile Management at the Swedish School of Textiles. The thesis aimed to deepen the understanding of how supplier relationship management can leverage textile-to-textile recycling in the textile industry.

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Abstract

Supply chain management is found to be highly related to collaborations among stakeholders to create successful strategies for the supply chain. To leverage circularity in the textile and clothing industry, successful circular strategies that support the businesses in an economic and environmental manner are key. Through this research, the interconnection and communication between the relationships within the supply chain are found to be the most significant factor. In this qualitative study, the purpose of the research was to investigate how relationships and partnerships in the textile supply chain can affect and enable commercial scale for recycling of textiles-to-textiles. In-depth semi-structured interviews with six key stakeholders in the European textile industry. This study found that relationship characteristics such as trust, communication and strategic values through long-term relationships and key suppliers play an important role in realizing textile-to-textile recycling. Furthermore, findings confirm that the financial aspects are the most prominent condition for textile recycling to improve win-win partnership models to promote key operational conditions. With Europe having a leading position in the textile industry, the research study has geographically limited the empirical scope to solid focus on textile supply chain and business relationships in Italy to provide the study with accurate cluster accusation.

Keywords: Supply Chain Relationship Management, Textile Recycling, Textile Waste, Circular Economy, Business Relationship

List of Abbreviations

Abbreviation	Definition/Description
CE	Circular Economy
CECSC	Circular Supply Chain
CLSC	Closed Loop Supply Chain
EPR	Extended Producer Responsibility
SC	Supply Chain
SCM	Supply Chain Management
SME	Small-Medium-Enterprise
SRM	Supply Relationship Management
T&C	Textile and Clothing
WFD	Waste Framework Directive

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1. Introduction

The chapter gives a context to the topic of supply chain management and the movement from a linear to a circular supply chain within the textile industry.

1.1. Background

Circular strategies for supply chain management in the textile and clothing (T&C) industry have received increasing attention in recent years. To leverage circularity in the textile and clothing T&C industry, successful circular strategies that support the businesses in an economic and environmental manner are key (Milios 2018). Hence the development of relationships, partnerships, and collaboration is a strategic opportunity often mentioned to help create circularity (EMF 2017). Regardless of the SC, the T&C industry encapsulates a global network of companies and organizations, buyers, suppliers, customers and third-party providers with the consequence of a comprehensive range of relationships thus demand the acknowledgement of internal and external factors (Lambert, Emmelhainz & Gardner 1996; Mohapatra, Tripathy, Dash & Biswal 2020). Collaboration is particularly needed around closing material loops on recycling technologies. It is found that when brands collaborate and approach suppliers directly, the confidence for suppliers to develop new products increases (Watson, Elander, Gylling, Andersson & Heikkilä 2017).

The T&C industry is an aggressive user of non-renewable resources, high energy consumption, chemicals and water, emissions of pollutants, and enormous textile waste (Milios 2018). This increases as the industry grows and the SC process begins again with the same environmentally harmful processes as before (Sinha, Muthu & Dissanayake 2016). This to the extent that the T&C industry is acknowledged as the second-largest polluter in the world, just after the oil industry (UN 2019). During the last 15 years the sales of T&C has doubled and their utilization has decreased by 36 %. Once the clothes have been used, they are thrown away and about 73% of these clothes worldwide end up in landfills or are incinerated. Only 1% of the clothing is recycled within a closed system (EMF 2017). The two key fibers used in production are cotton and polyester which represent over 85 % of global fiber production (Muthu 2019). Cotton relies on finite landmass for agricultural and food production (Muthu 2019) and is furthermore one of the most polluting fibres (Luiken and Bouwhuis 2015). Additionally, it is stated the cotton production is at its limits and stabilized at 25 Mton/Year on what annually can be produced (Aronsson & Persson 2019). With growing population and demand, resource management and ensuring the raw material for the future has become a high promoter in the industry (Wang 2010).

The preponderance of the industrial textile production and manufacturing in Europe occurs in Italy, France, Germany and Spain which together account for a third of the total global production (Euratex 2020a). Hence the manufacturing industry is recognized as an imperative feature for the economy, marketplace, and welfare throughout Europe. Key figures from 2019 show that the European T&C sector has a turnover of 162 billion euros, with approximately

160,000 companies where over 99% of the companies are micro and SME (small and medium) enterprises, employing 1.5 million people (Euratex 2020a). Furthermore, key figures from 2019 show that the European T&C sector exports approximately € 61 billion (+ 4.8% from 2018) and imports € 109 billion (+ 3.3% from 2018) (Euratex 2020a). Due to the geographic perspective of the research focus, Italy has a limited but developed business regarding the manufacturing of both recycling pre-consumer waste (Hall 2019) and post-consumer waste (ASTRI n.d.).

This traditional SC is known as a forward-looking or linear SC that is recognized as a resource- and labor-intensive industry in production and manufacturing. The SC flow goes from raw materials, production, and manufacturing, to distribution and retail, consumption, and disposable waste (de Brito, Carbone and Blanquart 2008; Fletcher 2014). The immediately interchangeable fashion and the great demand for new fashion trends and variation in garments ultimately become a short life cycle and fall within the take-make-dispose pattern, where resources are extracted, used, and manufactured into products that are then discarded at the end of their service life (EMF 2017). In recent years, there has been a paradigm shift in the T&C sector from environmentally destructive to a more sustainable industry, by introducing a circular supply chain (CSC) and promoting more sustainable and environmentally friendly solutions for the industry (EMF 2017). An extensive factor in the textile industry's transition from a linear SC to a circular one for the scaling of recycled feedstock is to foster textile-to-textile recycling. In the aspect of circular economy (CE), the integration of recycled fiber in the supply chain and the development of a versatile network and imposing collaborations as for the importance of all stakeholders with focus on design, closed-loop supply chain (CLSC) and reverse logistics has been emphasized in academic literature (Payne 2015; Watson, Palm, Brix, Amstrup, Syversen & Nielsen 2016; EMF 2017; Geissdoerfer, Savaget, Bocken & Hultink 2017; Watson et al. 2017; Niinimäki, 2019; Roos, Sandin, Peters, Spak, Bour, Perzon & Jönsson 2019; Sandvik & Stubbs, 2019; Jia,Yin, Chen & Chen 2020).

1.2. Problematization

The transitions for sustainable and circular practices within the T&C sector demonstrate growing pressure from NGOs, institutions, and communities on firms and organizations to adopt sustainable change in supply chain processes and activities (Dubey, Gunasekaran, Childe, Papadopoulos & Helo 2019). Following, an increasing pressure on governments to incorporate stricter policy commitments on sustainability with improved laws and regulations on resource management in production and consumption, for the disposal of resources and waste (Choi & Dooley 2009).

The transitions show that solution-oriented strategies, including closed-loop and reverse logistics, can improve sustainability and reduce resource consumption (Fletcher 2014; Sinha et al. 2016; Pal, Sandberg & Paras 2019). Although, the current situation shows that only 1% of clothes recycles in a closed system. Consequently, the commercialization of circular practices with broader activities in textile recycling is a necessity for the textile industry (EMF 2017). A concerning aspect of the situation relies on the textile recycling operations,

thus facing issues with the feasibility and barriers along the route of implementation throughout the SC (Kazancoglu, Yarimoglu, Kazancoglu & Kahraman 2020).

Previous academic research indicates that opportunity lies in further collaboration and communication between stakeholders that can help scale and commercialize the textile-to-textile recycling (Geissdorfer et al. 2017). Geissdorfer et al. (2017) highlight that the change can not only come from one stakeholder in the supply chain. It is also found in academia that business relationships in the long term perspective can improve and strengthen the business. Hence it provides the SC with the opportunity to improve project performance by developing and building relationships of different levels across the supply chain (Håkansson & Snehota 1995; Matopoulos et al. 2007; Bygballe, Jahre & Swärd 2010; Quinn 2015). Furthermore, a long-term commitment of relationships can presuppose the possibility of achieving specific business goals for the SC to maximize efficiency based on the utilization of all key parties and the sustainable management of resources (Bygballe, Jahre & Swärd 2010).

This incitement means that the circularity and commercialization of recycled materials can be made possible through clear strategies for processes and assets. Hence also building strong business collaborations for textile circularity.

1.3. Purpose

The purpose of this research is to investigate how relationships and partnerships in the textile supply chain can impact the commercial scale of textile-to-textile recycling. By identifying relevant components along the supply chain, the research aims to understand the circumstances to leverage textile-to-textile recycling of pre-and post-consumer waste.

The research contributes to examining both the textile recycling processes, relationship management, and current textile circular economy, and thus hope to be able to develop a more comprehensive knowledge of how to close the loop with recycling origin textile and its implementation in the industrial sector. As collaboration is playing an important part of the scaling of textile-to-textile recycling, an interest is found in developing more comprehensive knowledge and understanding regarding Supply Chain Relationship Management and its impact in the industrial sector.

For this reason following research questions (RQ) are developed:

RQ 1. What factors may play a significant role for relationships within supply chain management in the textile industrial sector and for textile recycling?

RQ 2. What conditions are required for (pre-consumer and) post-consumer waste to demonstrate commercial scale in a textile-to-textile recycling?

1.4. Delimitation

The research refers to a geographical delimitation for European industry with a focus on Italy. Thus to establish accurate and trustworthy quality within finding from the stakeholders perspective of who operate and interact in a specific market.

Supply chains and organizations outside of Italy or working in relation to Italy were only considered if a corresponding company was not found in Italy. The company would, although have high relevance to the Italian supply chain, in order to narrow the scope down. Only one company interviewed was located outside of Italy. All companies interviewed are working in an international field and have international suppliers and/or markets. Furthermore, only one company per SC processing step was interviewed or companies which cover several processing steps. Furthermore, the research delimitation does not involve government institutions, non-governmental organizations and associations perspectives. A company from a test institute for textiles and project initiatives in textile sustainability and circularity were interviewed to get an industry-wide perspective.

The aspects of textile recycling were delimited to only consider mechanical recycling processing. Aspects of chemical recycling or other recycling processes implemented are not covered by this study. The focus of the fiber was defined to first and foremost consider cotton and secondly wool.

2. Theoretical Frame of Reference

The following chapters introduce previous research and theories that were essential to the implementation of the study. The chapter is divided into the two topics the research paper investigates. The first section focuses on concepts, theories and aspects on supply chain management. Followed by introduction of circular economy. The second topic takes on internal and external aspects of textile recycling.

2.1. Textile Supply Chain Management

The textile SC as a concept explains the process flow of core activities between suppliers, manufacturers, wholesalers, and distributors to deliver a finished textile product to the significant end consumer (See figure 1) (Hedén & McAndrew 2005). In each stage, value has been added to the product because the focus is on succeeding with maximum customer satisfaction (Burns & Mullet 2020). Within each stage, a composition of relationships and partnerships of businesses and organizations are operating across the SC processes and activities. The planning and control of these processes are defined as supply chain management (Porter 2004; Lambert & Enz 2017).

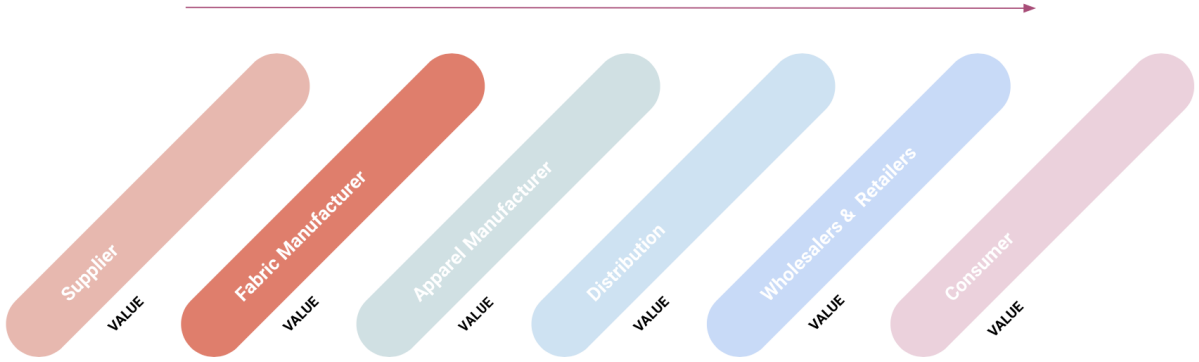

Figure 1 illustrates the structure of the textile supply chain stages and flow, described in the text above.

Furthermore, the term sustainable supply chain has addressed different concepts and strategies, as being parts of concepts within CSC with examples of reverse logistics and closed-loop (Farooque, Zhang, Thürer, Qu, & Huisingh 2019).

Reverse Logistics. A supply chain of reverse logistics means *"the collection of used products, consolidation, inspection and sorting, and transportation of those products for various recovery options"(Sinha et al. 2016 p.13).* This involves moving or transporting goods of new or used product that is still of value that has been consumed or previously shipped, reintroduces materials and products into a reverse SC for recycling or remanufacturing (Sinha et al. 2016). In the acquisition of reverse logistics, SCM requires

appropriate planning and control of activities to enable value creation and business-related aspects.

Closed Loop. The concept of a closed-loop is to use waste and disposed resources into a new product life cycle that would otherwise have resulted in landfills (Sinha et al. 2016). By maximizing the longevity of the products, the utilization of scarce and energy-intensive resources becomes more efficient, which contributes to minimizing waste and environmental pollution (Sinha et al. 2016). Thus to help the product or resources and allow it to circulate in society until they are no longer usable.

CLSC differs from reverse logistics in terms of the possibility of being integrated into the forward or linear supply chain and with reverse logistics (Sinha et al. 2016). Hence reverse logistics solely manage post-delivered products with reintroduction in a new supply chain (ibid)

2.1.1. Supply Chain Management

Supply chain management (SCM) indicates planning and control management for activities and processes across the SC, effectively managed through a network of collaborations (Lambert & Cooper 2000; Porter 2004; Lambert & Enz 2017). Dubey et al. (2019) argue that collaboration between suppliers and buyers with influential business relationships throughout the SC has a greater degree of scope for enabling sustainable proposals.

The development of business relationships begins with the identification and analysis of which set of qualified parties can promote the supply chain to advantage. This to demonstrate the extent of the relationship performance and its ability to develop with additional qualifications hence it will affect the supply chain flow and the possibilities of proactive business decisions (Håkansson & Snehota 1995; Quinn 2015). The interactions between buyers, suppliers and customers can distinguish the interest and awareness in collaborations and relationships and in different types of partnerships (Quinn 2015). Regardless of the structure of the relationship, it aims to build on trust, commitment to common goals, open communication, and understanding of each other's expectations and values (Brito et al. 2008; Rusanen, Halinen & Jaakkola 2014; Quinn 2015). However, Matopoulos et al. (2007) further believe that encounter barriers in establishing relationships and collaborations in the supply chain are associated with limitations of effective communication, such as data and information exchange. Since some companies or firms have newer technical attributes connected to technological development such as e-business applications than others or lack of technical knowledge areas, this affects the ability of active buyers or buyers to connect or interact across the supply chain (Matopoulos et al. 2007).

A factor that academia emphasizes is the understanding of different relationships and partnerships' values for how the supply chain management can generate profitability in the business strategy (Lambert et al. 1996; Brito et al. 2008; Mohapatra et al. 2020). Supply chain management deals with the total planning and control across the supply chain process flow thus supplier relationship management (SRM) focuses on key suppliers and partners in each business process and strives to improve the value and efficiency of the entire supply chain by

achieving common goals. A study by Lambert and Schwieterman (2012), acknowledged through a macro business perspective, demonstrates product and service agreement as a driver for SRM, Lambert and Schwieterman (2012) advocate that a product and service agreement, through a small group of key suppliers and key customers of long-term partnership, will improve value creation and achieve profitability of competitive advantages. This incitament introduces a so-called cross-functional operating system where the information flow transports across the SC (Lambert & Schwieterman 2012). By focusing on a small group of key suppliers with closer relationships the functions can gain optimized and maximized productivity and a greater focus on "customer-focused system" due to fluctuations in customer demand (Lambert & Cooper 2000; Lambert & Schwieterman 2012). Following the cross-functional system, the supply chain should only include a collection of intangible resources of specialized know-how, skills, experience, creativity and tangible resources such as software, equipment, and devices that will distinguish a product, service or supply chain flow from competitors (Lambert & Cooper 2000 ; Lambert & Schwieterman 2012; Rusanen et al. 2014).

According to Garcia-Torres, Albareda, Rey-Garcia and Seuring (2019), following The European Commission, one of the key priorities for SSCM is transparency due to the support and transformation in supply chains. Moreover, due to the technological development, further possibilities of various innovative systems, the commitments and enhancement in sustainability can increase. Through cross-functional collaboration strategies, the authors believe that through traceability, the business can thus support the environment, society and economy. This contributes to a more even distribution of resources and the transfer of knowledge and learning that can further deepen the capacity that demonstrates competitive advantages. In societies with value creation and risk management, the authors believe that the integration of advanced and complex processes contributes to the development and strength of traceability in the SC (Garcia-Torres et al. 2019). It is also about optimizing cost savings and profitability.

2.1.2. Definitions of Business Relationships

Business relationships are a concept that summarizes different types of relationships that prevail supply chain management. One typical form of relationship is closed collaboration between two businesses thus can be recognized as customer-supplier or supplier-buyer with focus is on each business's features and functions or the characteristics supplement to interact and develop the processes (Håkansson & Snehota 1995). Gattorna and Walters (1996) describe this form of relationship as vertical and refer to strategic partnerships or solid partnerships. Another one form of relationship is an open structure that mimics a network of interdependent relationships, linked together and are dependable on each party (Håkansson & Snehota 1995). This relationship can also be described as horizontal and refer it to alliance, thus *"the purposes of entering into a strategic partnership are to achieve objectives that otherwise could not be realized and to reduce the overall risk of a project while increasing the return on investment; at the same time the partnership will aim to maximize the utilization of scarce resources"(Gattorna & Walters 1996 p.189).* Regardless of relationship form, the strategic partnership, vertical or alliance, horizontal, should both generate direct short-term

benefits for the partners and at the same time identify unexpected possibilities for long-term benefits (Gattorna and Walters 1996).

Furthermore, Håkansson and Snehota (1995) argue that circumstances that can form the basis for the development of business relationships. These are *"technology, knowledge, social relations, administrative routines and systems, and legal ties" (Håkansson & Snehota 1995 p.26).* Håkansson and Snehota (1995) argue that technology is of great importance for the industrial sector due to its impact on progression flow from design, production and manufacturing but also logistics and planning. Due to the business relationship, each company represents a set of core competencies and tangible and intangible resources that will be essential and well-selected for the purpose. Håkansson and Snehota (1995) believe that the main asset a company possesses is tacit knowledge as this cannot be copied but distinguishes business previously developed experiences are developed and thus reflects the company's reputation. Therefore, *"the knowledge of a company and its competence depends on its relationships, which is thus an important tool for connecting the knowledge from different actors" (Håkansson & Snehota 1995 p.27).* According to Håkansson and Snehota (1995), the business relationship is consistent with social networks in different contexts. Social relations demonstrate a mutual trust within the business relationship between the stakeholders that interact across the supply chain, regarding the commitments and responsibilities. Furthermore, it affects the connectivity and efficiency to improve the performance. The administrative system controls communication and information access and thus has an important role for the parties understanding and collaborating. One aspect that stands out is the lack of data and the cost of maintaining and developing a relevant communicative information system as all partners may have insufficient scope for understanding the meaning. Håkansson and Snehota (1995) argue that underlying causes are related to language barriers, technical and cultural. To reduce the risk of misunderstandings, this should assume an imperative position in relationship development in the network in the supply chain management (Håkansson and Snehota 1995). According to Håkansson and Snehota (1995), the legal ties can *"connect different business units with privileged ties"(Håkansson and Snehota 1995 p.29)* and *"especially to different forms of ownership control or other forms of agreements" (Håkansson and Snehota 1995 p.29).* Hence it may affect the development and establishment of new units abroad or technology, third-party agreements, joint ventures, and licensing agreements depending on the form of relationships held in the network (Håkansson and Snehota 1995).

Business relationship in terms of partnership is not a fundamental factor for success, but the phenomena of success through relationships can benefit the feasibility and profitability. Thus the acknowledgement relies on distributing certain relationship forms on various levels to manage concrete and necessary resources (Lambert et al. 1996).

"A partnership is a tailored business relationship based in mutual trust, openness, shared risk and shared rewards that yields a competitive advantage resulting in business performance greater than would be achieved by the firms individually" (Lambert et al. 1996 p.2)

The partnership model is a tool for designing existing business relationships with identification and analysis to define key relationships that are considered to be of value

(Lambert et al. 1996). The model classifies six characteristic business relationships and distinguishes these between high- and low-value. The model defines the non-partisan relationship as arms length, an independent business agreement between buyer and supplier with separate activities and doesn't interact. Joint venture, a business arrangement of two independent firms conducting a project with joint control. And vertical integration, a business agreement of two or more organizations with common factors and attributes by integrating processes or stages. The definition of partnership follows three levels. *Partnership Type 1* defines a short-term relationship with partial participation through activities and planning. *Partnership Type 2* describes a long-term relationship with a commitment to partners in coordinating and integrating activities. *Partnership Type 3* describes the incorporation of a long-lasting operational integration at a significance level without a time frame for the relationship partnership. The identification and analysis of the characters follows three elements: *drivers, facilitators, and components* (Lambert et al. 1996).

Drivers. This element includes that both parties see the potential for benefits around the partnership like cost efficiency, market benefits, and economic growth (Lambert et al. 1996). Moreover, to enhance exquisite development opportunities, managed by the partner thus need to benefit the significant other. However, these benefits do not have to be the same but equally exceed the request (Lambert et al. 1996). Consequently, without having a significant role for the purpose nor reflecting the business model strategy, it might not be considered as drivers.

Facilitators. The element has a significant role to play in considering the development of relationships between stakeholders. Hence the element corresponds to how supportive the environment is the ability to manage the integration of the relationship in the form of development potential by the partnership sharing like-minded compatible values, risk-taking approach, the goal for success, and competitive advantages (Lambert et al. 1996). An additional aspect Lambert et al. (1996) refers to demographic similarities in terms of the establishment of market, finance, and reputation, also the capabilities of technological utilization in both tangible and intangible resources.

Components. The element refers to the enabling of operational processes and activities to create a reliable and sustainable relationship. One of the most prominent components of such a relationship is communication, which contributes to efficiency throughout the supply chain as both costs, lead-time, misunderstandings, or gaps can be reduced (Lambert et al. 1996).

Lambert et al. (1996) believes that developing a partnership without legitimate consent will minimize the chances of profitability and competitive advantages and instead dissipate valuable resources and be directed to become time and costly. Thus, Lambert et al. (1996) believes companies can, through the developed model, analyze and evaluate the most suitable form of partnership.

2.2. Circular Economy

Circular economy has increased immensely in the last years in business and industry context with interest around the economic models (Jia et al. 2020). The concept of CE stands for

retaining society's resources in a cycle by reusing and recycling products, resources, and materials, both biological and technical cycles to maintain economic value (Farooque et al. 2019).

The Ellen MacArthur Foundation (2017) is working deliberately in shifting the linear textile SC to a circular one. CE has emerged as a fundamental tool coping with economic growth and sustainable development going hand in hand (Franco 2017). Previous research on CE agrees that the industrial economy is restorative and regenerative by intention and design (ibid). In 2017, the Ellen MacArthur Foundation proposed a new textiles economy for the industry including and imposing brands to implement new business models around design, remanufacturing, repairing reselling, rental and recycling (EMF 2017). One of the fundamental differences in terms of SCM, between linear business structures and circular, is the view of relationships in general (Bygballe, Jahre & Swärd 2010).

Chertow and Lombardi (2015), relate the CE to industrial symbiosis, which refers to resource sharing between joint ventures. It offers a material or product circularity between different industrial companies within the same country, region, or nearby companies that can thus use the waste from one company that can identify as valuable material to another (Chertow and Lombardi 2015; Milios 2018). This not only offers reduced use of new resources but also prolongs the material life cycle (Chertow & Lombardi 2015; Milios 2018). Additional benefits that demonstrate through this strategy are the financial ones linked to compromised need for logistics due to closer destinations. Furthermore, economic benefits are acknowledged due to the cost-effectiveness of reducing the need for insurance and legal documents. Hence lead time and financial approach towards sourcing and purchase of raw materials, and the possible reduction of costs for the production and manufacture of chemicals, water, and energy.

The concept of Circular Supply Chain Management (CSCM) is to integrate the CE within the SCM, thus the achievement of a more sustainable perspective on a supply chain (Farooque et al. 2019). Yet today, the concept of CSCM is still a young term and quite unexplored area (Lahne, Kant & Shankar 2020), where mainly desktop research of current literature has been conducted.

Farooque et al. (2020) argue for the potential in CSCM practices as it can improve organizations' breakthroughs in sustainability practices. However, there is a need to create both sustainable and circular strategies for the SC practices so the collection of post-consumer textiles is put back in the system to be recycled into new T&C (EMF 2017). Furthermore Lahne et al. (2020) find in their research that the topic has received increased interest since 2017 and onwards, with an exploitative amount of scientific papers published around CSCM. Farooque et al. (2019) as well highlight the increased interest in integrating CSCM practices into SCM. Furthermore, (ibid) notice the need of a clear definition of CSCM and through their research conclude on the following definition of CSCM:

"Circular supply chain management is the integration of circular

thinking into the management of the supply chain and its surrounding

industrial and natural ecosystems. It systematically restores technical materials and regenerates biological materials toward a zero-waste vision through system-wide innovation in business models and supply chain functions from product/service design to end-of-life and waste management, involving all stakeholders in a product/service lifecycle including parts/product manufacturers, service providers, consumers, and users."

(Farooque et al. 2020 p.884)

According to previous studies on the reverse supply chain, there has been a demand for sustainability and CE in the T&C industry (Jayaraman & Luo 2007; Sinha et al. 2016; Pal et al. 2019). This through reverse SCM and activities have acquired contemporary consciousness due to value creation in recycling textile waste (Pal et al. 2019). Jayaraman and Luo (2007) further believes that research in supply chain management on reverse supply chains has shown a contradictory effect with a greater focus on corporate relations in the cross-functional systems rather than end-customer. Consequently, to enable efficient corporate strategy for reverse logistics in a recycling system believes Pal et al. (2019) that a key factor for success does rely on the relationship in a cross-functional integration to enable a CSC. Brito et al. (2008) also mean that the business relationships, referred to as multi-disciplinary teams, play an essential key role regarding product and process innovation with, among other things, technological developments and high-skilled labor. Such statements can enhance customer satisfaction, and internal and external value creation (Pal et al. 2019) for further business performance. Thus, Jayaraman and Luo (2007) believes that *"Reverse logistics should be part of the overall business strategy for any value chain partner" (Jayaraman & Luo 2007 p.71).*

2.3. Textile Waste and Textile Recycling

Textile waste is generated along all production steps of the textile SC and can be classified into three categories: pre-consumer, post-consumer and post-industrial. Pre-consumer refers to waste that is generated by the production steps of textiles and are bi-products produced from the production process. Post-consumer refers to clothing that has been worn and no longer desirable for the user. Lastly, post-industrial waste is waste generated at the manufacturing process (Hawley 2006; Muthu 2019; Islam 2021).

The process of textile recycling starts with the collection of used clothing. The first step in the recycling system is that the textile and clothing are collected. The collection of textiles and clothing differ if it is considering pre-, post-consumer or post-industrial textile waste. Pre-consumer and post-industrial cotton waste is collected during the spinning, weaving, and cutting process (Muthu 2019). Furthermore, there are platforms such as the Re.Verso enables the trading of pre-consumerand post-industrial waste between stakeholders and as well

increases transparency (Watson et al. 2017). The collection of post-consumer textiles starts normally with collection bins within the public or take-back bins at retailers and brands (Watson et al. 2016). After collecting the waste, it is sorted. The current sorting process for post-consumer textile waste is a manual process, where each piece of clothing is evaluated in terms of its quality and condition. This process and evaluation determine if these clothing can be used again or will have to be recycled (ibid). The clothing for reuse and recycling is sorted on product typology (Watson et al. 2016). To sort textiles and clothing manually for textile-to-textile recycling is difficult due to two reasons. First, the introduction of fast fashion clothing has led to more blends in the T&C (Greenpeace 2017), which makes it impossible to determine the fiber composition. The Fast Fashion movement has further led to the decreased quality of textiles and clothing (Bvse 2020). Secondly, with approximately six seconds to determine the quality of a garment, it is not possible to determine the composition according to the care label within that time. Sorting facilities as well report that around 50% of the clothing has no label to check, since it is removed or washed out (Texaid 2017).

This leads to the sorting for recycling that needs to be optimized and automated, which enables T&C to be sorted in substantial amounts at a higher speed. Furthermore, enabling the textile sorting on material composition, construction (woven or knitted) and color (Circle Economy 2020b). New automated solutions are emerging and can be accomplished by different technologies (Englund, Wedin, Ribul, de la Motte & Östlund 2018; Leal, Ellams, Han,Tyler, Boiten, Paço, Moora & Balogun 2019; Gunnarsson and de la Motte 2019). One option would be to sort with a near infra-red technology which can the first layer of the clothing and matches the scanned value with a database and so knows which composition this material has (Circle Economy 2018; Englund et al. 2018; Gunnarsson & de la Motte 2019). Furthermore, there are other technologies coming, like sorting with RFID-, QR- or NFC- (Englund et al. 2018; Leal et al. 2019), but these technologies then need to be integrated into the clothing piece already in production. Leal et al. (2019) as well mentions blockchain or material passports as technologies, which would enable transparency and product verifications.

Textile waste can be reutilized in different loops at different processing steps in the SC. The recycling of textile waste is distinguished between open- and closed-loop recycling, where closed-loop recycling refers to when the material from a product is recycled and used in a similar product (i.e textile-to-textile recycling). The closed loop recycling can be divided into upcycling or downcycling. Whereas open-loop recycling or downcycling refers to processes in which the material from a product is recycled and used in another product, often in other industrial areas or where i.e. PET bottles are recycled into textile fibers. The least preferable method is the energy recovery of T&C for generating heat or electricity (Gulich 2006; Payne 2015; Sandin & Peters 2018).

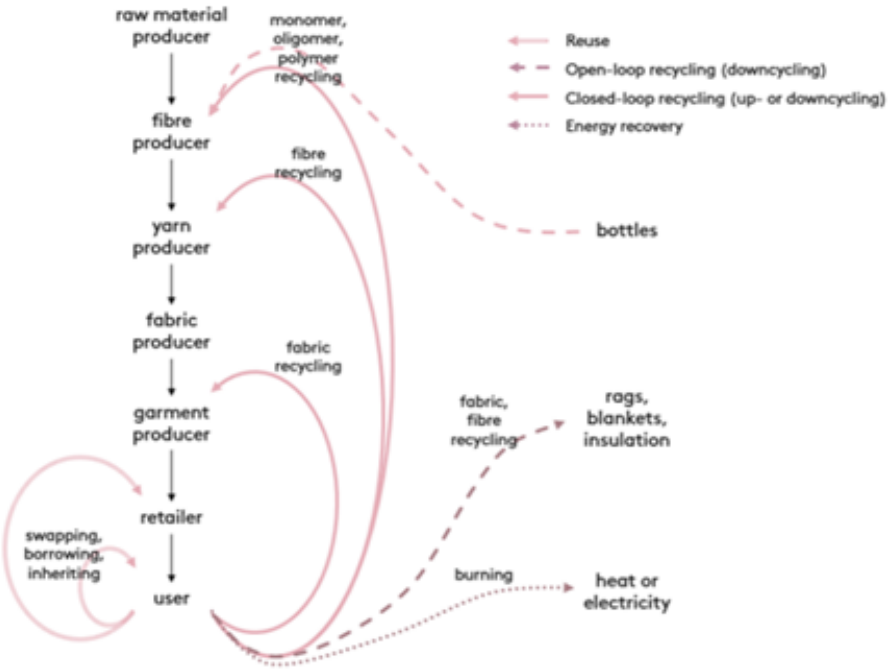

Figure 2. Reuse and recycling loops (Sandin and Peters 2018)

Pre-consumer and post-industrial waste is to some extent already recycled in their corresponding processing step, i.e. spinning waste is used again during the spinning process (Muthu 2019). Pre-consumer denim, which mainly contains cotton, is shredded and reproduced to yarn for the weft insert in the weaving of new denim. These fibres are mostly shorter than virgin fibers, but can be reused in weft insert yarns by mixing them with virgin fibres, using up to 50% recycled fibers. The quality of the final jeans is not influenced by the recycling of pre-consumer denim (Luiken & Bouwhuis 2015). If pre-consumer waste is not recycled into textile fibers and yarns, they are recycled through an open-loop into products to other industries, so as for the post-consumer waste. Today, cotton material is mainly downcycled into cleaning rags and wipers, and textile blends shredded into a fiber mix called shoddy which is used to develop acoustic panels in the automobile industry (Gulich 2006a; Hawley 2006; Wang 2006; Watson et al. 2016; Sandin & Peters 2018). There are, although niche recycling is already at a commercial scale for the textile-to-textile recycling of wool. Recycling systems and processes for wool exist in the geographical area of Prato in Italy (Hawley 2006; Hall 2019). Wool has been recycled in Prato for several hundred years, where a specialized supply chain for wool has been built up. Knitted wool products are sorted based on their wool quality. Cleaned in terms of removing non-textile parts, shredded and spun into new yarns (Hall 2019).

The commercially implemented recycling process is mechanical recycling (Gulich 2006a). After the sorting, the material is cut into smaller pieces before being transported into a drum where the textile pieces are processed under 3-6 rotating cylinders. All cylinders having different steel pins which are tearing up to textile construct to fibers (Gulich 2006a; Aronsson & Persson 2019). When using mechanical recycling, the color of the original textile is utilized, which as well as environmental benefits as the clothing might not have to be dyed

(Roos et al. 2019). Although the process needs sorting on color to receive a wished colored output. Furthermore, the process is well suitable for mono material or fabrics consisting of only one fiber or an extremely high amount of one fiber. This due to the fiber put into the process is as well the fiber and its pureness which will come out of the process (Gulich 2006b; Gunnarsson & de la Motte 2019).

Woven and knitted fabrics can be regenerated through a mechanical process, although Ütebay, Çelik and Çay (2019) found that knitted textiles have the best outcome from a mechanical recycling process. The shredding of the tearing process is an intensive process that has shown to have a negative impact on the fiber length (Ütebay, Pinar & Ahmet 2019; Aronsson & Persson 2020; Lindström et al. 2020). The reduction of fiber length is believed to be caused by friction when shredding between the fibers (Lindström et al. 2020). Lindstörm et al. (2020) see a potential in using a lubricant when shredding to increase the fiber length. During the mechanical recycling process, a staple fiber is obtained and can be spun into a yarn. The spinning of fiber depends on the fiber length obtained in the shredding (Aronsson & Persson 2020). Once the yarn is spun it is integrated with the existing textile supply chain and can be knitted or woven, manufactured into a product, distributed to the market (Muthu 2019).

The recycling of post-consumer cotton denim implies difficulties, because the material is less homogenous in terms of color, material composition and potential blends. Lastly fiber quality and trims. Where trims should be removed before the recycling for and processing to a new yarn (Luiken & Bouwhuis 2015). Therefore the recyclability of a certain T&C is connected to the garment design. Through the pyramid seen in figure 3, the recycling complexity is explained such that the recyclability of T&C is increased and the product complexity decreases. If T&C are of complex technical design, with many layers and trims, they are as well very hard to recycle (Gulich 2006b).

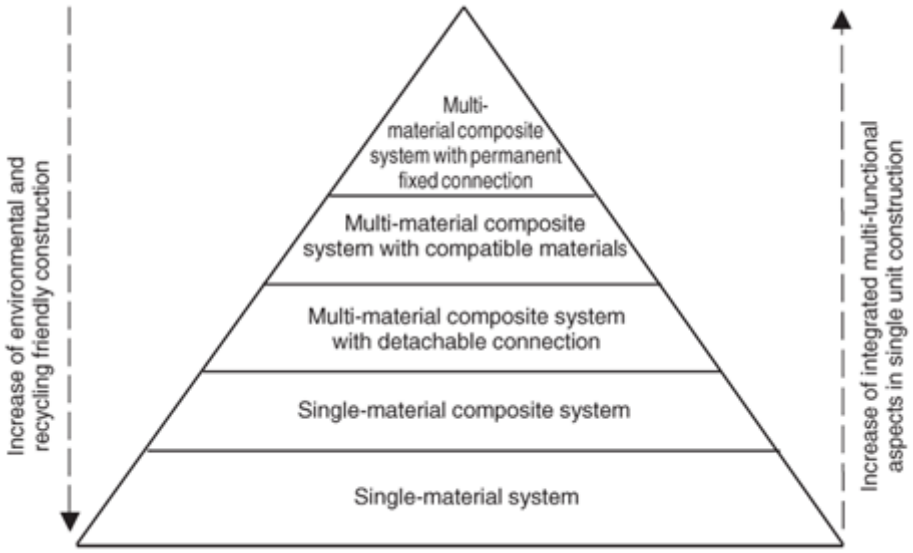

Figure 3. Recycling complexity (Gulich 2006b)

2.3.1. Financial Aspects of Textile Recycling

The collection and sorting business models are cross-financed by the products in the highest condition and quality also called the cream quality. Recycling is only an aspect of minimizing the waste. As an increasing number of textiles is estimated with a lower quality which will need to be recycled, financial incentives are needed to make the collection and sorting of textile waste economically feasible (Ljungkvist, Watson & Elander 2018). For the mechanical recycling of products, it is found that their financial viability is highly related to the feedstock price (WRAP 2019); this means the price of the sorted textiles. Leal et al. (2019) as well mentions, without supportive government policies and standards, the broader recycling industry cannot grow rapidly. Huang, Azevedo, Lin, Cheng and Lin (2021) reports that it is found that an immense amount of investments are needed with low economic benefits in the short term. Mishra, Hopkinson and Tidridge (2018) confirms this with insight of high cost in facilitating the recycling operations.

2.3.2. Regulatory Concerns

Within the EU, textile waste is regulated under the EU Waste Framework Directive, council directive 2008/98 (EU) and the textile industry is therefore obliged to follow the EU Waste Hierarchy, including the 3 R´s; reduce, reuse, recycle (See figure 4). Operations covered in the waste management are the collection, transportation, sorting and then ensuring that the Waste Hierarchy is followed. The first step of the Waste Hierarchy is to prevent waste from being generated by reducing the generation of waste. The second step is preparing it for reuse, meaning i.e. sorting (EU Council directive 2008/98). From an environmental and economic perspective textile that can be worn and reused should go into this cycle (Muthu 2019). Afterwards the products can be recycled, recovered or, if not possible, disposed of. Recycling operations are referred to as processing where waste material, which cannot be reused, are

processed into products and materials for the material or material used for other purposes. When waste cannot be prevented or recycled, recovering its energy content is better than landfilling it, which is the least preferable option (EU Council directive 2008/98).

Figure 4. Waste hierarchy (European Commission n-d.)

Within the WFD, T&C are mandatory to be collected separately by latest 2025. Due to this it is estimated that the collected clothing will rise from the current 2.2. million tons to around 4.7 to 5.5 millions tons (Euratex 2020b). As of the implementation of mandatory separate collection and due to the cross financing of the textile collection and sorting operations, financial support is needed to shift the cost structure (Ljungkvist, Watson & Elander 2018). Therefore, the discussion of implementing different policy measures and furthermore an *extended producer responsibility* (EPR) for textiles has increased, with proposals for implementing EPR systems in different countries (Policy Hub, 2021). An EPR system is a financial incentive put on products once they are produced and put into the marketto finance the recycling of these products (OECD n.d.). Hole and Hole (2020) report that due to the increased material recycling through the Waste Framework Directive 2018/851 the introduction of an extended producer responsibility (EPR) scheme for waste management is required. Hence the recycling operations not being able to cover the cost of the operation itself. Through an EPR system, the responsibility of the disposal is placed on the producers and importers.

Until now, France is the only country within the EU and in the world which has implemented an EPR for textiles. It was introduced in 2008 and facilitated an increase of 21% of collected textiles, clothing, and shoes and doubled the amount sorted (Refashion 2019).

Furthermore, a new textile strategy for the EU is under development and estimated to be published in the fall of 2021 (Wright 2021), where it is assumed that an EPR scheme for textiles will come.

Additionally to the Waste Framework Directive, further regulations are directly in relation to the textile waste. The used clothing is excluded from the product legislation, Council regulation (EU) 1007/2011 (2012). As well as the REACH legislation on chemicals, Council

regulation (EU) 1907/2006 (2007). Concerning the import of clothing, there are as well countries banning the import of used clothing (Watson et al. 2016). Furthermore, the export and import of used clothing is regulated under the EU Waste shipment regulation, Council regulation (EU)1013/2006 (2006), which is currently under revision and it is unclear which impact, possible new regulations will have on the market.

2.3.3. Textile Certifications for Recycled Content

Certifications is a means implemented, in order to verify their corresponding product or process. This verification is done by third party auditors. Concerning textiles, a large number of certifications are used, although only three certifications cover recycled content (Eryuruk 2015). These are the Global Recycled Standard, GRS, the recycled claim standard, RCS (Textile Exchange 2020) and the cardato recycled standard (Hall 2019). The GRS is used by companies making or selling products with recycled content. It furthermore covers the whole SC and addresses aspects of traceability, environmental principles, social requirements and labelling (ibid). It sets high targets on social and environmental goals to achieve but as well on the material content. In order to become certified at least 20% recycled content needs to be used and in order to market the product with GRS, at least 50% recycled content needs to be used (Textile Exchange 2017). The RCS concerns products with minimum 5% recycled content and does not emphasise social and environmental aspects under the production. It is mainly used for traceability concerns (Textile Exchange 2014). Concerning traceability the GRS and RCS uses a chain of custody, meaning that the certification ensures the identity of the recycled material and hence achieves traceability (Textile Exchange 2020). The chain of custody starts with a declaration of where the material comes from, i.e. pre or post-consumer waste. Each stakeholder which processes the material in the supply chain, needs to provide documentation on their processing, a so-called Transaction Certificate. This document will follow the material until the brand and so provide traceability (Textile Exchange 2017).

The cardato recycled brand is a standard developed in Prato, concerning the recycling processes being made there. The requirements are that the product needs to be produced in the Prato district, be made with at least 65% recycled material (both pre- and post-consumer is possible) and have measured environmental impact concerning water, energy and CO2 (Cardato 2021).

2.3.4. Barriers within Textile Recycling

There are many barriers found in academia around textile recycling. The recycling of the T&C into new yarns and fabrics are currently limited due to both technical barriers as well as financial, legislative, network and supply chain barriers (Circle Economy 2020a; EMF, 2017; Govindan & Hasanagic 2018).

Leal et al. (2019) mention barriers being the economic viability of textile recycling. Mishra et al. (2019) found that the cost of facilitating the operations for recycled material is the biggest barrier. As well, Hang et al. (2021) confirm through their literature review that tremendous upfront investment is needed and high cost with low economic benefits in the short term.

Jia et al. (2020) found barriers as well to be of financial aspects and policy work. Furthermore, they found barriers in organizations and companies and their strategies and inter-company aspects such as training and education and performance metrics. Ki et al. (2020) found through their research that there is a big interest within the stakeholders in the industry on technological approaches but as well found that lack of technology for waste textiles sorting, and this leads to an infrastructure problem.

Lahane et al. (2020) found barriers include lack of; environmental laws and regulations, financial resources, government support, information and knowledge, supply chain integration, circular design aspects and lack of market for remanufactured products. Leal et al. (2019) found that there is poor coordination and weak policies concerning standards. It is found that an absence of a well coordinated framework can have negative effects on the industry as well as that the deficiency of unified and generally-acceptable standards affects the operation and development of the recycling industry.

Kazancoglu et al. (2020) found many barriers in their research, laying in the topics of; management and decision-making, labor, design, material, regulations, lack of knowledge and awareness, lack of integration and collaboration, cost, and technical infrastructure. Payne (2015) also mentions that the collection of waste is a barrier, as well as the pre-processing of goods for recycling.

Concerning the technical aspects of the textile-to-textile recycling of cotton many barriers concerning the material was found around the quality of the recycled fiber through the shredding process (Palme, 2016; Ütebay et al. 2019; Gunnarsson & de la Motte 2019; Aronsson & Persson 2020; Lindström et al. 2020).

Leal et al. (2019) as well highlights the technical limitations within recycling and adds the availability of textile waste. . Ljungkvist and Elander (2016) as well highlights the issues with the raw material of post-consumer waste, consisting of fiber blends and contaminations which hinders the recycling process. They furthermore mention the lack of sorting technologies and recycling technologies.

2.3.5. Opportunities within Textile Recycling

Sandvik and Webbs (2019) found an opportunity in the design and incorporation of recycled content in garments; where they see sorting and recycling technologies as an enabler. Drivers were found from Jia. et al. (2020) to be on an organizational and institutional level as customers. Opportunities for the high value recycling are as well found in the sorting of textiles (Englund et al. 2018; Leal et al. 2019) and in improving the infrastructure of the system (Ki et al. 2020). Leal et al. (2019) highlights the importance that advanced and automated technology is needed to receive insight about the origin and composition of discarded textiles. Wang (2010) sees the opportunity in using recycled materials as a substitute for virgin materials as their capacities are decreasing though demand is increasing.

Chkanikova and Sroufe (2021) mentions that third-party sustainability certifications schemes are vital for companies to integrate sustainability practices to their product supply.

Furthermore, certifications help businesses, buyers, consumers, suppliers and governments to make their purchase choices based on environmental aspects (Eryuruk 2015). Leal et al. (2019) highlights the importance of supply chain transparency and product verification and that digitization technologies can support these matters or material passports. Partzsch and Kemper (2019) mentions that certifications provide a guarantee for the consumers that environment and social standards are fulfilled during production.

Relations and collaborations between stakeholders is found as an opportunity for textile circularity. Niinimäki (2019) highlights the importance of direct collaboration between industry stakeholders is needed to create a functional closed-loop fashion system. An opportunity is found between designers, sorters and recyclers to increase the dialogue between these stakeholders and therefore circular design is seen to be increased, an approach towards a new system (See figure 5).

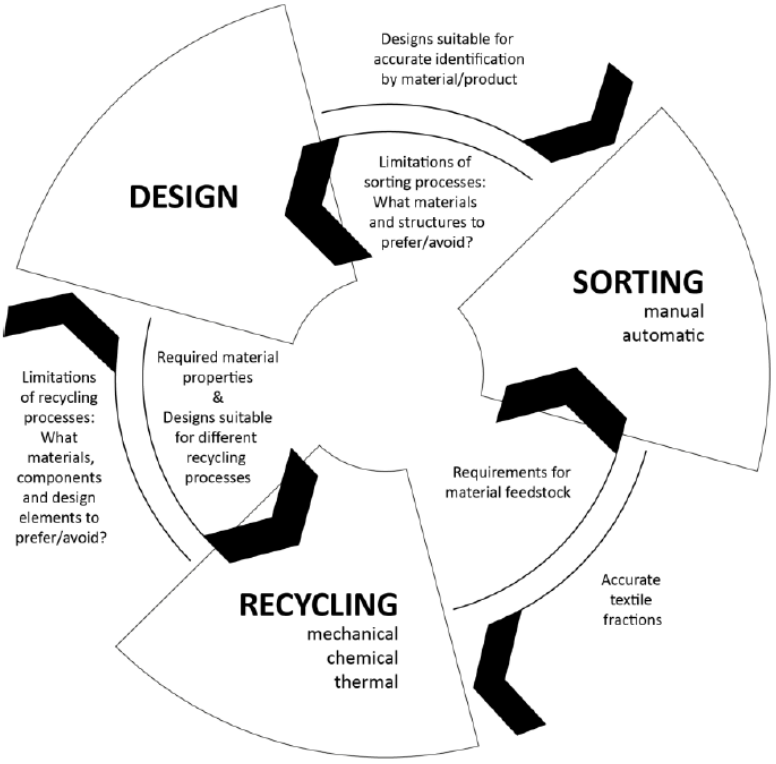

Figure 5. Closed-loop fashion system (Niinimäki 2019)

Sandvik and Stubbs (2019) found collaborations to be an enabling factor in their research. Their main finding is that collaboration is a necessity to enable textile recycling and creating a stream of recycled materials. The most important collaborations will be collaborations with consumers and between large companies. The main points of collaboration is around design and reverse logistics in form of take-back schemes for used clothing. Roos et al. (2019) refers to collaborating with the yarn producers recyclers in order to enable more recycled content. Payne (2015) mentions that effective recycling involves action from stakeholders throughout the supply chain, including fiber and textile producers, apparel companies, manufacturers,

consumers, local and national governments and non-government organizations. Where each stakeholder playing a crucial role will be important for the industry.

The most referred collaboration inhibitor is the Ellen MacArthur Foundation (2017) who mentions that this will be essential for the transformation:

"Transforming the industry to usher in a new textiles economy requires

system-level change with an unprecedented degree of commitment,

collaboration, and innovation" (EM 2017 p. 3)

The collaboration is referred to as being about demonstrating with pilots, projects and state of the art projects that the vision of a new textiles economy will be possible. They highlight that the gap in the industry around collaboration is not the lack of collaboration but the coordination, alignment and impact of these collaborations which needs further improvement. The demonstrations are referred to as large-scaled and cross supply chain collaborations around recycling, design, new guidelines and business models. They as well highlight the importance of collaboration between several designers, buyers, textile mills, and recyclers. Furthermore, including researchers, NGO and other organizations is of importance (EMF 2017).

2.4. Summary of Literature Findings

Supply chain management commands the control and planning of supply chain processes and activities (Porter 2004; Lambert & Enz 2017). Supplier relationship management commands the connection and communication between stakeholders to achieve high trust, loyalty, and value to improve productivity and provide competitive advantages (Lambert & Cooper 2000; Lambert & Schwieterman 2012). Depending on what the company wants to achieve, different types of collaborations in terms of business relationships endure, long-term relationships of key suppliers identify as most profitable in terms of financial growth, better customer focus and circular development potential (Håkansson & Snehota 1995; Gattorna & Walters 1996; Lambert et al. 1996; Rusanen et al. 2014).

The implementation of circular supply chains and circular economy practices, have potential to utilize the value of the products and save resources (Chertow & Lombardi 2015; EMF 2017; Franco 2017; Milios 2018; Farooque et al. 2019). It is found that partnerships and industrial symbiosis play a fundamental role when implementing circular practices (Bygballe, Jahre & Swärd 2010; Chertow & Lombardi 2015; EMF 2017). Direct collaborations between the supply chain stakeholders are found to be important for textil-totextile recycling (Niinimäki 2019). Especially collaborations with spinning mills will be of importance (Roos et al. 2019).

Textile recycling is shown to face many barriers from financial to technical aspects (EMF, 2017; Govindan & Hasanagic 2018; Leal et al. 2019; Circle Economy 2020; Huang et al. 2020; Jia et al 2020; Kazancoglu et al. 2020). At the same time show much potential in

resource utilization and environmental savings (EMF 2017; Wang 2010). It is found that the sorting of textile waste is an important step in order to increase textile recycling (Englund et al. 2018; Leal et al. 2019). Moreover, the handling of textile waste is regulated under the WFD, which further will ensure that more clothing will be collected as a mandatory separate collection until 2025 will be implemented in the EU-27. At the same time the quality of the clothing collected is anticipated to decrease (Bvse 2020). Currently there is a lack of textiles being recycled into textiles (EMF 2017) and most textiles being recycled into other products (Gulich 2006b; Sanding & Peters 2019). The use of certifications can help the supply chain tracking and tracing the use of recycled materials. Three certifications are found that cover the implementation of recycled content (Eryuruk 2015; Chkanikova & Sroufe 2021).

3. Method

Under the following section, the methodology and research design is presented.

3.1. Research design

The research design of this thesis is of an explorative form (Bryman 2016). The theory is constructed from the theoretical frame of reference regarding textile recycling and supplier relationship management.

The exploratory research design is suitable for research studies of new or unexplored areas where the research problem does not have previous data or has limited references (Bhattacherjee 2012). The secondary data for the theoretical framework is from various sources, such as public reports, previous studies of similar problems, opinions, or case studies. Bhattacherjee (2012) argues that a study of exploratory research design can not demonstrate concrete solutions to the research problem. Thus the goal is more related to expanding understanding or deepening the research area to generate a more comprehensive study of research or the phenomenon of the future research.

The research was conducted with a deductive approach (Bryman 2016), where the testing of the theory is done through a qualitative method of industry interviews. The interviews help to define the current relationship between players and the future needs, opportunities, and barriers. Which outlines the implementation of SRM in the transition from a linear to a circular textile industry.

A qualitative research method will be used to fully understand the relations between current suppliers and the needs, wishes, barriers, and opportunities for future relations. The acquisition of the empirical material is based on our network of contacts from the textile industry, which has led to the possibility of interviews. As the study examines both textile companies' views on company relationships and their textile recycling behavior and perceptions, we believe that the qualitative method is most relevant as it includes an in-depth investigation or analysis of the substance which is interpreted from a subjective perspective (Bryman & Bell 2015). A qualitative method answers the questions of “what” and “why” (Bryman 2016). The goal of the research will be to conclude which barriers and opportunities in the supply chain there are and which type of relationships and partnerships can be helpful within the supply chain to overcome these barriers and which supporting processes or certifications can be useful. The research study of a qualitative method must present accurate reasoning with possible interpretations through essential arguments that fulfill the purpose. Due to the geographical limitation and limited selection of the empirical data, the study can only provide a general perspective and is not considered reliable or applicable on a larger scale. The study only increases understanding of the factors that underlie the problem, how perceptions of reality can be interpreted and perceived, and give possible solutions or answers to the problem (Bryman & Bell 2015).

3.2. Data Collection

The empirical data was collected through semi-structured interviews based on a so-called interview guide (Bryman and Bell 2015) with a selection of experts working in companies along the supply chain. The interview guide was developed after a literature screening on the topic of SRM, circular economy in the T&C industry and textile recycling, which laid the groundwork for the theoretical frame of reference. The interview guide used open-ended questions to help understand the relationships. The main questions concerned, the drivers and barriers using recycled materials. How their supply chain relations resemble and the key competence and capability. Furthermore, discussing technical, economic and regulatory aspects around textile recycling. All companies were in the end asked, what their or the industries biggest priority is in order for textile recycling to scale.

The interview guide was approved by the thesis supervisor and tested as a pilot with the first interview conducted, after the interview feedback was received from the interviewee in order to validate and improve the interview guide. This helped to ensure face validity, which is validation to ensure that the questions reflect the targeted content (Bryman 2016). For this thesis, implying face validity ensured that the interview guide was evaluated from experts from academia as for industry. From this, the interview guide was refined, and the final version is published under Appendix 1. These two measures as well help to design the questionnaire and reduce researcher bias. Additionally, a consent form, including GDPR information concerning the date, provided by the University of Borås, was adapted and sent to the companies to agree. The GDPR form can be found in Appendix 2.

In the end, six companies were interviewed using a video-phone option through zoom. The interviews were scheduled for an hour. An overview of the interviewees and their process step can be found below (Table 1). The interviews were recorded and transcribed.

Company Code	**Position in the supply chain**	**Informants**	**Company Information**	**Market Establishment**
CI	Institute	Senior Manager	*Accredited textile institute.*	Italy
CII	Collecting and Sorting post-consumer waste	CEO	*Collector and sorting of post-consumer waste.*	Europe
CIII	Shredding and Spinning	Senior Manager	*SME enterprise shredding and knitting fibers to yarns*	Global

CIV	Weaving	Senior Manager	*SME enterprise, weaving fabrics, specialized on cotton*	Global
CV	Knitting	Manager	*SME enterprise producing knitted fabrics*	Global
CVI	Retail brand with internal and external brands	Senior Manager	*Large fashion brand and retailer with global markets*	Global

Table 1. Overview of companies interviewed

3.3. Sampling

The sampling used to select the companies and people for the interviews was of a non-probabilistic manner. The sampling was a mix of convenience and snowball sampling (Bryman 2016). Convenience sampling is a method of sampling where the sample is easily available to the researcher. A snowball sampling is a technique where current sampled participants lead to further sampling participants (Bryman 2016).

The convenience sampling was companies of which were already known by the researchers or found during the literature screening. The snowball sampling occurred as some interviews recommended further people and companies to interview. Mainly companies working in Italy or with an Italian supply chain were considered, except for one interview. This interview was conducted with one of the largest european collectors and sorters having close export relations to Italy. Additionally a person from an non-governmental organization active in research and development and the field of textile recycling was interviewed as the first interview. This was chosen due to getting a neutral understanding of the topic and testing the interview guide before conducting the further interviews. A risk of sampling bias occurring is to be considered.

3.4. Coding

The interviews were afterward coded. Bryman (2016) highlights that coding methods can vary, for this thesis it is found that a combination of focused coding and open coding being the most relevant. Open coding is looking into the transcripts and analysing the transcripts step by step by finding relevant codes. Afterwards these codes are grouped into categories and themes and so common topics are found. Focused coding is the coding between theoretical codes and elaborating on the empirical analysing to then find the relevant themes (Bryman 2016). Focus codes were outlined from the interview guide and the theoretical frame of reference. Codes which were defined were: sustainability, technical aspects, supply chain relations and economics. Focused coding was used in order to relate codes between the

academic literature and the expert interviews. The coding of the transcripts was conducted in terms of open-coding, from descriptive parts in the transcripts. This through an inductive approach, relating codes directly to the description (Linneberg and Korsgaard 2019). A wide amount of codes were defined and from this grouped into categories. These categories were grouped into themes (ibid). The themes were evaluated in terms of the focus codes already given. The inter-reliability of the coding was secured through the cross-coding of the interviews by the researchers. Simultaneously analytical memos, which is mentioned by Linneberg and Korsgaard (2019) were noted in order to find relevance for the findings and the narrative to be written and help seeing patterns in the transcripts.

3.5. Trustworthiness

Validity and reliability are seen as crucial criteria to ensure the quality of quantitative research (Bryman & Bell 2015). Validity and reliability evaluate the quality of quantitative research with instruments and established measures. Thus many researchers argue that different criteria are more accurate to assess the quality of qualitative research. Bryman and Bell (2015) argues for Lincoln and Guba criteria trustworthiness, and correspond to validity and reliability. To ensure trustworthiness the four-sub criterion *credibility, transferability, dependability and confirmability* must be met (ibid).

Credibility demonstrates how believable and accurate the research findings are. Techniques to ensure credibility refers to respondent validation which suggests engaging the respondents to confirm the interpretation of findings (Bryman & Bell 2015). The credibility can also strengthen the validity of trustworthiness through triangulation by examining the consistency of the findings with cross-checking the primary and secondary data (ibid). Transferability demonstrates the extent to which the results can convey in other contexts or be generalized. The dependability demonstrates the research process's stability and transparency regarding the content (ibid). By allowing a group of independent audits to review the content, dependability can strengthen the quality (ibid). The confirmability determines how neutral the research is from the researcher's subjective view (Bryman & Bell 2015). To demonstrate confirmability, the researcher can follow an in-depth audit trail from independent or objective readers who evaluate the research study's approach to the empirical data collection and findings (Bryman & Bell 2015).

The qualitative research was evaluated in terms of its trustworthiness (Bryman 2016). The trustworthiness was ensured by the respondent validation after the written part of the empirical findings. The respondents received the written empirical findings and could so verify if the data interpreted corresponded to their interviewed. Furthermore, they had the possibility to comment and give feedback. The transferability is increased through the explanation of the sampling and geographical area. Dependability and confirmability is increased through the analytic memos kept during the interview process and researcher minutes during the whole process. Furthermore, ensured through conducting a literature screening and comparing the theoretical frame of reference with the empirical findings. The credibility of the research is ensured by cross checking the coding by the both researchers.

4. Empirical Data

The chapter presents the empirical data collected from the interviews

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4.1. Company I

Through the interview with Company I the most important driver found in the industry is the ecological aspects; *"... The main driver is the growing awareness about sustainability"*. The evolving interest is seen in the sustainability demand by the stakeholders in the industry.

Recycling fibers into other sectors and other applications might be a solution for post-consumer textile waste as there are technological hurdles to recycling them in a closed-loop. This due to the blends in the materials and the time and costly process of removing trims.

Company I emphasized that more clothing needs to be collected and sorted due to the mandatory collection of textile waste by 2025. This will put pressure on the textile industry and incentives and EPR schemes are important for the system to operate. It will additionally be important to follow the waste hierarchy and sort out textiles that are suitable to be sold on the second-hand market.

Chemicals were found to be a concern for the supply chain stakeholders, handling both virgin materials as recycled materials. The solicitude of chemicals in the development over time from first being of importance to testing textile and clothing according to certifications like Oeko-Tex 100 into concerning all aspects of sustainability and lately the topic of LCAs of processing and the topic of circularity.

Concerning the recycling of textile waste, two important aspects were found. One being of economic sense, where recycling only is feasible if the virgin price of the fiber is high, then the cost of recycling is attractive *"... other fibers, we start to recycle, if they are very expensive"*.

Company I argues that local and regional collaborations will be of importance when finding new solutions. Through the experience of conducting pilot cases in collaborations within the industry, new solutions have been developed and company connections have been established. An example was made of a local district where two companies from different sectors were cross-connected and a collaboration possibility was found in recycling waste from one sector to be used as a raw material for another sector. Both economic, as well as environmental gains, were made; *" ... no cost ... to dispose ... the second company ... buy raw material at less cost"*. The layer of the local district as well reduced the transportation distances and so CO2 emission but as well have a positive impact on the cost. Therefore the networking will be of importance. But as well as digitalization in the form of platforms and marketplaces. It is found that sometimes something innovative is not needed, the connection and communication between the stakeholders can be sufficient enough to a certain extent.

4.2. Company II

The main drivers for the T&C industry with focus on recycled materials concerns are the economic and environmental aspects. The company highlights that a life cycle extension by reusing the product for as long as possible, will promote the highest environmental and economical benefit. Hence *"....the ecological value of the garments is higher ... if you can keep them in the circle longer, meaning that they are reused.",* as well as being compliant with current regulations.

Textile and clothing waste is different from other waste streams such as plastics, hence *"we need to have a number of specialist companies, specialised companies who can handle these materials",* specialized companies will be needed. Digital platforms are found to give the best gain through only networking and not found to be feasible for a digital marketplace.

However, Company II indicates that, *"there's no demand for that product at the moment"*. Even though many brands have a strong vision and mission in implementing recycled fibers, the most recycled fibers are argued to come from PET bottles to PES fibers which cannot be recycled in the same loop. Company II argues that this of course means environmental gains, but it will be important to challenge the brands and the industry, *"I would challenge them"*, and focus on textile-to-textile recycling to fully become circular. Through this the economic gains within recycling will be better distributed.

To increase the commercialization of recycled fibers, different measures need to be taken. Incentives need to be put into place which will make recycled fibers financially attractive, i.e. implementing recycled content goals in the production of new textile or clothing. Another possibility would be implementing an EPR system, which would *"infusing money into the system"*.

Concerning the technical aspects of textile-to-textile recycling, there are hurdles to be found in removing the trims and many blends present in the textile and clothing. This hinders the sorting and recycling of post-consumer textile waste. Moreover, the information and *"...the validity of the labels..."* of the care labels are questionable. In the end, as well, more products need to be designed for recyclability to be recycled, *"We need more recyclable products"*. By designing recyclable products it will as well be easier to sort for recycling. First and foremost designing clothing that is sustainable and last will be of relevance.

As found in the literature research there are automated sorting technologies available but not largely scaled in the industry. When company II was asked about the possibilities of automated sorting, it was argued that it is an economic question and not a technical one; *"That's an economic question at the end. Currently it doesn't make sense to invest in such a technology because you cannot get a higher revenue out of the recycling material today"*.

From another point of view, the recycling technologies on the market today and the recycling processes need to improve; *"More flexible in terms of input material and the material they need. You'll also need to scale up to sorting operations for the treatment operations. It's also*

not about the quantity in itself". In the end it emphasized on that *"right now we just at the linear model"*.

As for economical concerns, Company II highlights that the economical aspect of sorting for recycling is misperceived in the industry and it is important to communicate with the different stakeholders in the supply chain to achieve a common understanding of the possibilities. The sorting for recycling is a costly process as it requires special and different criterias among stakeholders; *"there will be some more specifications needed, we don't really have a standardized product"*. At the current state, the criteria on the feedstock and the price able to pay are not corresponding; *"...not able to pay the premium price to have this sorting done.."*.

Concerning relationships within the supply chain network, Company II has a positive approach towards collaborations thus believes *"...that's a must to build up networks…"* for the implementation of recycled materials as the industry requires investing in technology to scale. For instance through projects that can affect the situation. Company II also believes that, depending on what the result is to generate, it is essential to create a network with key suppliers that support the processes and the supply chain hence it promotes the communication for the information flow. It is believed that through the key suppliers, the purpose and worth will promote a strong approach.

Yet on the question if such would include cooperating with competitors to improve the technology, collaborations with competitors operating in the same market are complex. Although casual communication can improve the issues, hence the market within textile sorters today is limited and more so, of small enterprises, and in the end regards improving competitive advantages and increasing business and economic growth.

4.3. Company III

For the supply chain flow and value creation, Company III indicates that long-term partnerships will be key as the partners jointly work on developments to improve the quality of the desired material for the applications and semi-products. Within this aspect, knowledge sharing and communication is of importance.

Company III argues that communication between the stakeholders will be of importance in scaling the textile recycling. All stakeholders need to increase knowledge and awareness of what textile recycling means *"we need to educate the people"*. Therefore Company III argues that *"a big consortium"* connecting all stakeholders will be vital. It is of high importance while all aspects of textile recycling are connected; *"it needs to be all connected"*.

Certifications impose a possibility for the supply chain partners to increase trust around the product and traceability. But at the same time putting pressure on the supply chain partners; *"everybody is looking for something that is certified without having any idea of what this means"*.

Company III furthermore, highlights that not only vertical collaboration but as well horizontal collaborations can help scale the commercialization of recycled textile fiber. Moreover, digital tools, platforms, and blockchain can be found beneficial in scaling textile recycling.

Before even recycling the textile and clothing, it will be important to consider the design characteristics and *"... how we do the garments… "* which needs to improve for textile recycling to be feasible. There are technical aspects that are important when recycling textiles and clothing. The sorting is found to be a key process for the recycling aspects and the quality of the end product; *" Recycled post-consumer garment, you need to ensure the composition. You need to select by color.*" A further important step that needs to be conducted for textile circularity is the removal of non-textile material, which is envisioned as a process step for the sorting company; *"...Sorting plants that should do this business because garments, meaning removing buttons, removing zippers…".*

Today the main implementation of recycled fiber comes from wool and cotton. Wool due to its expensive fiber and cotton due to the availability of pre-consumer textile waste; *" ... cotton because of the big availability of these coming from pre-consumer waste…."*. Even though improvements can be done it is noted that the mechanical process is a process which itself harms the fiber; *You can improve as much as you can, what you are doing, but it is always a mechanical recycling".* This leads to a direct impact on the quality of the recycled textiles and clothing; *"When you want to keep a certain quality on the yarn you need to put some virgin fibers together"*. Additionally, the perception and knowledge around the quality of textile recycled products need to be improved. Products containing recycled fibers cannot and do not need to be perfect, but have to be nice. How a brand later markets the product is then important to perceive the imperfections as unique products, instead of mass production and accept the quality achieved.

Using recycled fibers and materials as well have a financial impact. Currently, post-consumer textiles are more expensive than pre-consumer textiles and both are more expensive than virgin fibers and will be in strong relation to the brands' strategy; *"It cost more than ... virgin, you need to have a strong motivation"*. But there are economic gains to be found as a dyeing process will be eliminated which well gives environmental gains.

4.4. Company IV

For Company IV, the quality of the yarn is of great importance and the main factor for the weaving of the fabric. For the ability to produce a high-quality fabric, certain aspects are a requirement. Such are combed long-staple cotton fibers spun into high yarn counts as it provides a finer yarn and improves the quality and strengthens the finished product. Unlike virgin cotton, the recycled cotton fibers are significantly shorter, provide a yarn into lower counts which indicates a coarse and weaker spun yarn, thus, commands a greater risk of breakage. Hence, as a solid content *"... for shirts it's impossible to use recycled materials.."*

During the last 10 years, the company has developed sustainability goals by improving the raw materials, process and internal workforces. This challenges the industry since if there is a requirement of including recycled fibers, to enable a higher quality weave, the composition

must be of a blend. Although the company manages production with recycled fibers certified according to GRS, there is a higher demand for the high quality of Supima Cotton or the use of GOTS and BCI certified cotton.

In the question on how Company IV would predict a product consisting of recycled composition, it is believed that the current demand for the post-consumer waste within the sector is low due to the weakness of the fibers and the economical aspect. Moreover, this is a risk and cost customers are not willing to pay because of the possibility and requirements to decide on the fiber origin, composition, and previous status from the suppliers. Additionally, the current quality is not corresponding to the end-products which they produce and the quality requirements of their customers, hence certain applications will be more feasible for recycled fibers than others. For scaling the applications with recycled content, the perceptions from the customers is vital, *"...customers have to accept the new material…"*. Thus in the end the customer needs to understand that recycled material has a different quality which needs to be accepted for textile recycling to scale.

Regarding technical barriers to the weaving process, the main aspects during the interview are explained. The cost of the weaving process includes the machine's operating costs, maintenance, labor costs, and energy. Since the recycled cotton yarn has a lower count and is of shorter and weaker fiber character, a normal speed of the loom would cause high stress and tension on the yarn which can lead to machine stop and fabric breakage. Therefore, the manufacturing of the fabric must perform at a lower speed. With long-staple fiber yarn, the risk of machine stop and breakage is lower hence the productivity can generate at a higher speed and therefore be more cost-effective. This generates a slower productivity for recycled material per minute with an effect of higher costs for the process and thus the production cost of the fabric becomes more expensive per minute with a significantly lower quality. Although the manufacturing process, purchasing, and outsourcing are managed equally between cotton and recycled materials, hence *"the pre-consumer is cheaper than post-consumer"* regarding waste, the production of weaving with recycled content demands higher capacity which will affect the unit price. Another technical barrier concerning the quality aspect of recycled materials is the pre-dyed fibers, hence *"post-consumer even a lot of problems because the material is already dyed"*. As the aspects of having a yarn-dyed material, due to the color sorting of textile waste is found to be an environmental benefit but technological aspects impose a barrier.

Concerning the strategic vision, sustainability is acknowledged as the driver and main important factor in the textile industry sector which permeates the entire business. Both by improving solutions within the internal policy and culture mindset as well as the company's raw materials and resource consumption. Internal and cultural, this appears in improving the workforce management, hence the inter-organizational being of the top-down driver where the management "*... believes in this solution…"* for the integration of a more comprehensive sustainable approach.

Relationships are an important factor within the industry which Company IV refers to their long-term relationships. To establish a network of customers and suppliers, Company IV

argues that, since the textile supply chain consists of a long process, there is a demand for continuous products yet a variety depending on the customers and product. Due to the fact that ensured quality and continuous product generates trust and openness in both directions, supplier-buyer-customer. It will also lead to improvements on the manufacturing process and global marketing. A common platform that the company uses for network development is fairs.

On the question on how the Company joins new supplier relationships for example more coherent with recycled fibers, the Company IV responds that the suppliers network they are working with is of a big system thus already consisting of the existing various yarn on the market. With the built supplier relationships, they have enabled systematic partnerships to improve the business. Moreover, there is a complexity in the market for new suppliers to enter due to the system of the supplier network. The supplier system has a long history of long-term partnerships which interpret a fundamental trust in communication, lead times and quality and more so, already enable the demand on supply and is of an established network.

Company IV has a positive approach towards greater and better waste management for the future whereas their textile waste can benefit another company and a greater directive on legislative policy to promote circularity. During the interview Company IV explained that in the current situation, waste is recycled into applications for other industry sectors. As Company IV operating process is with large machines, they believe that smaller factories in Italy could use their waste amount in production thus for the company themself, it would require a larger amount of waste for reimplementation.

4.5. Company V

To enable strong long-term relationships, Company V believes that this is built on honesty, trust, transparency, and openness. On the question on how the Company joins new supplier relationships for example more coherent with recycled fibers, Company V explains that since the development of production with recycled fibers, they have built a strong long term relationship which they grow with and developed an established network of partnerships, which has been built over a decade.

During the last 10 years, Company V has implemented recycled yarn into their knitting mill and has since then, developed and improved their recyclability enabling. Currently, they operate with customers and suppliers on a global market, which leads to some extent that products are being shipped back and forth worldwide, due to market demands.

Concerning the quality, the stakeholders need to have a product or semi-product which is consistent and you can rely on and *“a product you can trust in”*. This imposes a collection with continuous products so the customers can ensure the quality. Working with recycled fibers can be difficult as batches vary and the product development being a long- and complex process with many stakeholders, claims in the end by the end-customers is a big worry. Therefore the most essential part of the company is the quality; *“we must guarantee the quality*”. Hence communication and transparency between all stakeholders in the chain will be

crucial. From the supply chain perspective having a continuous flow in the quality of the raw material and hence being the most important factors upstream towards the costumer.

Company V argues that storytelling from big brands, and information flow about recycled materials can achieve a higher value and understanding from consumers hence promote a greater demand and educational consumption guidelines. With communication and knowledge *"...it's really important to be clear and to explain it to the end. Customers, the people, must learn about the Recycled fabrics and understand, understand this difference and appreciate it..."*.

In today's market, customers claim, regardless of fiber content, "... everything must be perfect ...:". Following; "they do not permit any errors, they want quality and so it must be a chain of trust and of liability". Although this is not the case with recycled content, Company V says that customers and brands need to learn that recycled fibers are different and learn to like this. Therefore, one of the barriers that have been profound in the textile industry sector and knitting production of recycled materials is knowledge.

It is as well found that the application of the end product is highly related to the recycling chain and quality. Knitted fabrics impose a better quality where it additionally as well has economic gains. Cost aspects for outsourcing materials for virgin and recycled are similar and with both materials, it creates a product of good quality at a good price. What distinguishes the materials is the need to repeatedly have to remove impurities in the recycled material to achieve smoother and more comprehensive properties. However, Company V explains that some products of recycled content are identical to virgin content yet some are not.

Company V as well has waste being generated in their process and informs that textiles are classified as special waste and therefore needs to be treated differently. The disposal of this waste is correlated with a recycling fee. The waste is in the end recycled into products for other sectors and applications.

4.6. Company VI

Regarding the question of the main driver Company VI sees the environmental aspects and the greater interest and awareness on sustainability. One aspect of that is that sustainable fashion not only presupposes consumption of clothes made from more environmentally sustainable or recycled materials but also ensures the intended use of the garment. They believe that *"...To spend a little bit more but to have something that lasts maybe forever..."* is an important factor. By purchasing a garment of high quality with sustainable conditions should contribute to prolonging the garment, not only for recycling but also inheritance thus allow the garment to be passed onto future generations. They acknowledged that using recycled materials might have a slightly higher development or purchasing cost but this is a feasible price increase for them and their customer. Furthermore, it is believed that this pattern of consumption must be continuously communicated to end customers to transform from the action of buying more to buying better.

The integration of sustainability and circular economy should not only reflect the consumption or the material content of the garment but also the internal business approach which Company VI believes is going in the right direction hence *"...the focus is real.."*. Even if the business is about economic growth, Company VI clarifies that *"...we need to take responsibility for shopping behaviors of all consumers…"* which is one of the driving forces that has influenced the company's development for more sustainable solutions.

It is furthermore elaborated that the company culture and mindset not only from the board and management but as well from the individuals working within the company play an important role while implementing the circularity strategy. Company VI has a strategic vision in their core *"...was always a pioneer …"* and this is found to be a guiding motivation in their sustainability work over their whole company lifetime.

The work with circulatory and sustainability is referred to as a culture which as well incorporates the mindset and attitude and further highlighting the importance of the long-term vision and work this means,*"... it's a change of mindset also because when moving to circularity maybe it's more long term…"*. Referring to the developments made in the paper industry on recycled material, which has taken decades. Company VI is optimistic and sees new developments and technologies in terms of textile recycling and circularity rising.

To increase consciousness and promote the development and *"...building the culture within the company…"* for circularity, the company has developed inter-organizational communication referred to as webinars and an informative learning platform. Interorganizational communication but as well external communication is key processes for enabling circularity along with marketing language and storytelling.

Acknowledged barriers converting the value content within the supply chain are directly related to the controlling of external brands and in general terms, suppliers. Therefore, Company VI sees long-term relationships as an advantage and the main factor hence it contributes to fundamental trust, respect, and the opportunity to get to know each other and thus follow the guidelines; *"... always better to work with someone that it's always with you it's more reliable…"*.Close collaborations of long-term relationships also increase the chances of being able to discover if this whole thing is being followed and generate corresponding quality understanding as *"...you grow together…"*. Furthermore, long-term relationships; *"...we are building a long-term relationship…",* enable the joint growth of development on the sustainability journey but also in the development of sustainable solutions. As a large enterprise and renowned company in the industry, the acquisition of new partners is not difficult as *"...companies approach us so you actually can choose…"*. A barrier can although be found in the difference in the size of corporations and the corresponding capabilities in development and production this means.

When working with the suppliers, their supplier and purchasing guidelines is a tool enabling the sustainability strategy to be implemented. Traceability is an important aspect encompassing all aspects of the sustainability pillars. This is ensured through the usage of certifications in the material to be used or processed. New technologies and digitalization play an important role for the future, hence *".... you can have all the information about the*

goods….". Additional collaborations in the industry with consortiums and different groups working on the same vision is important for the company and industry to grow.

5. Analysis

The chapter analyses and elaborates on the findings from the empirical data.

An inevitable factor in the textile industry that has permeated all interviews is the systematic development of long-term relationships (CII; CIII; CIV; CV; CVI). The supplier system has a long history of long-term partnerships which interpret a fundamental trust and reliability. Shared values and open communication around technical aspects, lead times and quality and more so, already enable the demand on supply and is of an established network (CIV; CV).

It is essential to create a network with key suppliers that support the processes and the supply chain hence it promotes the communication for the information flow (CII). Through honest and transparent information flow about recycled materials can achieve a higher value and understanding from consumers hence promote a greater demand and educational consumption guidelines.

To establish a network of customers and suppliers, Company IV argues that, since the textile supply chain consists of a long complex process, there is a demand for continuous products. Due to the fact that ensured quality and continuous product generates trust and openness in both directions, supplier-buyer-customer. What presupposes a long-term relationship is the enabling of building a network of key suppliers (CII; CIII; CIV; CV; CVI) with special skills, which are able to tackle the technical hurdles. Collaboration horizontally was found could be needed in order to increase capacity building (CIII), but on the other hand be complex (CII). Platforms for collaborations in the form of both digital and physical were mentioned to be a must and of importance (CI; CII; CIII; CVI).

Another incitament that presupposes a long-term relationship is trust. Trust is today built on the communication and sharing of information between the stakeholders but as well in the certifications provided. The certifications play an important role in traceability and transparency as they ensure reliable data and information to be shared and trusted by the audit from third parties (CVI). They can as well accordingly be seen as a KPI when measuring sustainability and used in the communication and trust both for business to business relation as well as business to customer relations.

Communication has found to be an important factor (CI; CII; CIII; CV), which can enables both traceability and transparency when setting a common understanding of the supply chain capabilities, which can enable many aspects of textile recycling. Through communication between long-term relationships or partnerships, the chance of achieving a higher value and understanding regarding operational processes and resources between supplier-buyer-customer increases. The current connection and communication between the stakeholders can be sufficient enough to a certain extent (CI). Although this communication is mainly towards the direct suppliers or customers. The communication between all stakeholders in the supply chain is lacking and limitations are found in the communication exchange today (CI; CII; CIII; CIV; CV; CVI). Hence textile recycling needing technical

expertise and specialized companies, communication and education between the stakeholders is needed (CII; CIII; CV). The indications from the findings prove that technology is an extensive factor for today's T&C industry due to the complex environment that experiences sustainable transitions (CI; CII; CIII; CIV; CV; CVI).

In production with recycled textiles or fibers, the interconnection with partners involved in the specific relationship should benefit equally to efficiently support the SC based on its valuing features. Hence, the strategic vision is found as an important factor in scaling and commercializing textile recycling. This vision can be interpreted as *"The culture of circularity"* mentioned by Company VI and that it needs to be top down and it is important to *"believe in the solutions"* Company IV. A set of common values needs to be established both within the companies, as well as in society in order for the network's flow for the SC to more effectively develop and complement necessary key capabilities and manage to immediately clear targeting strategies for acquisition and competitive advantages (CIV; CVI).

Furthermore, economic feasibility is an important condition that must work to facilitate the operating environment (CI; CII; CIII; CIV; CV; CVI). Economic feasibility is found as the most prominent unspoken driver. If the economic situation is not attractive for all stakeholders involved, the system will not operate successfully. The economics of recycled feedstock is highly related to the feedstock price (CII; CIII), through implementing an EPR system the cost is found to be better distributed (CII).

The economic feasibility is highly relevant to both technical aspects but foremost the consumer perception and the awareness of society. Through the empirical findings (CIII; CVI), it can be analyzed that the feasibility of recycled fibers is more likely to have a positive economic implementation in the higher segment than the lower segment. This is due to the expensive raw material (CIII; CIV), which textile waste constitutes and due to the eventual higher processing cost, this contains (CIV). But as well the companies operating in the space need to have the strategic vision and motivation and believe in the solution, to be willing to develop, invest and collaborate. Furthermore, the perceptions of the consumers and society and the awareness needs to be rising, in terms of how they perceive T&C containing recycled material (CIII; CV), but also how they purchase and use T&C and how they discard them (CI, CII; CVI).

A further important factor is the legislative decisions both implemented or lacking (CI; CII; CIII; CVI). Within the legislative tools in place, the WFD is setting the scene for the textile waste sector and for textile recycling. First and foremost musst the life of T&C be prolonged and be designed for longevity (CI; CII; CIII). When the mandatory collection of textile and clothing comes into place, it will be of importance that the correct infrastructure is in place. As well, sorting capability needs to be ensured in order to both align to the WFD (CII) and create availability and consistency of the feedstock (CIII; CV). Although the WFD needs to be accomplished with an EPR system in order to create the economic feasibility, due to the cross financing of collection and sorting of the T&C, from the reusable goods towards the recycled goods which are anticipated to increase due to low quality (CII). It is found that EPR systems can have a positive effect on both the economic feasibility, the demand but also on

the technical aspects (CI; CII; CIV; CV; CVI). It is further found that current legislation in place such as the product labelling and the REACH legislation (CII) should be aligned with the vision of a circular economy, which will help create a clear understanding within the industrial sector.

Sorting for recycling is found as a key process for the textile-to-textile recycling (CI; CII; CIII) but not being financially viable at the current state (CII). From here on the availability of the material for recycling will be an important condition (CI; CII; CIII). Found through empirical analysis the size of the corporations working in the supply chain has a direct impact on the different capabilities for recycled feedstock. Since SMEs can only be due to their corporation size be able to deliver a certain level of availability and large enterprises might want to have another level of available feedstock. This will have a direct impact on the importance of a wide network but at the same time specialized.

There are additional conditions to consider and that products are designed for recycling to increase the recyclability of post-consumer waste. Recycling technologies need to continuously improve their process to handle contamination. Mechanical recycling is found to be a harmful process (CIII) which can and needs to be further improved to achieve better fibers. This will enable better quality yarn, fabrics and products. Additionally contamination itself, such as blends and trims (CI; CII; CIII), needs to be handled properly and the SC needs to understand and be aware of these processes and be able to carry the cost this means at all stages. The processing of the materials containing recycled content needs to be handled accordingly so that the equality, cost, and operational workload is found in a compelling triangulation (CI; CII; CIV).

Recycled content goals and design guidelines will be crucial to increase the demand and the scaling of textile recycling (CII). It can be argued that products will as well need to be "designed with recycled material", meaning that the design and product development processes in the linear model need to be adapted for a circular model. How to choose colors, how to develop the quality assurance of color and how to market and tell the story, and how to develop the clothing needs to be adjusted for what it means to work with recycled materials. The development of colors, when color sorting is needed for mechanical recycling will be vital (CIII) but will as well be a unique process and this uniqueness needs to be valued and appreciated and not be seen as a limitation or imperfection (CIII; CV). It will additionally be important to design with an application and quality in mind as the quality and possibilities to work with recycled feedstock has an impact in the knitting and weaving (CV; CIV) and its corresponding outcomes.

It is found that waste is generated during all processes (CI) both through the literature and the empirical findings. It is furthermore found that the waste coming from processes with recycled material is not feasible to be recycled again due to the current technological state (CV). The current waste is handled in established recycling systems and established markets (CIV; CV).

The geographical scope is a condition that will have an impact on the environmental and economic aspects. It can be argued that local hubs will be a winning condition to a certain

extent throughout the supply chain and in aggregating a critical mass before shipping. It is further noted that the geographical scope today is global land led by the market demand. The local market needs to be developed to achieve, both the environmental and the economic conditions needed for the business to operate.

A common understanding of what needs to be established and both the perception of the quality from consumers and brands needs to be aware of the possibilities in the supply chain. The SC on its side needs to continuously improve, develop, and optimize its processes. Consequently, the way how to market and how to tell the story will be key in the communication. It is found that communication can overcome the technical aspects, as the understanding of qualities and technical possibilities are directly aligned, upstreams with the design and product development and downstream with the collection and sorting. Furthermore, it is noticed that valuable technical expertise is lost in the supply chain due to incorrect communication (CII; CV).

From the analysis and coding of the transcripts six themes are found which are highly related to all companies; economy, environment, regulatory concerns, organizational factors, product characteristics and the relationship characteristics itself. All of these themes are interconnected and come hand in hand, *"All is connected"* (CIII) ,when analysing the SRM in the textile-to-textile sector. The themes are described below in table 2.

Themes	**Description**
Economy	Economic feasibility is an important factor and condition related both to uåstream and downstream markets and market demands.
Environment	The environmental aspects are found to be the biggest driver, concerning all aspects of sustainability from raw material sourcing, to resources used in process to chemical concerns and waste management.
Organizational factors	The organizations themself play an important role in the inter-organizational process, their communications internally, externally and how they tell the story and do their marketing. Furthermore the culture and strategic vision within a company set the scene on the organization itself
Product Characteristics	The product characteristics of both the products to be recycled and the products being produced with recycled material play an important technical role within textile-to-textile recycling. The quality of products and the supply chain process capabilities is a significant factor in this aspect. Additionally the traceability of the products is an important concern from all interviewees.
Regulatory	Legal framework and the impact, both positive and negative, incentives, taxes and other means can have set the scene for the textile-to-textile recycling both in economic aspects but as well in technical ones.

Relationship Characteristics	Characteristics found important in the relationships are; loyalty, trust, communication and a win-win situation. Long-term partnerships are important. Collaborations is different forms, ie. platforms, networks, faris, are found relevant and being beneficial.

Table 2. Themes found.

6. Discussion

In the discussion chapter, reasoning is given about previous research theories linked to the empirical data by following the three pillars of the research paper; SCM, CE and Textile Recycling

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6.1. Supply Chain Management

In terms of business relationships between stakeholders, the collaboration has influential importance when enabling value creation, quality, and sustainable proposals that facilitate the development in the textile and clothing industry (CI; CII; CIII; CIV; CV; CVI; Dubey et al. 2019). As noted in previous research studies, the relationships can be of different types, vertical (closed collaboration), horizontal (open collaboration), partisan or nonpartisan relationship, depending on the purpose and expectations (Håkansson & Snehota 1995; Gattorna & Walters 1996; Lambert et al. 1996). Hence whether the relationship is vertical and only between supplier-buyer or customer-supplier, or horizontal with an open approach mimicking a network or alliance was undefined. The distinctive kind of relationship from the findings of the empirical data collection is long-term relationships built on a high level of loyalty between the stakeholders, thus considered as most profitable for the company (CII; CIII; CIV; CV; CVI). According to Lambert et al. (1996) partnership model, long-term relationships indicate both close participation of partners in coordination and integration of activities or long-term operational integration. Factors that contribute to the value of the relationship are according to Lambert et al. (1996) depending on the facilitators, components, and driving forces of the stakeholders. Here, reference to benefits such as cost-effectiveness, market advantages, and economic growth, sharing like-minded values, assets of capabilities, tangible and intangible resources or consistent communication. Hence also developing a business relationship in a supportive environment with a clear purpose. Since companies CIII, CIV, CV and CVI follow a supplier system that they have used for many years, the companies' relationships can interpret high value of such factors.

Following Håkansson and Snehota (1995), the empirical findings on the aspect of recyclability correspond adequately well regarding the circumstances of "technology, knowledge, social relations, administrative routines and systems, and legal ties". Due to the limitations in the mechanical cotton recycling system today, further technology development is required and the need for knowledge to close the loop. Hence due to the qualitative,

technical, and financial unprofitability, there is limited demand. (CII; CIV; Ljungkvist, Watson & Elander 2018; Mishra et al. (2019). Håkansson and Snehota (1995) also argue its impact on the relationship due to administrative systems that will improve the understanding of the differences between virgin and recycled properties and informative data access. Hence it is in correlation with a social network whose connectivity and efficiency will impact the performance of the supply chain and the resources (CI; CII; CV; CVI).

With the support of the empirical findings, the communication correlates satisfactorily well with previous research, a reliable and sustainable relationship is created between the stakeholders, achieved through trust and loyalty (CI; CII; CIII; CIV; CV; CVI; Lambert et al. 1996; Brito et al. 2008; Rusanen et al. 2014; Quinn 2015). The communication concerning trust and loyalty links to transparency and traceability, which is of importance for the sustainable supply chain business, thus supporting the environment, society, and economy (CI; CII; CIV; CV; CVI). Particulate regarding textile recycling in the industry hence several companies refer to lack of understanding the fiber performance and are in need of open communication across the supply chain and towards the end-consumer. Communication through intra-organizational and inter-organizational strategies can the sourcing and distribution of resources, knowledge, and learning by workforce management, platforms and key suppliers further deepen the capacity (CII; CIII; CIV; CV; CVI; Garcia-Torres et al. 2019). Furthermore, findings support Lambert and Schwieterman (2012) regarding the need for key suppliers to improve value creation and increase the conditions for customer satisfaction, particularly related to fiber content (CI; CII; CIII; CIV; CV). A supply chain with a strong focus on close relationships with key suppliers gives the company better benefits to improve and maximize productivity. Thus communicate across the supply chain to achieve higher value in a "customer-focused system" and obtain sustainable profitability and competitive advantages (CII; CIV; CV). Supporting the processes in the supply chain can strengthen the communicative tools for the information flow.

6.2. Circular Economy

In terms of the circular economy within supply chain management, the goal of the closed-loop is to reduce the extraction of raw resources through reusing and recycling pre-and post-consumer waste. The importance of the circular supply chain system in reverse logistics seems to be for industries the requirement and developed efficient production methods with both pre- and post-consumers waste due to an intensive time consuming, energy and costly process (Jayaraman & Luo 2007; Brito et al. 2008; Pal et al. 2019). This is in alignment with findings in the empirical data as waste is an issue that is generated across all processes in the supply chain (CI; Sandin and Peters 2018; Muthu 2019). Concerning waste management , the development potential for reverse logistics has given a positive impression from empirical results and, previous research corresponds to industrial symbiosis (CI; CIV; Chertow and Lombardi 2015; Milos 2018). Thus to a limited extent and not of specific produced textiles. The term refers to a material or product circularity for trade-in waste or unwanted material between different industries, local or regional sites (CI; CIV; Chertow and Lombardi 2015; Milos 2018). The waste management of cooperation between industries presupposes raw

material and resources reduction, decrease environmental footstep and can be economically beneficial for the companies. Hence it refers to smaller volumes of material that companies might otherwise have had to purchase in larger quantities to make it financially profitable in both directions. Furthermore, reverse logistics through this strategic application does not necessarily mean a need for recycling but only reuse for another purpose. Due to the limited extent, it may refer to the waste management policy for the industry due to waste declaration. In addition, textiles fall into the category of special waste and involve specific management governed by the EU waste management policy. Hence it allows the EU to control the textile circulation.

Concerning the implementation of a circular supply chain within the industry, the major focus in the textile and clothing industry correlated to economy and sustainability hence through different strategies and levels due to customer demand (CI; CII; CII; CIII; CIV; CV; CVI). The communication for sustainability and circularity between customer-supplier to meets the customer's requirements is demonstrated by certificates (CIII; CIV; CV; CVI). The empirical findings confirm that a company with a certificate improves trust, loyalty, and competitive advantage (CIII; CIV; CV; CVI). Thus, the textile certificate verifies the product inputs from processes and ensures the identity of the recycled material and the tracing of the products and raw materials in the supply chain can be comforted (Eryuruk 2015). Findings are in good agreement with Garcia-Torres et al.'s (2019) aspect of certification as a sustainable strategy for transparency and traceability. Hence it supports customer demand and governmental policy and legislation for textiles and possibilities for circularity. In addition, traceability and transparency through certification ensure reliable information and information from third parties (CVI). Due to technological development, additional opportunities for various innovative systems, commitments, and improvements in sustainability may also increase.

It is found that the inter-organizational vision is a key to the implementation of a circular economy in the textile industry. This vision can be interpreted as s set of common values need to be established both within the companies, as well as in society in order for the network's flow for the supply chain to more effectively develop and complement necessary key capabilities and manage to immediately clear targeting strategies for acquisition and competitive advantages (CIV; CVI; Rusanen et al. 2014). Company VI mentions *"The culture of circularity"* which has to be implemented in the whole organization where a common vision and goal is achieved. Furthermore company CIV highlights the importance of the management to *"believe in the solutions"*.

6.3. Textile Recycling

The supply chain with closed-loop and reverse logistics systems, indicates environmental and sustainable benefits due to the opportunity of extending the product life cycle in the society and promotes reuse or recycling of post-consumer waste by adding value to the end product.

Findings confirm that the participating companies show a positive approach towards these strategies and changes. Moreover, show that the industry is faced by financial and quality barriers to these implementations in the current linear supply chain. What is emphasized in the

empirical data is the lack of demand from customers as the performance of the fibers is significantly lower in quality than virgin fibers. It was found that Company V which is a knitting manufacturer states that the quality of the finished product was of the same quality as virgin quality, on the other hand, Company IV which is a weaving manufacturer shows the finished fabric have quality deficiencies. The quality of the material recycled is dependent on what is firstly put on the market. The sorting companies are reporting a decrease in quality and the low availability of high quality material for the textile-to-textile recycling, hence more recyclable products will be needed (CII). The design for recyclability will be of importance and furthermore design with recycled materials, where the design and product development processes are found to be needed to be reconsidered in the textile industry and optimized for handling textile waste.

The aspect of color will then be of high importance as the color correlates to colors from the sorting from post-consumer recycled fabrics, which means that color samples may deviate and therefore be less attractive to the customer. Other issues that have been highlighted in the empirical findings are that post-consumer recycled fabrics can involve additional costs due to impurities. The financial barriers correlate to that the economics of recycled feedstock is highly related to the feedstock price (CII; CIII; WARP 2019). Today the recycled material refers to a higher purchasing and processing cost than virgin fibers (CIII; CIV), which affects the customer's purchase decision.

Economic growth is important so that further technological investments can be applied to related processes and activities along the supply chain. Hence the purpose of the business is to provide economic growth (CII; CIII; CIV; CV; CVI), the problematization of the situation could generate a higher profit through lower price point than virgin fibers or the implementation of an ERP system that shows more favorable cost structures (CII).

Findings indicate that the majority of the companies argue that EPR systems can have a positive effect regarding recycling scaling in the industry related to economic feasibility, customer demand and technical aspects (Hole and Hole 2020; CI; CII; CIV; CV; CVI). The empirical data show that collection and sorting are of great importance for both the commercial scale and infrastructure of textile-to-textile, aligned with the waste management according to the WFD (CI; CII). The sorting process for recycling is perceived as a key process for textile to textiles despite current limited activity (CI; CII; CIII; Englund et al. 2018; Mishra et al. 2018; Leal et al. 2019; Jia et al. 2020; Huang et al. 2021).

A recognized deficiency confirmed by all companies is accurate and reliable knowledge and its communication flow. Companies argue that to enable scaling of textile-to-textile recycling, the supplier-buyer-customer needs to communicate through transparency and with broader knowledge to enhance the shared understanding of the differences between recycled and virgin fibers (CI; CII; CII; CV; CIV; CVI; Lahane et al. 2020; Kazancoglu et al. 2020; Niinimäki 2019). This in regard to both internal and external information channels from the design department to the supply chain and finally towards the end consumer.

It is further found that the size of corporations have an impact on the supply chain capabilities between the stakeholders themself and an incorrect vision of material availability is existing.

The geographical location of the companies is a found condition which directly affects environmental and economic aspects. It can be argued that local hubs will be a winning condition to a certain level. Aggregating a critical mass of material before shipping, increases both environmental and economic benefits. It is further noted that the geographical scope today is global land led by the market demand. The local market needs to be developed to achieve, both the environmental and the economic conditions needed for the business to operate.

7. Conclusions

The chapter concludes the findings of the research purpose and research questions.

The purpose of this research was to investigate how relationships and partnerships in the textile supply chain can impact commercial scale of textile-to-textile recycling by identifying relevant components along the supply chain to leverage textile-to-textile recycling of pre- and post-consumer textile waste. The discovered relevant components are answered in the research questions.

The significant finding when it comes to relationships in supply chain management is that business is about collaborations between stakeholders to achieve competitive advantages. Regardless of the linear or circular supply chain, the supplier-buyer-customer is built on the same principles but commits to different purposes and strategies.This leads to the first research question "*What factors may play a significant role for relationships within supply chain managemen*t *in the textile industrial sector and textile recycling?*

Business relationships built on loyalty, trust, and communication increase the qualifications to create reliable and sustainable relationships to develop and maximize productivity. Hence the stakeholders can facilitate the informative, knowledgeable, and competitive flow through transparency and traceability. The composition of stakeholders' capacity, intangible and tangible resources are decisive factors for value creation, economic feasibility, and customer demand. These factors can interpret key suppliers who, through significant assets, optimize processes and activities. Through common goals, shared values of culture, economy, and environment, it is more likely to emerge a win-win situation for the business relationship. Thus not only required for the establishment of the specific supply chain but should permeate the entire business structure. In correlation to the closed loop supply chain or reverse logistics the supply chain management should adopt a cross-functional system. Since there is no commercial-scale of textile-to-textile recycling in the T&C industry, it is found that these business relationships are in great need of key suppliers due to product development of quality, performance, price and value creation of demand.

The consideration for the type of relationship that falls within the framework of all factors is a long-term business relationship. The factors promote sustainable circular strategies to be more financial and quality stable in the leverage of textile recycling.

Following the second research question; "*What conditions are required for (pre-consumer and) post-consumer waste to demonstrate commercial scale in a textile-to-textile recycling?*"

The current market situation limits economic feasibility for companies in the textile and clothing industry to adopt a closed supply chain with reverse logistics. Tools that can improve the conditions for economic growth can be related to extended policy and legislation, including WFD, which adds financial pressure through the mandatory separate collection of textile waste. This also means that activation is supported by the government, following i.e.

an EPRs system will be feasible in order for demand to increase and enable the business case for recycled fibers. Thus product and chemical legislation will be important to align with the vision of CE.

This means that the commercialization of textile-to-textile recycling must include economic growth for stakeholders of a supplier-buyer-customer network to stimulate interest in further development and integration within the industry.

The opportunities for commercialization with textile-to-textile recycling are limited to a certain extent due to technical barriers. Moreover, it is limited due to recycling capacity, quality performance, inadequate volume, and high sourcing costs. This means that industrial operations require further development and optimizing of product and development processes. Such optimization correlates to key suppliers and stakeholders exchanging information. Communication is the most significant intangible factor for the supply chain management in terms of leverage textile-to- textile recycling. When increasing communication between the processes from sorting, spinning, fabric production, assembly of garments, and the design office, products designed with sustainable and circular principles furthermore designed and developed with recycled content are enabled. From this aspect, equal values and vision are a key prerequisite as the internal organizational workforce management is important for the supply chain progress when transforming from a linear to circular supply chain.

The commercialization of textile-to-textile recycling also needs more reliable knowledge, thus achieved through communication in various channels between stakeholders and end-consumer. Both to increase demand and the understanding of performance and quality to adapt the design to enhance value creation to the features.

7.1. Further Research

Communication is found to be the most important factor for scaling textile recycling. The condition of this environment and the corresponding platforms both digital or physical is found to be something which further needs to be investigated and optimized. This is found to be the key of all collaboration and could be the intangible enabler in scaling and commercializing textile recycling.

It will further be valuable to develop the scope of the research and include more organizations and open up the geographical scope. It will also be interesting to look into chemical recycling of cotton supply chains to see if there are any similarities or deviations.

In the research it is also found that the textile raw material in the form of garments are not a standardised feedstock as in other sectors like the plastic industry or metal. It would be interesting to look into the topic of this and what this could mean for the industry and what perceptions brands and designers have of such a topic.

Additionally the regulations in place need to be evaluated and aligned with the vision of a circular economy and textile circularity.

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Appendix 1. Interview Guide

Master Thesis in Textile Management 60 credits at the University of Borås
Charlotte Bjerstaf and Anna Pehrsson

General information

- Please introduce yourself
- Please introduce what the company is doing.

Sustainability

- Do you work with sustainability practices today?
- What are your thoughts about circular economy and sustainability? Business perspective and general ?

Textile recycling

- Do you work with recycled materials? What is your motivation to work with recycled materials?
- What quality considerations are there with working with recycled material?
- What opportunities and barriers are there working with textile recycling
- Do you see the demand for circularity and textile-to-textile recycling from suppliers in the industry / society/ customers ?
- What do you need as a company in order to invest more in circularity and in textile recycling? How can Textile recycling scale?
- Is waste produced in your facility and what happens with this waste?

Supply Chain Relations

- Which stakeholders are involved in creating textile recycling? How
  Does collaboration play a role in this?
- How is the relationship between you and your suppliers both upstream and downstream today?
- What would you say are the main qualities one is looking for around building relationships?
- Which circumstances are most important for the relationships or partnerships, both short-term and long-term, to be successful - both in terms of development but also financially?
- Which meaning does the supplier relationship management have on the production and product development, in both current and future operations?

Economics

- How is the business case around textile recycling?
- How to make recycling financially attractive?
- Do you see legislative measures needed? i.e. taxes, incentives etc.? If so, are they helpful or a barrier?

Endnote

- What barriers and opportunities do you see concerning textile recycling?
- What from your perspective can be done to benefit the recycling of material for you as a company and the supply chain you work with?

Appendix 2. GDPR Form

Högskolan i Borås
The Swedish School of Textile
Charlotte Bjerstaf and Anna Pehrsson
MSc. Textile Management

2021-05-XX

Consent for the collection and processing of personal data

As part of the Degree Project in Textile Management at the University of Borås, we are conducting our Thesis around the topic of Textile Recycling and Supplier Relationship Management.

We who are conducting the study would like you to provide certain information about yourself, more specifically name, profession and answers to an interview regarding the textile supply chain concerning textile recycling and the impact of supplier relationship management.

The personal data and information provided will be used to evaluate and get a picture of the relationship between stakeholders in the textile recycling supply chain.

The University of Borås is the controller of the processing, and the legal basis for the processing is article 6.1 (a) in the General Data Protection Regulation, GDPR, (consent).

The personal data will be used by usand may be made available to the teachers of the current course and central administrators at the university. The data collected will be converted to anonymous form and the result will be published in the Thesis report and also made public through the University Website. Which means that anyone as a general rule may access it in accordance with the principle of free access to public records. Transcripts and recording of the interview will not be published or made public.

The personal data will be stored in the EU/EEA, or countries outside the EU/EEA that the EU Commission has determined to have an adequate level of protection, i.e. sufficiently high according to the GDPR. The data will be erased when it is no longer necessary.

The results of the study will be presented in an anonymised form, so that no data can be traced to you.

Your participation in this study is completely voluntary. If you consent to the processing of your personal data as described above, you may withdraw your consent at any time whereby we will stop using your personal data. Because of legal requirements we may however be prevented from immediately erasing your personal data.

I hereby consent that University of Borås may collect and process my personal data as described above.

_____
Signature

_____
Name in block letters

_____
Place and date

To be filled in by the responsible teacher or supervisor

Student’s name

Course and semester

Course responsible (name, department)

Privacy Notice

Your privacy is important to us at the University of Borås. We are committed to protect your personal data and only process it according to applicable laws and regulations, including the General Data Protection Regulation (GDPR).

The University of Borås is the controller of the university's processing of personal data. If you have any questions about how we process your personal data, you are welcome to read more about this on our website, http://www.hb.se/privacy, or contact the course responsible.

Your Rights

- The university is transparent with how we process your personal data. If you want to know what personal data we process about you, you can request a copy of the personal data and information about the processing free of charge once per year. To order a copy of your personal data and information about the processing, you can use the form for this that is available on our website, http://www.hb.se/dataskydd.
- If you consent to processing of your personal data you may withdraw the consent at any time. We will then not continue to process your personal data. Personal data that have been made public, e.g. published on social media, is usually not affected by a withdrawn consent however. Because of legal provisions we may also be prevented from immediately erasing your personal data.
- You have a right not to be subject to a decision based solely on automated processing, including profiling, which produces legal, or other significantly effects. The University of Borås does not make such decisions.
- You have a right to have the processing of your personal data restricted.
- You can request rectification or supplementation of personal data that is inaccurate or incomplete.
- You have a right, under certain circumstances, to have your personal data erased.
- You have a right to receive your personal data in a structured, commonly used and machine-readable format to transmit those data to another controller.
- You have a right to lodge a complaint to the supervisory authority (Datainspektionen).

Contact us

Controller
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THE SWEDISH SCHOOL
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