CIRCULAR ECONOMY IN FINLAND: PERCEPTIONS FROM THE TEXTILE INDUSTRY

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ABSTRACT

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Abstract

Textiles are a mandatory part of everyone's everyday lives. Still, textiles have been widely treated as disposable products due to our consumption habits and fast fashion. This wasting of valuable resources burdens the nature and pollutes areas on the planet that are the most vulnerable. This can, however, be changed by transition the current linear economy model to Circular Economy (CE). CE has gained a lot of research interest in recent years. Yet, there has been insufficient amount of research focusing on textile industry in the context of Finnish market.

The objective of this thesis is to explore the perceptions towards CE and its implementation in Finnish textile companies. Additionally, this thesis will focus on what advantages and challenges Finnish textile companies have experienced in their transition towards CE. The results of this thesis will help to understand the hindering and supporting factors of CE implementation within Finnish textile industry. This thesis seeks for the answers by conducting a qualitative study based on 16 semi-structured interviews within four different Finnish textile companies.

The findings of this thesis discovered multiple challenges that Finnish textile companies have experienced with their CE implementation. The information available concerning CE was considered as unclear and not easily accessible. Additionally, the interviewees in this thesis expressed to be unaware of all the possible applications of CE. The current textile recycling system in Finland was considered as a hindering factor in promoting CE as the infrastructure is not functional and machinery would need updating. The findings indicate that the Finnish textile companies are despite the challenges still committed and interested to transition linear economy to CE. The companies recognise potential financial benefits that CE would bring. Importance of collaboration between different actors within the textile industry is highlighted as one company has limited power to influence the whole industry.

Key words

circular economy, textile industry, Finland, fashion industry, fast fashion, textile recycling

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Tiivistelmä

Tekstiilit ovat pakollinen osa jokaisen ihmisen elämää. Tästä huolimatta tekstiileitä kohdellaan laajasti kertakäyttötuotteiden tavoin nykyisten kulutustottumustemme ja pikamuodin vuoksi. Tämä arvokkaiden resurssien hukkaan heitto rasittaa luontoa ja saastuttaa alueita, jotka ovat kaikista haavoittuvaisimpia. Tämä on kuitenkin mahdollista muuttaa siirtymällä nykyisestä lineaarisesta taloudesta kiertotalouteen. Kiertotalous on saanut viime vuosien aikana kohtaansa paljon kiinnostusta erilaisissa tutkimuksissa. Silti aihetta on tutkittu vain vähäisesti suomalaiseen tekstiiliteollisuuteen liittyen.

Tämän tutkimuksen tavoite on tutustua käsityksiin, joita suomalaisilla tekstiilialan yrityksillä on kiertotalouteen liittyen. Lisäksi tämä tutkimus keskittyy selvittämään mitä mahdollisuuksia ja haasteita suomalaiset tekstiilialan yritykset ovat kohdanneet siirtyessään lineaarisesta taloudesta kohti kiertotaloutta. Tulokset auttavat ymmärtämään mitkä seikat hidastavat ja tukevat kiertotalouden omaksumista Suomen tekstiiliteollisuudessa. Näihin kysymyksiin etsitään vastauksia kvalitatiivisen tutkimuksen myötä, joka pohjautuu 16 puolistrukturoituun haastatteluun neljästä eri suomalaisesta tekstiilialan yrityksestä.

Tutkimuksen tulokset tunnistavat useita haasteita, joita suomalaiset tekstiilialan yritykset ovat kohdanneet kiertotalouden omaksumisessa. Kiertotalouteen liittyvän tiedon koetaan olevan epäselvää sekä vaikeasti saatavilla. Tämän lisäksi haastateltavat ilmaisivat olevansa epätietoisia kaikista mahdollisista osa-alueista, joihin kierotaloutta voi hyödyntää. Nykyinen tekstiilikierrätyksen järjestelmän koettiin hidastavan kiertotalouden tukemista sillä nykyinen infrastruktuuri ei ole toimiva ja laitteisto vaatii päivittämistä. Tulokset kuitenkin osoittavat, että suomalaiset tekstiilialan yritykset ovat sitoutuneet ja kiinnostuneet siirtymään lineaarisesta taloudesta kiertotalouteen haasteista huolimatta. Yritykset tunnistavat potentiaaliset taloudelliset hyödyt, joita kiertotalous toisi. Yhteistyön tärkeyttä useiden eri toimijoiden välillä korostettiin, sillä yhdellä yrityksellä on vain rajattu mahdollisuus vaikuttaa koko alaan.

Asiasanat	
kiertotalous, tekstiiliala, Suomi, muotiala, pikamuoti, tekstiilikierrätys	
Säilytyspaikka	
Jyväskylän yliopiston kirjasto	

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1 INTRODUCTION

1.1 Background

It would be hard to imagine our current everyday lives without textiles and clothing. Clothing gives us a way to express ourselves, it comforts us, allows us to make statements, protects us and almost everyone in the world wears clothing. However, textiles are currently treated widely as disposable products. Products that are used once or a couple of times and then forgotten about and disposed of.

The current linear system of production wastes valuable materials that could be utilised in future production as well as water and energy resources (Niinimäki, 2018). This constant wasting of valuable resources burdens the nature and pollutes areas that are the most vulnerable. This, however, can be changed with a system that closes the loop of the linear economy. This system is called Circular Economy. Circular Economy (CE) has been getting increasing amount of research interest. Geissdoerfer et al. (2017) have defined CE as "*a regenerative system in which resource input and waste, emission, and energy leakage are minimum by slowing, closing, and narrowing material and energy loops*." They state that CE can be achieved by having design that is long-lasting and being able to repair, reuse, maintain, refurbish, remanufacture, and recycle the goods. The core aim of CE is to maintain materials, components and products at high value and utility thorough the whole life cycle (Azevedo et al., 2017). In this way it is possible to enable the need to consume finite resources. China has adopted CE as its main framework for environmental change and economic development (Murray et al., 2017).

Consumer attitudes on CE have been researched before. For example Vehmas et al. (2018) state that consumers like the idea of recycling their used clothing pieces to produce new ones. They also emphasize that Finnish consumers are generally more likely to return their old clothing for reuse rather than throwing them away. Companies' attitudes and readiness of the adoption of CE have been covered in the literature to some extent. However, coverage on Finnish markets and especially Finnish textile market has been low.

CE will have a prominent role in the future of textile industry which is evident as different policies utilising CE are emerging. In 2018 the European Parliament approved a package that updates its' current waste management rules which is a crucial element of the Circular Economy Action Plan that was adopted by the European Commission in 2015 (European Commission, 2018). The EU member states will set up separate collections of textiles by 1st of January 2025 (European Commission, 2018). This new policy creates pressure for governments to arrange textile waste collection. Knowledge on Finnish textile companies' perceptions and views on CE would offer useful information for the policy makers. Additionally, the importance of CE in the future is recognised also among the

academia as there are multiple research projects focusing on CE in Finland. CICAT2025 is a project that has a goal to ease the transition from linear economy to CE (CICAT2025, n.d.). FINIX is a research project that produces new scientific research on sustainability aspects of textile systems to help co-create resource-wise textile business (FINIX, 2019).

Personally, CE is a field of which I am interested in. I believe that in future it will gain significantly more attention and popularity. CE is also a system that can be applied in the fashion and textile industry to create more sustainable operations. During my previous studies I have focused on fashion and textile retail and have worked in textile companies that are thriving to be more sustainable. However, CE is a topic that rarely comes up in the discussion. It may be that companies are practising CE without knowing or they do not have the knowledge on which operations are easily applicable to support the CE system.

1.2   Research design, research questions and structure

The aim of this thesis is to learn how CE can be utilised and applied to Finnish textile industry to improve the overall sustainability in Finnish textile companies' perspective. This thesis examines what perceptions of CE Finnish textile companies have and whether they are aware of potential opportunities that CE may present. Moreover, the thesis seeks what challenges these companies have experienced in the application and integration of CE in their operations. It is important to gain understanding of these companies' standpoints to further develop new CE applications and operations in the future. Furthermore, this thesis discovers what role CE will have in future in the point of view of Finnish textile companies. This thesis focuses on the integration of CE mainly in the micro level.

This thesis will be carried out by interviewing four Finnish companies working in textile industry. In this way it is possible to gain understanding on how companies themselves see how they can integrate CE into their operations. What are the advantages and disadvantages? Understanding on how Finnish textile companies view CE and whether they have certain beliefs in relation to integrating CE will also be gained. CE in relation to Finnish textile industry has hardly been researched before. Therefore, deep, and thorough understanding on CE in Finnish textile industry must be gained first. Thus, this research will be executed as a qualitative research.

This thesis is conducted in collaboration with CICAT2025 project. The project is part of supporting Finland's objective in becoming a global leader in CE by 2025 (CICAT2025, n.d.). The project will have one focus on Finnish textile industry. This thesis will support the project in their data collection phase and will utilise shared data. This shared data consists of interviews from four different Finnish textile companies in varying sizes.

Research question:

What are the opportunities and challenges of Circular Economy in Finnish textile industry?

Sub-questions:

1. What is the understanding of Circular Economy in Finnish textile companies?

2. What are the potential challenges Finnish textile companies may have in the process of integrating Circular Economy into their operations?

3. What advantages Finnish textile companies see in the integration of Circular Economy?

4. What is the role of Circular Economy in future in Finnish textile companies' point of view?

In the following two chapters the theoretical framework of this thesis is presented. In Chapter 2 global textile industry as well as Finnish textile industry are introduced which create a deeper understanding of the context of this thesis. In Chapter 3 the concept of CE is described. The chapter will also create understanding of different ways in which CE can be implemented into operations of organization or company. Moreover, the chapter also describes ways of CE implementation within textile industry and Finnish textile industry. Chapter 4 presents and gives reasoning to the methodological choices of this thesis. The chapter also describes the process of data collection and data analysis. Chapter 5 introduces the research findings of this thesis and in Chapter 6 these findings are discussed in relation to existing literature. Chapter 7 gives final conclusions of this thesis.

2   TEXTILE INDUSTRY

This chapter will present a part of the theoretical framework of this thesis. The first part of this chapter will focus on the textile industry globally. The general picture of the global textile industry is given, and current consumption patterns of textiles and clothing are presented. Fast fashion as a phenomenon plays an important role in the textile industry today and therefore is also described in the first part of this chapter. Additionally, the impact of textile and fashion industry is revealed.

The second part of this chapter will address the current state of Finnish textile industry. Key figures from recent years will be presented as well as export and import rates of textiles and fashion. This chapter will create a general understanding of the context and framework of this thesis that is Finnish textile industry.

2.1   Textile industry today

This chapter will describe the overall global textile industry today as well as the current grievances of the textile industry. It is estimated that the overall apparel consumption will rise from 62 million tons in 2017 to 102 million tons in 2030 which is equivalent of more than 500 billion t-shirts (Eder-Hansen et al., 2017). The textile industry is among the most polluting industries due to its high resource intake, chemical usage and current business models which make it possible that textiles are considered as these disposable products. The USD 1.3 trillion clothing industry employs globally over 300 million people in the whole value chain of clothing, according to Ellen McArthur Foundation (Ellen McArthur Foundation, 2017). Clothing industry today mostly depends on linear economy. The linear model puts materials in a fast system which includes fast design, manufacturing, consumption and easy disposal process (Niinimäki, 2018). This fast way of economy sets the model for the fashion business as well as its means of making profit, according to Niinimäki (n.d.)

Clothing production uses large amounts of resources that are non-renewable and used often only a short period of time (Ellen McArthur Foundation, 2017). After the use materials will be thrown to landfill or incineration causing a large material loss (Ellen McArthur Foundation, 2017). Remy et al. (2016) states that clothing production has doubled from year 2000 to 2014 and the average consumer purchases 60 % more clothing pieces. This is a result from lower costs, streamlined operations, and the rise of consumer spending. At the same time, consumers are wearing their purchased clothing pieces less than before. Consumers keep their clothing pieces half as long as they did 15 years ago across almost every clothing category and discard them after just seven or eight wears (Remy

et al., 2016). Ellen McArthur Foundation (2017) have estimated that globally consumers lose USD 460 billion of value each year by discharging clothing pieces that could still be worn. By making production more streamlined and creating new clothing designs significantly more often than before, consumers have been enabled to expand their wardrobes and update it more frequently (Remy et al., 2016).

As previously stated, the textile industry utilises mostly non-renewable resources, as much as 98 million tonnes a year which includes oil in synthetic fibre production, chemicals in dye production and to finish fibres and textiles, and fertilisers in growing cotton (Ellen McArthur Foundation, 2017). Remy et al. (2016) state that to produce 1 kg of fabric generates 23 kg of greenhouse gases on average. Environmental problems are also often caused by textile production as harmful and even toxic chemicals are handled and waste is not handled appropriately (Niinimäki, 2018). Eder-Hansen et al. (2017) predict that the amount of waste fashion industry generates will increase by 60% from 2015 to 2030 if the current level of solid waste generated by end of use and productions continues. This would mean 57 million tons of waste annually and the total level of fashion waste would rise to 148 million tons by 2030, which is equivalent of 17.5 kg per capita globally (Eder-Hansen et al., 2017).

A survey commissioned by Greenpeace (2017) has studied European and East Asian consumers and their shopping habits. The survey argues that two thirds of Hong Kong residents own more clothing pieces than they need. 60% of Chinese and over a half of Italian and German participants also admit that they own more clothing pieces than they need. Additionally, 40−46% of Taiwanese, Italian and German participants say that they have unworn clothing pieces with still tags on in their wardrobes.

Textile and fashion manufacturing has largely moved to lower-cost countries as well as many environmental issues (Niinimäki, 2018). Niinimäki (2018) argues that the true value of resources used in the textile production are subsidized and easily forgotten. Additionally, the costs of environmental impacts of the production are not part of the price of the finished product. She highlights that as a result low cost clothing pieces can have a significant impact in the area the clothing is being produced.

A strategy which culminates the negative impacts of linear fashion business model is called fast fashion. Sull and Turconi (2008) describe fast fashion as a strategy that democratises couture and brings affordable and trendy fashion items to the masses. According to them, fast fashion strategy adapts merchandise assortments to trends that are current but also emerging as effectively and rapidly as it is possible. This means that retailers have replaced the traditional model where designers decide what is "in" with an approach in which retailers respond to market shifts within only a few weeks (Sull & Turconi, 2008). Fashion companies working as leaders of fast fashion such as Zara take only 14−21 days from designing the clothing to displaying in retail store which means that new clothing pieces and trends are constantly being introduced (Presley & Meade, 2018). Zara and H&M are examples of retailers that have become well known for constantly

renewing their product ranges with styles which attract media attention and tempt customers that mostly young females in their stores frequently (Barnes & Lea-Greenwood, 2006). A term ultra-fast fashion has also been introduced as some fast fashion players introduce up to 1,000 new styles to their customers a week (Fashion Revolution, 2020).

Fast fashion has many negative effects which include cheap fabrics, disposable fashion, limited product duration and low prices that encourage consumers to impulsively buy more, states Presley and Meade (2018). They argue that consumers are encouraged to buy more clothing pieces than they need by the low prices which leads to fashion waste. Generally, fast fashion clothing is not designed to last or to be durable which leads consumers to dispose their clothing after just a few wears (Presley & Meade, 2018). Unfortunately, a lot of clothing waste ends up in the landfill instead of recycling, re-using and other end-of-life management means (Kozlowski et al., 2014).

On 24th of April 2013 a building called Rana Plaza collapsed in Dhaka, Bangladesh, killing over 1,130 people and injuring more than 2,500 (International Labour Organization, n.d.). This factory housed five garment factories and only five months earlier 112 workers were killed in a fire in Tazreen Fashions factory on the outskirts of Dhaka (International Labour Organization, n.d.). These disasters are among the worst industrial accident that have been recorded which showed how poor labour conditions are in the ready-made garment industry with some of the lowest wages in the world, unsafe work environments, occupational diseases and a high incidence of work-related accidents and deaths (International Labour Organization, n.d.). Clean Clothes Campaign (n.d.) have identified at least 29 global brands that had current or recent orders from at least one of the five factories in the Rana Plaza building. These brands included for example Benetton, Mango and Primark of which some can be recognised as companies with fast fashion strategy. Therefore, fast fashion burdens people behind the production in addition to the environment. To answer to these ethical and environmental problems some fast fashion companies have started to adopt some sustainable practices and strategies (Turker & Altuntas, 2014).

2.2   Textile industry in Finland

This chapter presents the current state and consumption rates of Finnish textile industry. Finnish Textile And Fashion (2019) reports that in 2018 a total of 3400 companies operated in the textile and fashion industry in Finland. 660 of these companies produced clothing and textiles or subcontracted the production employing 4 780 people. For a reference, there were 361 069 companies in total in Finland in 2018 employing 1 495 000 people (Tilastokeskus, 2020). The turnover of the textile and fashion industry in Finland in 2018 was € 4.4 billion and for these companies producing or subcontracting the production the total turnover was € 1 050 million (Finnish Textile And Fashion, 2019). The turnover of all the

companies in Finland in 2018 was € 436.5 billion (Tilastokeskus, 2020). The biggest sector in Finnish textile and fashion industry was the retail of textiles and clothing with 1 500 companies, 9 560 employed people and turnover of € 1 620 million (Finnish Textile And Fashion, 2019). The total turnover of Finnish textile industry has been steadily rising since 2015 although it has been slowing slightly, according to Finnish Textile And Fashion (2019). On the other hand, the Finnish fashion industry struggled in the 2010s and the turnover decreased from 2012 to 2016 annually (Finnish Textile And Fashion, 2019). In 2017 the turnover increased by 5% and in 2018 it was slightly negative (Finnish Textile And Fashion, 2019).

In Finland € 870 was spent on clothing and footwear per capita in 2017 which is 4,2% of the overall consumption a year, according to Finnish Textile And Fashion (2018b). This results in € 4.8 billion spent on clothing and footwear in Finland annually (Finnish Textile And Fashion, 2018b). For home textiles, not including carpets, around 90 € a year is spend per capita which is 0.45% of the overall consumption (Finnish Textile And Fashion, 2018b). As the prices of clothing and textiles has decreased during last decades the amount of money used in the textile and clothing sector has also decreased (Finnish Textile And Fashion, 2018b). Still, clothing is a significant consumption sector. For example, cars are being bought for around € 3.3 billion annually and € 5.9 billion are spent in restaurants annually (Finnish Textile And Fashion, 2018b). In 2017 52% of money spent on clothing was spent on women's clothing and 28% on men's clothing in Finland (Finnish Textile And Fashion, 2018b). The group with the highest consumption rates were between ages of 45 to 54 for women and men (Finnish Textile And Fashion, 2018b).

Levels of textile and fashion imports surpass the levels of fashion and textile export in Finland as, according to Finnish Textile And Fashion (n.d.), the imports of fashion and textiles were € 2.4 billion in 2018 and the exports were € 700 million. The biggest import countries were China, Bangladesh and Germany and biggest export countries were Sweden, Germany and Russia (Finnish Textile And Fashion, n.d.). The most significant import items were clothing pieces and footwear and most significant export items were clothing and technical textiles (Finnish Textile And Fashion, n.d.).

3   CIRCULAR ECONOMY

This chapter is the second part of the theoretical framework of this thesis and will begin by scoping the concept of CE and determining the definition as well as the origins of the concept. Different actions and principles required to implement CE are defined and compared. Additionally, different ways to implement CE will be presented in the second part of this chapter with possible opportunities and challenges that may appear during the process of implementation.

In the third part of this chapter CE in relation in textile industry will be addressed. How CE has globally been implemented in the textile industry and possible hindering and advancing factors will be presented. In fourth and final part of this chapter Finnish textile industry's relation to CE will be investigated. Companies working with CE are presented as well as some future outlooks.

3.1   The concept of Circular Economy

This chapter will present the concept of CE with distinguished definitions. CE is described as *"an industrial system that is restorative or regenerative by intention and design"* by Ellen McArthur Foundation (2012). The goal, according to them, is to replace products' and services' end-of-life concept, which is achieved by restoring resources, using renewable energy, avoiding toxic chemicals, and eliminating waste. There has been an abundance of different definitions of CE in the literature which can cause a challenge for research working on the topic, according to Kirchherr et al. (2017). For example, some scholars may define execution of CE as recycling whereas some may define it as reducing, reusing, and recycling. Kirchherr et al. (2017) have analysed 114 definitions of CE and emphasize that this abundance of definitions and researchers having different understandings of CE may cause misleading results in the research. They define CE as following:

> *(…) an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers. (p. 229)*

Prieto-Sandoval et al. (2018) state that CE is generally outlined as cycle (Fig. 1) in which firstly, organizations take resources from the environment to produce products and services. Secondly, the services and products are distributed to consumers either directly or through other organizations. These products and services are used by consumers. This is where CE closes the loop by recovering the services and products. When products and services are designed in a circular way they minimise resource use and help foster materials' reuse, recyclability and recovery (European Commission, 2019).

It is generally agreed that CE operates in three different levels which are micro, meso and macro, according to Prieto-Sandoval and Jaca, et al. (2018). They describe micro level as a level where organizations focus on improving their own operations and creating eco-innovations. The meso level aims to develop an eco-industrial network which benefits regional production systems as well as environmental protection (Yuan et al., 2006). Finally, the macro level focuses on developing eco-cities, municipalities and provinces (Yuan et al., 2006), which is achieved through developing institutional influence and environmental policies (Prieto-Sandoval et al., 2018).
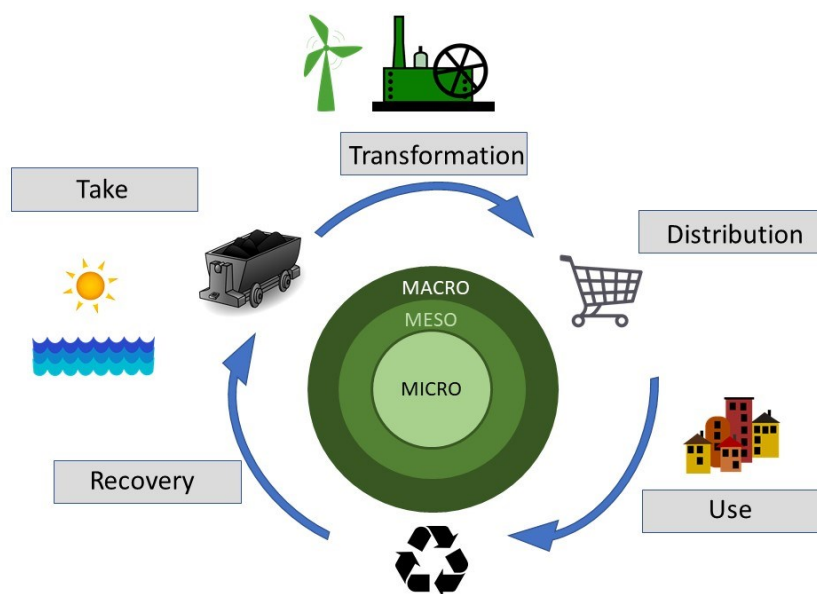
Figure 1. Circular Economy cycle (Prieto-Sandoval et al., 2018)

The roots of CE, according to Geissdoerfer et al. (2017) are European and China has recently been playing a huge role in CE research. CE is seen as a condition of sustainability in the research literature (Geissdoerfer et al., 2017). There is some uncertainty around when and where CE was first introduced. Ellen McArthur Foundation (2015) argues that major schools of thought around CE emerged already in the 1970s and gained notability more in the 1990s. They also identify seven different schools of thought related to CE. These are performance

economy of Walter Stahel, Cradle-to-Cradle by William McDonough and Michael Braungart, biomimicry by Janine Benyus, industrial ecology by Reid Lifset and Thomas Graedel, natural capitalism by Amory and Lovins and Paul Hawken, blue economy by Gunther Pauli, and regenerative design by John T. Lyle (Ellen McArthur Foundation, n.d.).

According to Ghisellini et al. (2016) three main "actions" can be seen as founding principle of CE. This is called 3R's principle which stands for reduce, reuse, and recycle. The principle requires reformation of norms including production of goods and way they are being consumed (Yuan et al., 2006). Yong (2007) argues that the 3R's principle is good principle in implementation of CE. According to him, reduction aims to reduce the use of energy and resources in the production phase and consumption. Reuse, on the other hand, is aiming to use the products and services as long as they have any usage function. Finally, recycling promotes translating wastes into new resources and connects production and consumption phases. Ghisellini et al. (2016) states that the 3R's principle can be integrated with Ellen McArthur Foundation's (2012) additional principles. The core principle of CE is to design products in a way that no waste is generated and reuse and disassembly are priority (Ellen McArthur Foundation, 2012). The second principle is to differentiate durable and consumable product components. Therefore, consumable components should be made of biological ingredients that can be safely returned to the biosphere. Durable, on the other hand, are components such as computers that cannot be returned to the biosphere. These are made of nutrients such as plastics and metals. Durable components are designed to be reused. Third principle is that the energy that is being consumed should be generated from renewable sources.

3.2 Implementation of Circular Economy

This chapter provides understanding of different ways in which CE can be implemented and adopted into operations of organizations or companies. Urbinati et al. (2017) argue that to adopt CE model in business operations, organizations are required to create a new business model or adapt their existing business model. Thus, organizations must add and manage reverse supply chain activities such as product evaluation, reuse process, recycling, and remanufacturing. This adoption requires new technological skills and equipment to identify where the value of supply chain is created highlighting the importance of for example LCA principle (Urbinati et al., 2017). Ghisellini et al. (2016) states that CE in China and worldwide is being adopted differently. They argue that China has adopted a top-down approach which, according to Zhijun and Nailing (2007), is promoted by China's basic national policy. On the contrary, in Europe CE is mainly been adopted as a bottom up approach from initiatives by for example NGOs (Non-Governmental Organization) and environmental organizations (Ghisellini et al.,

2016). European Commission (2014) has identified six possible challenges that can barrier the transition and implementation of CE. They are identified as:

- lack of awareness, knowledge, or capacity by companies;
- current business models, systems, infrastructures, and technologies may lock economies in a linear economy model;
- investments in CE can be seen as complex and risky;
- there may not be enough demand for sustainable products and services; particularly if they require change in behaviour;
- commonly prices do not reflect the true cost of products to society of energy and resource use; and
- not strong and consistent enough policy signals for the transition towards CE (European Commission, 2014).

However, there are many opportunities in the adoption of CE. Ellen McArthur Foundation, SUN, and McKinsley have identified what advantages adoption of CE can have in Europe (Ellen McArthur Foundation, 2015). They state that Europe could take advantage of future's technology revolution and create a net benefit of €1.8 trillion by the year 2030, or €0.9 trillion more than the current linear model generates. CE would benefit companies and organizations by creating new and bigger profit opportunities, reduce volatility and create more security of supply, create new demand for business services, and improve customer loyalty and interaction (Ellen McArthur Foundation, 2015).

To comply with principles of CE four main modifications are required by organizations (Urbinati et al., 2017). These four modifications require implementation of reverse supply chain activities and more co-operation with the actors of supply chain, as well as a new value proposition for their customers. That requires new ways to recognize the buying process in addition to more co-operation between companies and their customers (Urbinati et al., 2017).

Ormazabal et al. (2018) have studied the barriers and opportunities small and medium-sized enterprises (SMEs) may face when they are implementing CE into their operations in Spain. Their study shows that for SMEs it is easier to adopt principles and measures that relate to supplier and sources selection rather than operations that would close the loop. These operations are related to the return and enrichment of materials and energy. Still, the study found that some economic sectors are more willing to implement environmental strategies within the CE cycle. An example was given of construction sector which has high limitations regarding the implementation of CE in the use phase. Yet, they are more willing to return and enrich materials they use in their production. The SME participants of the study also explain that they do not believe that implementation of CE would increase their profitability and sustainability which can result to unwillingness to invest in better technology or materials that are needed to close the loop.

European Commission (2019) emphasizes that SMEs are key players in the transition from linear to circular economy. The transition requires engagement

from consumers as well and changing consumption patterns (European Commission, 2019). Sustainable choices should become easier for consumers as well as more attractive, affordable and accessible (European Commission, 2014). The decision making is affected by multiple factors such as immediate costs, benefits of choices, other people's behaviour, and way the information is received, according to European Commission (2014). Additionally, behaviour of consumers can be affected and changed by different influences for example at the place they work or the infrastructure around them. Therefore, these factors can change consumers seeing themselves from 'consumers' to 'users' and 'owner' to 'sharer' and this way create more possibilities and demand for services such as sharing, repairing and renting (European Commission, 2014).

One way to create new possibilities for businesses and create more sustainable business models are product-service systems. Product-service systems (PSS) is defined by Goedkoop et al. (1999) as *"a system of products, services, networks of players and supporting infrastructure that continuously strives to be competitive, satisfy customer need and have a lower environmental impact that traditional business models"* (as cited in Geum & Park, 2011). According to Tukker (2004) PSS are often seen as an excellent instrument to foster sustainability and enhance competitiveness simultaneously. He states that PSS business models aim to fulfil customer need in a customized and integrated way that lets customers to concentrate on activities that are important for them. Additionally, PSS business models help building unique relationships with customers and thus enhance customer loyalty. They also most likely help the innovation process to be more efficient as they follow their customers' needs more carefully (Tukker, 2004). The most important characteristics of PSS come from integration of services and products, Geum and Park (2011) state. They argue that the value creation of PSS comes from consumers not purchasing the products but organizations fulfilling customer needs. Moreover, as PSS delivers a function over a product, customers do not own a specific product or services in some forms of PSS (Geum & Park, 2011).

Tukker (2004) has identified three different types of PSS which are recognised for example by Geum and Park (2011) and Gaiardelli et al. (2014). These three types are *product-oriented services, use-oriented services*, and *result-oriented services*. Product-oriented services refer to a seller that in addition to selling a product also offers services that are needed in the use phase of the product life cycle such as repair and maintenance service. The seller also offers advice on the use of the product. Use-oriented services, on the other hand, refer to products and services that are not owned by the customer. This is often executed by offering product, leasing, renting, or sharing services. Product pooling is also one possibility that is similar to renting but incorporates simultaneous use of the product. Lastly, Tukkers (2004) result-oriented services include outsourcing for example catering services. This also includes pay per service model which practically means for example charging a certain price for printing and making copies of documents. In this type of PSS, the result can also be functional, meaning that the service provider is needed to deliver certain result but is free to choose how to perform it (Tukker, 2004).

When organizations are adopting PSS systems they should not focus only on the PSS and its value chain, but also consider the favouring or hindering contextual conditions that can affect the social embedding of PSS (Ceschin, 2013). Also, the long-term goals of PSS implementation should be reinforced with short and medium term actions as well as with flexible and dynamic approaches (Ceschin, 2013). Chen (2018) also argues that organizations should be innovative and think outside of the box and beyond the product use while they are trying to understand their customers' problems. He also emphasizes that addressing social issues will generate long-term value and improve brand image. Additionally, collaborative networks with communities, government and other actors can create a platform for innovation and more opportunities to develop sustainable values (Chen, 2018).

CE business models can be divided into two different groups, Stahel (2016) argues. First being business models that support product reuse and aim to extend product life through maintenance, remanufacture, possibility to upgrade, and retrofits. Second being able to turn old products and services into new resources by material recycling. Stahel (2016) emphasizes that using the same materials more than one time would generate more jobs and reduce waste and resource consumption. He gives an example of a glass bottle and how it would be less expensive to recycle the glass bottle than making a new one from minerals. Urbinati et al. (2017) state that in the literature it is emphasized that activities such as design for recycling, remanufacturing and reuse (DfR), design for disassembly (DfD) and design for environment (DfE) have a pivotal role in CE.

Stahel (2016) emphasizes the importance of future innovation in relation to CE as research and innovation is needed at social, technological, and commercial levels. He states that environmental and materials scientists and economics are needed to assess different costs and benefits and environmental impacts of products. Communication as well as information strategies are crucial in raising awareness of the responsible products (Stahel, 2016).

As previously stated by Stahel (2016) new innovations are required to adopt CE. Eco-innovations are inventions, new solutions and designs that fulfil nature's and human's needs ecologically effective ways, describes (Hofstra & Huisingh, 2014). To provide clarity in different features of eco-innovations, Hofstra and Huisingh (2014) have characterized four different types of eco-innovations. *Exploitative or degenerative eco-innovations* are designed to meet legal requirements and give hardly any attention to environmental impacts of production. *Restorative eco-innovations* focus on eco-efficiency to minimize energy usage, emissions, and generated waste. *Cyclical eco-innovations* connect humans as a part of ecosystems and design is an on-going process. Finally, *regenerative eco-innovations* emphasize the vitality of ecosystem and creates added value for humans and nature highlighting the importance of nature's uniqueness for the design process.

Other important principles of CE are sustainable design strategies (SDS). Prieto-Sandoval and Jaca, et al. (2018) define life cycle assessment (LCA), cradle-

to-cradle (C2C) and nature-inspired design strategies (NIDS) as three most popular design strategies. They believe also that SDS with the 3R's principle can co-exist and together shape the CE framework. However, it is important to understand that these principles have different functions and work on two different levels (Prieto-Sandoval et al., 2018). SDSs can be seen as the catalysers for CE as they are used as guidelines for eco-innovative goods and services design process (Prieto-Sandoval et al., 2018).

Urbinati et al. (2017) propose a framework to identify how organizations are adapting their current business models and creating new one in order to implement CE. The framework is based on their taxonomy of Circular Economy Business Model which evaluates the degree of CE adoption in value network and customer value propositions & interface. The value network stands for reverse supply chain activities and more co-operation with the supply chain. Customer value proposition and interface include three different modifications. Firstly, according to Urbinati et al. (2017), the organization should shift from a pay-per-own to a pay-per-use approach. Secondly, there should be more co-operation between customers and organizations. Finally, organizations should implement payment per use-oriented operations over payment per own operations.

Therefore, Urbinati et al. (2017) propose a taxonomy of four modes to adopt CE principles (Fig. 2). This taxonomy can be utilised when evaluating the adoption process of CE of companies that have significant differences among each other. *The Linear* mode represents the current linear economy model. *The Downstream Circular* mode includes organizations which run a marketing campaign or a price scheme that promotes the use or re-use of products. However, in this mode organizations do not have design procedures or internal operations that support CE and mainly focus on generating revenue. *The Upstream Circular* mode includes organizations that, on the contrary, have adopted CE principles into their internal operations and design activities. These organizations do not promote these principles and activities and, thus, they are not visible to the customers. The focus on these organizations is focused on cost efficiency. Finally, *The Full Circular* mode includes organizations that have adopted CE internally and externally. These organizations implement CE into their own production systems and additionally involve its suppliers into its circular operations. Organizations implementing this mode communicate to their customers of their implementation of CE as it creates value.
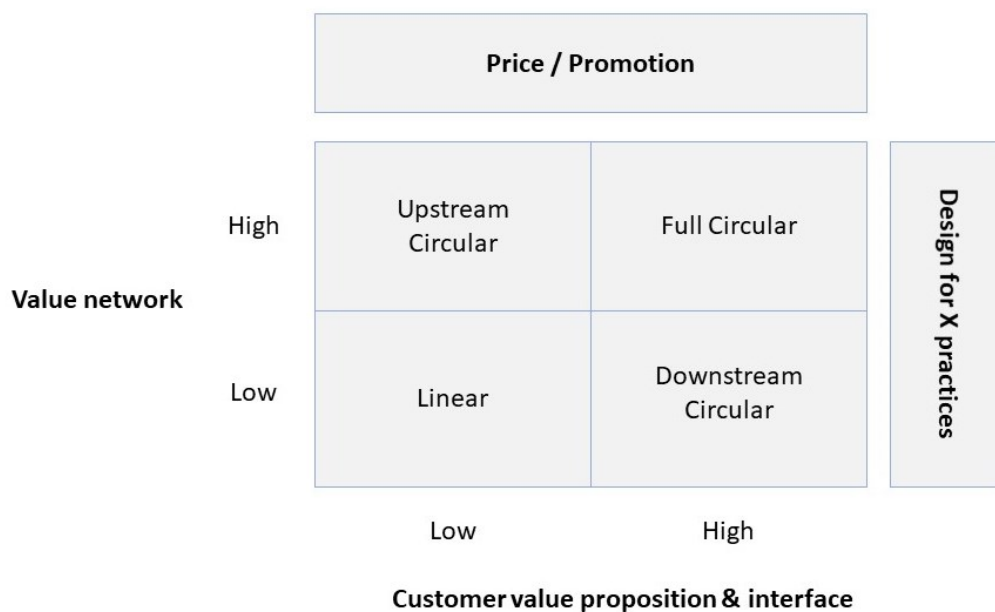
Figure 2. The four available modes to adopt Circular Economy principles (Urbinati et al., 2017)

3.3   Circular Economy in textile industry

This chapter sheds some light on how CE has been implemented in textile industry. Additionally, this chapter indicates what are the possible ways to implement CE in textile industry overall. The chapter addresses which factors can promote and hinder the shift towards CE in textile industry. There are some regional interpretations as well as global ones.

Some research articles study Swedish fashion companies' relation to CE (Stål & Corvellec, 2018; Stål & Jansson, 2017). Stål and Jansson (2017) have researched how PSS are being implemented in Swedish fashion companies and how these practices implicate strong and weak sustainable consumption. These companies have eco-labelled products but are also engaging in operations that concern the use and dispose phases of products (Stål & Jansson, 2017). This is where PSS such as product take-back practices are utilised, according to Stål and Jansson (2017). They highlight that consumer involvement is encouraged in the products use and disposal phase to make these phases more sustainable. For example, consumers are asked to pay a premium price for more sustainable materials.

Stål and Corvellec (2018) have observed two patterns of circular business model implementation in Swedish fashion companies. Their study focused on product take back systems that companies offer to their customers. These two identified patterns were identified on whether the company outsources their product take-back system or not. It was found that companies with fast fashion

business model (e.g. H&M, KappAhl and Lindex) outsourced these product take-back systems and did not make efforts to capture or create value from the clothing pieces that were collected (Stål & Corvellec, 2018). On the contrary, premium clothing brands (FilippaK and Boomerang) carried out activities that supported post-collection but were separate from these companies' business models and therefore remained linear (Stål & Corvellec, 2018). Still, most of these companies' talk and communication of required circular actions in their sustainability reports overshadows their actual actions (Stål & Corvellec, 2018), which indicates that they would have adopted *The Downstream Circular* mode (Urbinati et al., 2017).

Kant Hvass and Pedersen (2019) argue that an in-store product take-back system may not collect sufficient volumes to transition fashion industry towards CE. Other means such as new product designs supporting recyclability, textile waste legislation, demand for recycled fibres and customers' asking for products that are made from recycled materials are important supporting the industry moving towards CE (Kant Hvass & Pedersen, 2019). Kant Hvass and Pedersen (2019) also confirm that product return rates from consumers are commonly very low even though they would be awarded with a voucher after donating their clothing pieces to a product take-back area. Therefore, it is crucial that companies become closer with their customers and learn about their needs regarding purchasing, consuming, and disposing. There should be a customer engagement strategy that focuses on product life cycle and informs customers about their clothing pieces' reuse and recycling value (Kant Hvass & Pedersen, 2019).

The literature indicates that the current PSS models that companies are utilising are not enough to support the transition from linear economy to CE. Moreover, consumers are not engaged in the PSS models which results in low usage rates. More education and engagement are needed to gain more consumers to use PSS models. However, the fact that companies see PSS models as a separate operation from their business model hinders the promotion of these PSS models. Moreover, current PSS models alone are not enough to support CE.

The importance of the design process and the role of a designer in relation to closed-loop textile recycling is highlighted in a study by Karell and Niinimäki (2019). Their study indicated that designers are depended on multiple different actors in the supply chain and that designers have a limited ability to make decisions which support closed-loop textile recycling. Firstly, designers should consider product sortability which serves as a link between recycling and design phases. Karell & Niinimäki (2019) state that even though recycling and sorting have similar challenges of material input they have their own more specific issues that are related to processes. They elaborate that material sorting phase is where materials are being identified and if the identification process is not reliable it is not possible to move the materials to recycling phase. This automated sorting can be distorted by different material blends and product structures and additionally contaminate recycling phase (Karell & Niinimäki, 2019).

Karell (2018) has identified multiple solutions that depict the future of fashion designers' work. Firstly, the most important factors that need to be considered to design successfully for circularity are material choices, material combinations, products constructions, and surface treatments. She also predicts that different online tools will be in a significant role for education for designers on CE and they will make their work under pressure of price and time easier. There also needs to be a change in attitudes as innovation exists in challenges, and dependence on the existing materials at the time can be overcome with collaborations with suppliers (Karell, 2018). Additionally, Karell (2018) states that due to rapid advances in technology, companies operating in the fashion industry must be prepared for constant exchange with fiber manufacturers and textile sorters. Collecting and sorting textiles will be an economic viability which also requires changes in the design practices to be aligned with the requirements of recyclers (Karell, 2018). To make sorting process easier a reliable identification system used by multiple companies would be extremely helpful, according to Karell (2018). She also emphasizes that best practices in terms of CE and fashion industry should be shared openly, and patenting may be a hindering factor in the transition and should be thought over extensively.

Dialogue between recycling, sorting and design is required to successfully close the loop in textile recycling which in practice means that designers' knowledge should be extended beyond processes and practices which only they take part in (Karell & Niinimäki, 2019). Knowledge in textile sorting technology and material knowledge related to different recycling methods is needed (Karell & Niinimäki, 2019). Some communication between design, sorting and recycling is already emerging as clothing companies want to use recycled materials in their products (Karell & Niinimäki, 2019).

Designers will face new challenges as technologies and knowledge evolves, according to Karell & Niinimäki (2019). They predict that use of certain fibers, details and blends may become forbidden in the future which would limit the number of design choices and result more simple designs. This would challenge designers to be creative and promote innovative problem-solving. De los Rios and Charnley (2017) also highlight that as there will be a necessity to be innovative as optimizing resources, growing constraints of product representation and new users in the product life cycle. Thus, design targets will change.

The role of design process will increase in the future of textile industry, according to the literature. One important factor is the importance if the dialogue between design, recycling, and process processes. Product sortability is another crucial factor that should be considered in the design process of textiles. The design process itself may also have limitations in future as CE will have a more dominant role. Some fibre combinations may not be available in the future which may result in more simple designs.

Koszewska (2018) has identified main challenges that textile and clothing industry faces during the transition to the CE model. Firstly, she identifies waste creation as one main challenge as the current linear model leads to massive quantities of textile waste. She divides textile waste into three groups by their source.

First is post-industrial waste that is generated from manufacturing clothes. Second source is pre-consumer waste which includes clothing pieces that are inferior and unsold pieces from retailer. Last group is post-consumer waste consists of damaged, worn out and unwanted clothing pieces that are generated be the consumer. She indicates that the key challenge in textile waste handling is to minimize the current waste streams. Secondly, she names product design and development as one of the main challenges in transition towards CE. Decisions made in design process will influence the whole life cycle of the clothing piece in addition to range of end-of-life options (Koszewska, 2018). Lastly, Koszewska (2018) identifies recycling technologies and disposal practices as a challenging stage in developing CE textile systems. This is essentially linked with closing the loop in the textiles and clothing industry. She identifies three main barrier types that hinder closing the loop. These are *consumer disposal practises, producer disposal practices and possibilities and recycling technologies* (Koszewska, 2018, p. 344).

Franco (2017) explored what challenges companies in the textile industry that are already incumbent have faced when they transformed their products to Cradle to Cradle (C2C) framework. She states that the quantity and pace of C2C products manufacturing depend on the availability of component parts and materials, and how effective manufacturers are when they must deal with complexities in product architecture, basic materials, and product aesthetics and functionality.

Sandvik and Stubbs (2019) have explored how Scandinavian fashion industry could create a textile-to-textile recycling system. Textile-to-textile recycling, according to Sandin and Peters (2018) can mean for example creating a new yarn from wool or cotton waste. Sandvik and Stubbs (2019) state that to enable textile-to-textile recycling digitalisation can help to improve recycling technology through creating traceability, transparency, and automatization. Additionally, to replace linear economy with CE collaboration on various levels is needed. Finally, different strategies are needed for fast and slow fashion systems that would focus on more conditional design.

Staicu and Pop (2018) studied what elements facilitate or hinder the transition to CE in Romanian textile and fashion industry. They found that there is low interaction level between actors in CE and textile and fashion industry. Moreover, each actor sees the world through their own window with their own business agenda in mind which results in low interest for what other industry actors are working on. With collaborative dialogue the awareness would naturally move to group and community interests from individual interests which motives people to stay connected and collaborate to come up with solutions to problems they all have (Staicu & Pop, 2018).

An alternative way of doing business in textile and fashion industry which potentially reduces the environmental impacts and prolongs the service life of clothing pieces is called collaborative consumption, according to Zamani et al. (2017). They give an example of one collaboration consumption model in the textile and fashion industry which is clothing library. Pedersen and Netter (2015)

also state that initiatives such as clothing libraries that are based on collaborative consumption are appearing globally. In clothing library there is for example a monthly membership fee which allows its members to borrow a number of clothing pieces from the library for a set time (Zamani et al., 2017). However, despite the excitement around the concept, Pedersen and Netter (2015) argue that clothing libraries remain as a niche activity that is strongly driven by entrepreneurs that are enthusiastic and committed community around them.

The literature indicates several challenges that textile industry faces in the transition towards CE. Waste creation is considered as a major challenge as the current linear system generates massive rates of textile waste. As decisions made during the design process of textiles affect the whole life cycle including the end-of-life operations the role of communication between different actors increases. Collaboration on multiple level in textile industry is also required in the transition and to improve recycling technology. The current low interaction level between actors in CE and textile industry hinders the transition.

3.4   Circular Economy in Finnish textile industry

In this chapter the focus is in Finnish textile industry and the benefits of implementation of CE in Finland. Sitra (2015) has evaluated that CE is a great opportunity to Finland and Finnish businesses as the potential for growth is extensive. They state that CE would offer Finland at least €1.5 – 2.5 billion growth potential per year. There is a tension between economy and technology which relates to change in how we work and consume, according to Dufva (2020). He says technology and new ways to operate such as CE models are changing the way people work, the content of the work as well as reform industries which puts pressure on economy to change. Arponen et al. (2014) emphasizes that countries that shift their linear model to CE among the first ones gain the biggest financial benefits. They state that these countries will be able to create new jobs, solutions for exporting, and increase their equity ratio in terms of raw materials. Scarcity of natural resources will rise the prices of raw materials and makes them harder to acquire (Arponen et al., 2014). CE will help Finland to protect itself also from this evolution (Arponen et al., 2014).

CE and its relation to Finnish textile industry has been covered in the academic literature only scarcely. Yet, some research addresses opportunities of CE in Finland. Armstrong et al. (2015) state that there is preliminary interest of PSS among Finnish fashion-oriented women across wide age range and therefore might reflect the accept and reject possibilities of such systems. They argue that in Finland trust in the PSS provider is essential and information on how the service would be delivered, what are the guarantees, and how singular cases are being handled are desired information. Finnish participants in study by Armstrong et al. (2015) were sceptical towards costs associated with PSS and some also seeing limitations to ease of use. They state that, according to their

participants, hygiene and reputation of the provider are important aspects and that clothing-related PSS might be most ideal for a company with already a well-established brand image. The participants saw a lot of benefits to PSS models and showed interest particularly towards take-back services, clothing swaps, and consultation. Henninger et al. (2019) have studied the clothes swapping phenomenon more deeply and argue that Finnish and UK consumers take special care of which garments they bring to clothing swapping events. Consumers had a feeling of pride as other consumers chose their clothing pieces in these swaps. They also argue that as clothing swapping makes consumers suppliers, constant flow of clothing cannot be guaranteed and therefore this business model is most suited for small scale and not mainstream and mass market yet.

Armstrong et al. (2015) also found that certain age groups would be more appropriate for certain PSS services than some other groups. For example, younger age groups are more willing to use PSS services that are more innovative and social such as renting and swapping (Armstrong et al., 2015). On the other hand, older consumers would most likely prefer services which would enhance product satisfaction such as repair, customization and redesign services (Armstrong et al., 2015).

According to Finnish Textile And Fashion (2018a) by 2025 separate collection for textile in the EU will become mandatory and therefore in Finland a processing plant for textiles offering recycled materials for further processing is being planned. Similarly to Arponen et al. (2014), they emphasize that there is an immense global business potential in CE of textiles and that it is an opportunity for Finnish textile and fashion companies to become pioneers in the competition. There has been some development of different textiles recycling in Finland where discarded textiles are being used to manufacture for example yarn, filling and insulation materials through mechanical recycling (Finnish Textile And Fashion, 2018a). Companies like Touchpoint and Infinited Fiber Company have been utilising recycled materials. Additionally, new and more ecological bio-based fibres are being developed in Finland (Finnish Textile And Fashion, 2018a). Spinnova is also a company mentioned which creates new more ecological bio-based textile fibres.

Virtanen et al. (2019) have evaluated waste material flows in the regional level and their focus was Finnish regional area Päijät-Häme. They found in their study that in Päijät-Häme companies are relatively small and materials consist of multiple small side streams and that SMEs lack resources to promote reuse of these side streams. They also state that textile waste in Päijät-Häme is collected as a municipal solid waste (MSW) or as part of solid recovered fuel (SRF) and 20% of discarded textiles is collected my charity organizations and NGOs. The amount of textile waste in MSW is increasing due to fast fashion and poor quality of garments (Virtanen et al., 2019). Dahlbo et al. (2017) have also assessed flows of textiles, textile waste and their current environmental performance in Finland. They reveal that to increase recycling and reuse of textiles it requires vast changes within the current system in addition to engagement of all stakeholders in the

textile chain. Collection of discarded textiles needs more comprehensive networks for collection from existing operations as well as new operators (Dahlbo et al., 2017). Waste prevention should be primary goal for textiles and reuse operations would serve as waste prevention as it prolongs the life of textiles, Dahlbo et al. (2017) indicates. They claim that promotion of waste prevention and reuse will require textile industry to produce long lasting products along with educating consumers of the possibilities to reduce their consumption of natural resources.

Using recycled and leftover materials to create new products has also been explored in Finnish textile companies. Companies such as Finarte, Muotikuu and Costo use leftover material in their products (Finnish Textile And Fashion, 2018a). Finlayson utilises Finnish people's old jeans as raw material for towels, Remake produces new clothing from used clothes, and TAUKO uses discarded sheets and cloths from hospitals as their material for clothing (Finnish Textile And Fashion, 2018a). Additionally, new PSS models have been introduced to the Finnish textile market. Vaatepuu is a chain that provides clothing libraries where consumers can borrow designer clothes and accessories as an alternative to constantly increasing consumption (Finnish Textile And Fashion, 2018a). In 2019 Vaatepuu employed around 10 people and had expanded their business to other cities in Finland as well (Hakola, 2019). Additionally, Vaatepuu has made collaborations with Finnish stores where their services are also available (Hakola, 2019). Therefore, Pedersen and Netter's (2015) statement that clothing libraries shall remain only as niche business model is arguable at least in Finland. On the other hand, Emmy Clothing Company is an online store for second hand clothing in Finland which gives an opportunity to recirculate clothing effortlessly (Finnish Textile And Fashion, 2018a).

The CE implementation has not been found to be prominent within the Finnish textile industry in the literature. Despite the low implementation, Finland has bee recognised as a potential territory for PSS models. An essential factor in the acceptance of such models would be the trustworthiness of the provider and transparency of how singular cases are handled. One hindering factor in the transition to CE in Finland would be the current textile recycling system. Thus, vast changes within the current system and engagement from all the stakeholders is required. Still, there are some textile companies in Finland that has CE embedded into their operations. Some companies rely their business on selling textiles made from recycled materials and some provide PSS models such as clothing libraries.

4   DATA AND METHODOLOGY

In this chapter the methodology and scope of the thesis are presented and explained. This chapter begins with describing the research method chosen for this thesis in relation to the scope. Furthermore, data collection methods are presented, and the data collection process is explained including reasoning behind the selection on interviewees and companies. Lastly, this chapter describes how the data analysis was conducted in this thesis.

4.1   Research design & strategy

A general characteristic of qualitative study is that it studies participants' meanings as well as relationships between them, according to Saunders et al. (2012). It is considered as an interpretive study as the objective is to make sense of a subjective and meanings expressed about the phenomenon that is studied (Saunders et al., 2012). Eriksson and Kovalainen (2016) also state that qualitative research is concerned with interpretation and understanding while quantitative research aims to create explanations, test a hypothesis, and create a statistical analysis. Qualitative research approach is most likely the preferred research method to be used (1) when only little is known about the topic and research problem, (2) when previous research insufficiently succeeds to explain the research question, (3) if the main objective of the research is to propose new hypotheses and ideas, and (4) when current knowledge cultural, psychological, or subconscious material that cannot sufficiently be researched using surveys and experiments (Hair et al., 2015). A qualitative research approach was chosen for this thesis as the relation of CE in Finnish textile industry has hardly been researched before and thus adequate information cannot be acquired with quantitative approach.

In qualitative research there are two identified basic approaches called induction and deduction (Eriksson & Kovalainen, 2016). A lot of quantitative business research follows inductive reasoning which follows the logic of testing theory through hypothesis scrutiny empirically (Eriksson & Kovalainen, 2016). When using this approach, researchers are aiming to build a new theory from the collected data (Hair et al., 2015). In deductive reasoning, on the other hand, researcher aims to create one or more hypotheses based on what is already known about the phenomenon theoretically and then subjected to empirical study (Eriksson & Kovalainen, 2016). Induction and deduction can be both used in different phases in research and abduction is an approach that has been identified as a way to combine induction and deduction in a one research project (Eriksson & Kovalainen, 2016).

Saunders et al. (2012) simplifies the identification of these three approaches. They argue that if the research starts with theory and the research strategy is to test the theory, deductive approach is being used. Contrariwise, if research starts with data collection aiming to explore a phenomenon and the goal is to build or generate a theory, inductive approach is being used (Saunders et al., 2012). Finally, abductive approach is being used when data is being collected to explore a phenomenon, identify different themes and explain patterns, modify an existing or generate a new theory which is layer tested through additional data collection (Saunders et al., 2012). However, Eriksson and Kovalainen (2016) emphasize that even though these approaches clarify the direction and way for arguments and knowledge claims they are seldomly found purely presented. All of these three approaches are used in almost all qualitative research (Eriksson & Kovalainen, 2016). Saunders et al. (2012) also point out that no approach is better than the others and the decision on which approach to use depends on the research emphasis.

This thesis aims to understand how CE is being implemented in Finnish textile industry and the hindering and advancing aspects of the implementation process. Firstly, how CE has been implemented in the textile industry globally is determined in the literature review and possible opportunities and challenges are being identified from the literature. The focus in the data collection is mainly to understand the phenomena in the context of Finnish textile industry and the research questions do not solely pursue to test the theories presented in the literature review. Thus, inductive approach is more prominent in this thesis. However, as Eriksson and Kovalainen (2016) argue, one approach is seldomly purely used in one research. In this thesis some characteristics of deductive approach may also apply as this thesis begins with literature review which explores the themes of this thesis. Nonetheless, as this thesis does not aim to test hypotheses but to explore a phenomenon, inductive approach is more appropriate than deductive or abductive approach.

4.2   Data collection

When it comes to qualitative data collection, there are generally two broad approaches which are observations and interviews, according to Hair et al. (2015). Walle (2015) also identifies focus groups and surveys as tools for qualitative data collection. Qualitative data can consist also of texts, documents, visual and digital materials, argues Eriksson and Kovalainen (2016). Observation is the appropriate method if the objective of the research is to examine behaviour of people or events (Hair et al., 2015), which is not the case in this thesis. Interviews are the right approach if the objective is to learn why something happens (Hair et al., 2015). Interviews can also collect a vast variety of information and highly structured or open-ended (Walle, 2015). In this thesis, the objective is to understand

how CE implementation can create opportunities and challenges to Finnish textile companies. As the research problem requires understanding on what the reasons of these challenges and opportunities are, and how they emerge, interviews were chosen as data collection approach.

There are three types of interviews. *Structured interviews* have a pre-designed script what offer little flexibility in the order or wording of the asked questions (Eriksson & Kovalainen, 2016). Thus, interviewer is required to conduct each interview exactly the same way (Hair et al., 2015). The aim of structured interviews is to provide answers to 'what' questions and to collect facts (Eriksson & Kovalainen, 2016). *Semi-structured interviews*, on the other hand, give interviewers room to follow up to participants' answers and ask additional questions (Hair et al., 2015). The structure of semi-structured interviews is determined beforehand and there is a direction but in includes some flexibility to include unstructured questions (Hair et al., 2015). These interviews aim to get answers to 'what' and 'how' questions and the interview is fairly informal and conversational (Eriksson & Kovalainen, 2016). Lastly, *unstructured interviews* are conducted without sequence of interviews (Hair et al., 2015). Unstructured interviews provide an in depth insight to the participant's views and may not present itself as interview but a conversation to the participant (Eriksson & Kovalainen, 2016). Semi-structured and unstructured interviews also give the participant an opportunity to lead the conversation to another direction and areas that were not previously considered but are significant to understand the phenomena (Saunders et al., 2012). Saunders et al. (2012) also emphasizes that the interviewer's level of knowledge is essential when conducting the interviews. They state that interviewer must be knowledgeable of the research topic as well as the context in which interviews take place. This also includes information of the organizations that take part in the interviews (Saunders et al., 2012).

In this thesis, semi-structured type of interviews was used as the objective of the thesis is to gain answers to both 'what' and 'how' questions. Themes of CE and textile industry with a pre-designed outline of the questions guided the interviews to the right direction but gave enough flexibility to ask additional questions. To ensure that enough knowledge has been gathered before conducting interviews, a comprehensive literature review was prepared. The literature review composes an overview of the phenomena and the context of this thesis which is CE in relation to Finnish textile industry. To understand the companies taking part of the thesis, company websites, reports and news were examined before interviews to get a deeper understanding of the companies.

Specific sampling methods that are designed for statistical generalization are not required for qualitative research, according to Eriksson and Kovalainen (2016). They describe choosing participant for qualitative research as purposeful rather than random and representative. The goal of identifying participants is to gain rich data which provides opportunities to learn the phenomena that is being researched as well as in-depth analyses (Eriksson & Kovalainen, 2016). Eskola and Suoranta (1998) state that choosing participants is conducted with theoretical

coverage in mind and the analysis is done case-by-case. In analysis case-by-case the focus is not in statistical criteria but in the appeal of the data collected in relation to the research problem (Eskola & Suoranta, 1998).

The participants in the interviews of this thesis are employees and owners of Finnish textile companies. All the organizations are SMEs as due to the size of Finnish textile industry large operators are rare. The number of employees in the companies varied from twelve to 22. However, including a larger textile company would have been beneficial to this thesis as smaller companies are typically more agile with decisions and changes compared to larger companies. Therefore, insight to a larger company's viewpoints on CE would have made the data more diverse. However, the author was unable to successfully contact larger Finnish companies operating in the textile industry. One contributing factor of this is the fact that the companies were contacted in April, May, and June of 2020. This is when the COVID-19 pandemic forced some companies to lay off employees temporarily. This affected companies' capabilities to provide participants to the interviews.

The organizations chosen for this thesis identified themselves as sustainable or responsible. Therefore, there was a higher probability that the employees and owners of these organizations would be able to answer questions regarding CE. This is important to get reliable and useful interviews as if the participants would not know how to describe CE, answers to the research questions would not be possible to achieve. To gain a versatile sample of interviews, companies with production in Finland and outside Finland were chosen. Moreover, companies with and without their own production and factories were chosen to gain more versatility in the thesis. Two of the companies participating in the interviews focused on B2B-market and other two focused on B2C-market.

For each organization two to five employees were interviewed to get a comprehensive understanding of CE in relation to Finnish textile industry. The number of people interviewed from each company were based on the size of the company as well as the capability of the company to provide participants. One company provided two participants, another four participants and two companies provided five participants. All in all, 16 interviews were conducted for this thesis. 14 females and two males participated in the interviews. A description of the interviewees of this thesis are presented in Table 1. The descriptions of interviewees roles in the organization have been simplified in the Table 1 to ensure anonymity. It is important to consider that as the interviews addressed topics related to CE, the participants were required to have a certain level of understanding of the topic. Therefore, for some companies taking part of the thesis, it is justifiable to only provide two participants. As different people within the same organization may have different opinions and views, it was essential to interview multiple people from the same organization. Additionally, comparisons could be made between for example CEO's, marketing managers and designers. This would provide a lot of in-depth data for analyse.

Table 1. A description of the interviewees

A description of the interviewees

No.	Company	Interviewee	Duration of the interview (min)
1	Company A	CEO	39 min
2	Company A	Supply chain	75 min
3	Company A	Product manager	58 min
4	Company A	Sales & marketing	27 min
5	Company A	Product information	51 min
6	Company B	CEO	56 min
7	Company B	Designer	61 min
8	Company C	CEO	58 min
9	Company C	Founder & designer	58 min
10	Company C	Designer	65 min
11	Company C	Product coordinator	35 min
12	Company D	CEO	55 min
13	Company D	Designer	50 min
14	Company D	Customer service & social media	67 min
15	Company D	Production	50 min
16	Company D	Sales & customer service	40 min

The companies and participants were contacted by email. The interviews were conducted remotely using Zoom program and phone. All the interviews were recorded. Due to COVID-19 pandemic remote interviews were mandatory practices at the time. The interviews were conducted between 15th of May and 15th of June 2020. Before the interviews privacy policy and research permission forms were provided to the participants. The participants were required to accept both forms before the interviews. The forms were accepted by signing the forms remotely or by stating in the email that they had read the forms and will accept both. To ensure that the participants would be able to answer all the interview questions freely, identifiers concerning participants and the companies were removed from published thesis.

All the interviews were conducted in Finnish as all the participants worked in Finnish companies and spoke Finnish fluently. Finnish was used as an interview language to ensure that all the participants would be equally capable to verbally express themselves as their English language skills were unknown. Additionally, a common language in the interviews ensured that there would be a lower possibility of misconception. Conducting interviews in the native language of the participants made the interviews more pleasant for the participants and thus, improving the quality of the interviews. Extracts in the Chapter 5 have

all been translated from Finnish to English as accurately as possible while retaining the meaning of the extract.

The interviews consisted of two main parts. The list of research questions is presented in Appendix 1. The first part included topics from one to three and addressed interview questions for CICAT2025 project which mostly consisted of questions of sustainability in the work environment. The second part of the interviews included topic four which consisted of questions related to this thesis. However, some questions from the first and second part gave a possibility to include themes of one part of the interview from to another. Also, as companies and participants were contacted about the interviews, they were informed that the interview will include questions of both sustainability and CE. Thus, the themes naturally overlapped during the interviews. Therefore, while analysing the interviews it is crucial to analyse both parts of the interview as some essential points for this thesis may appear in the first part of the interview. Topic five was an external topic which was covered if the participants still had time to answer to those questions. The interviews lasted from 35 minutes to 75 minutes. Typically, the second part of the interview lasted one third of the total length of the interview.

4.3   Data analysis

The primary data of this thesis consists of text from transcribed interviews. After interviews were analysed, they were transcribed into a text. The transcribing was outsourced by CICAT2025 project to Tutkimustie Ltd. Tutkimustie Ltd is a company which specializes in transcribing interviews confidentially (Tutkimustie Oy, 2019). As the interviews included questions regarding CICAT2025 project as well as this thesis, the parts of the transcribed interviews relevant to this thesis needed to be defined. Therefore, all the interviews were first read thoroughly and parts that addressed questions regarding only CICAT2025 project were not considered. It is also important to note that some of the interview questions and topics gave answers to both CICAT2025 project and the thesis. In such situation, the part was kept for further analysis.

Thematic analysis has been chosen as a data analysis method for this thesis. In qualitative research, thematic analysis is the most commonly used data analysis method, according to Guest et al. (2012). They state that thematic analysis is most useful when the researcher is trying to capture the complexities of meaning from textual data set. This method identifies analyses and reports patterns that can also be described as themes within data (Braun & Clarke, 2006). In thematic analysis, codes are developed to identify these themes and they are linked to the data for later analysis (Guest et al., 2012). Interpretation pays a more important role in thematic analysis than in word-based analyses which may affect the reliability of the analysis, according to Guest et al. (2012). This has been considered in the analysis.

According to Braun and Clarke (2006), thematic analysis consist of six phases. Firstly, researcher should familiarize themselves with the data through reading and for example transcribing it. Second phase is to generate initial codes from the data in a systematically. Codes in data analysis are labels that symbolize inferential and descriptive meanings of information that is gathered during research (Miles et al., 2014). In other words, the process of coding assigns a certain word or a phrase to a data segment (Leavy, 2017). The process of coding classifies and reduces the amount of data that has been generated, and categorizes similar data for the researcher to easily find (Leavy, 2017; Miles et al., 2014). Coding can be executed by hand or with a computer software program and the codes should be linked to the research purpose and research questions (Leavy, 2017). Coding can easily generate hundreds of different codes even from a small set of data (Jolanki & Karhunen, 2010). In third phase of thematic analysis, according to Braun and Clarke (2006), the codes are reviewed and collated into potential themes. These themes are reviewed, checked, and generated into a thematic map of the data analysis in fourth phase. Fifth phase is to refine each theme and the story the analysis tells. After this phase, each theme has names and definitions. Finally, extract examples that relate the analysis to literature and research question are chosen.

In this thesis the thematic analysis followed the six phases by Braun and Clarke (2006). After carefully reading the transcribed interviews initial codes were generated. Approximately 20 to 40 different codes were generated from each transcribed interview. Most of these codes were same in each transcribed interview but some applied to only one interview. These codes were then reviewed and codes that were not relevant to the research question were deleted. From these codes 29 potential themes emerged. However, some of them were overlapping or turned out to be irrelevant to the research question. The themes as well as the coded data related to the themes were reviewed. Finally, 10 different themes were refined and named. Each theme has a list of codes with extracts. Figure 3 demonstrates how different codes from the data are have been designated under one theme.

Uncertain information

- No guidelines for textile collection
- How to recycle certain materials should be available
- Uncertainty around recycling
- No official information about fibre recycling
- Reliable information

- Deciding between different materials
- No guidance
- Lack of knowledge
- Lack of information
- Understanding recycling
- Gathering information is difficult
- Difficulty to find better textile alternatives

- A lot of information
- No practical knowledge on how to close the loop
- Too much information
- Hidden information
- Companies keep information of fibres
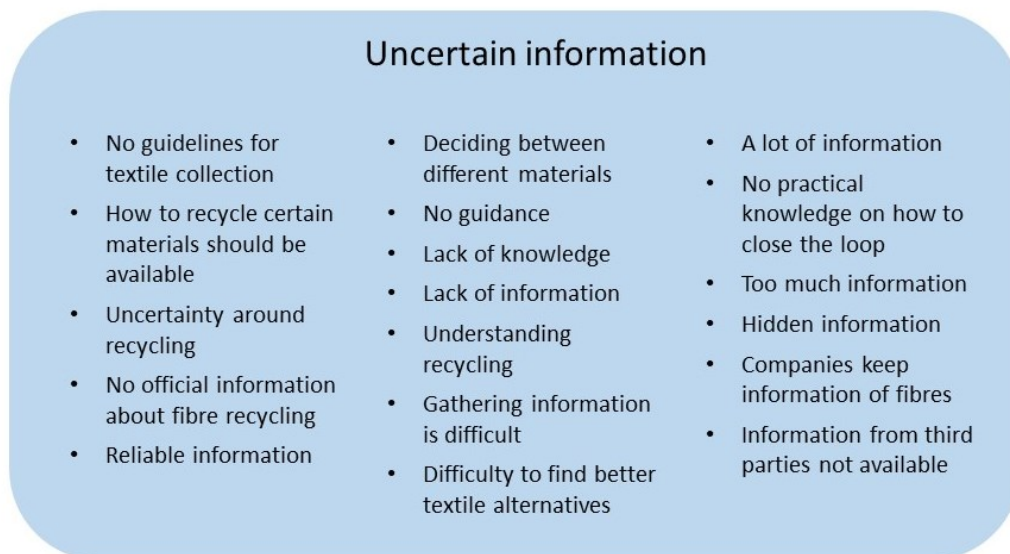- Information from third parties not available

Figure 3. Example of themes and codes

The themes were categorized according to the research question and sub-questions. Figure 4 illustrates how all 10 themes have been categorized. The categories Challenges and Advantages gathered most themes which was predictable as these categories are the most related to the research question. These different categories are helpful in making the data organized which gives the results of this thesis structure. Additionally, the categories support the reader to easily get a clear picture of the results of this thesis.

Understanding of CE

- Definition of CE
- Integration in the operations

Challenges

- Difficulty in recycling
- Uncertain information
- Difficulty in implementation

Advantages

- New business models
- Ease of CE

Future

- Industry change
- Role of consumers
- Responsibility
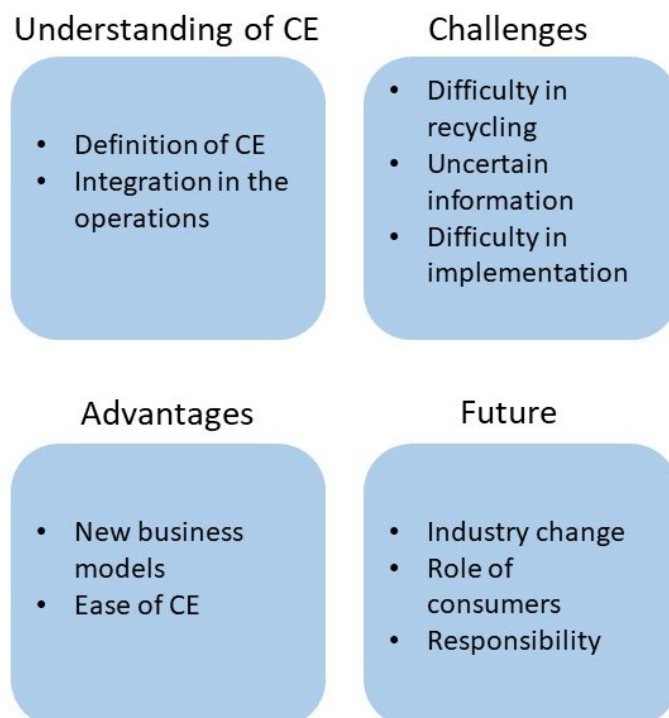
Figure 4. Themes from thematic analysis

5 RESEARCH FINDINGS

5.1 Understanding of Circular Economy

To answer the first sub-question of this thesis, the level of understanding of Finnish textile companies about CE need to be examined. This part of the results will determine what operations and aspects Finnish textile companies associate with CE and how they would describe CE. Additionally, this part will assess how CE has been already integrated in the operations of Finnish textile companies.

5.1.1 Definition of Circular Economy

Among the interviewees it was clear that CE was a concept that was familiar to everyone at least to some extent. The most dominant theme around the definition of CE was circulation of products and materials. The circulation can consist of multiple different parts such as fibre recycling and repurposing clothing pieces at the end of their life cycle. It was evident that the definition of CE mostly cycled around the concept of closing the loop. In addition, maintaining and repairing clothing pieces was included in the definition as well. This would also include telling customers how clothing can be maintained and repaired. Yet, maintaining and repairing clothing pieces was mentioned in the definition less.

In general, the idea of using materials that already exist instead of using virgin materials was another essential theme in the definitions. The materials could be excess materials from production as well as materials that have been turned into clothing pieces. Some interviewees defined CE more as using materials that already exist and extending the life cycle of a product.

> *"I would define circular economy as a maximal utilisation of raw materials. In my opinion, it is that in its simplicity. In practise it means that the life cycle of a product or material is as long as possible"*
> *–Interviewee 6*

All in all, CE was considered as a more complex concept that includes multiple different operations. For example, by one interviewee different processes were identified and targeted to pre-consumer phases of products life cycle and post-consumer phases. Pre-consumer phases included fibre recycling and production and post-consumer included product recycling. Another description separated CE in operations that were inside a company and outside a company. Operations inside company would ensure that the company is able to utilise its whole own production chain. Operations outside company, on the other hand, would focus more on creating products that can be used by other companies after the end of their life cycle. This would also include utilising material side streams.

Avoiding throwaway consumption was also seen as part of CE. This would imply altering clothing into something new, prolonging product life cycle, creating new clothing fibre, or creating something new from the clothing or fibre to another industry. Using materials from textile industry in another industry was mentioned in the definition more than once. In one company CE was described being simply just wise with how resources are used.

> *"Circular economy means being wise with resources. In circular economy some materials are being used which are always utilised again somewhere else at the end of its usage. That is circular economy. Different from recycling." – Interviewee 4*

5.1.2 Integration in the operations

The integration of CE in the operations of companies that participated in this thesis was mostly focused on the production of clothing pieces. It was frequently mentioned that in the production phase of the product life cycle different CE practices were easier to implement compared to closing the loop and returning the clothing pieces back to the circulation of fibres and materials. Essential part of the CE practices was producing high-quality pieces that last time and wear well. This would include using only durable materials and creating patterns and designs that age well rather than ones that start looking aged in the near future. Extending the life cycle of the products was a theme that every company in the thesis highlighted as one of the key elements in the integration of CE. It was also considered important that customers are taught how they should take care of their clothing to extend the life cycle. Clothing would also be designed in a way that it would be made to serve more than one customer.

Some interviewees highlighted that they would communicate to their customers not to buy more clothing pieces than what they needed. It was also highlighted by some of the companies that they were aiming to develop a way to sell their customers' used clothing pieces as second-hand pieces. There was also an interest towards developing rental services for clothing. Additionally, it was recognised that designing durable clothing pieces created more value for customers. This encourages customers to resell their used clothing pieces to other consumers instead of disposing them. Thus, giving the clothing pieces a second chance to get used and in that way extending its life cycle.

> *"… the main idea is maybe to aim to produce products that are durable and last time. And maybe overall the kind of products which have value for customers which also contributes to reselling the products and such, and when the customers values the product it does not end up in the trash so easily." – Interviewee 9*

The importance of using sustainable materials in the production was a common theme in the companies' operations as well. The companies shared a similar goal of increasing the percentages of sustainable and recycled materials

in their products. These materials included for example fair trade certified fibres, organic fibres, and sustainable alternatives for traditional viscose. There was also an emphasis of making sure that harmful chemicals are not used in the production of the clothing. This was monitored by having the production in the EU or having certificates that ensure that no harmful chemicals are used or both. The companies would also prefer using renewable energy and favour partners that also utilise renewable energy in their factories when it is possible.

Using resources such as fabric wisely recurred frequently among interviewees. Materials were considered as valuable resources and avoiding waste was a crucial way of saving money which also relates to CE. Minimizing cutting waste was a topic which all the companies touched on. Different ways and investments to reduce amount of cutting waste such as automation were implemented. Excess material from production was not considered as waste but rather excess material that can be used for products by the company or other stakeholders. Thus, donating or selling excess materials for other companies or organizations was considered as a natural extension of business. Companies also collected or showed willingness to collect old clothing pieces from their customers to be refined into something new. Typically, this excess material would be turned into new products such as furniture or insulators in another industries. Companies within B2B field would also openly discuss with their customers how excess fabric and materials can be utilised.

> *"And we have introduced this kind of way to return clothes that have been made by us back to us. So if someone has worn out a product we will gladly take it back and come up with a way to utilise it further"*
> *– Interviewee 6*

Not producing clothing pieces more than the market demand was also an important aspect of the operations of the companies. Producing less would help the companies not to have excess stock which meant that all the products would eventually be sold to customers. In this way, companies would not need to consider for example burning the unsold clothing pieces. Packaging material was also topic that was considered important. For example, replacing plastic packaging with more sustainable option was considered interesting and desirable. However, finding the right alternative caused problems as suitable options were limited.

5.2   Challenges of Circular Economy

This chapter provides information on what are the challenges that Finnish textile companies participating in this thesis associate with the implementation of CE practices. Firstly, the ease of textile recycling is discussed as well as the whether the current textile recycling system supports the companies. Additionally, this

chapter covers how the information about implementing CE is achievable to Finnish textile companies. Lastly, the difficulties of CE implementation are presented.

5.2.1 Difficulty in recycling

Recycling was generally seen as a major challenge related to the implementation of CE into companies' operations. There was a lot of uncertainty around the topic of recycling clothes and clothing materials such as fabric. The central point in the answers from interviewees was that the recycling processes in Finland are not clear and that the information is not easily accessible. Firstly, companies stated that they are uncertain of where they should bring for example clothing pieces that are worn out completely or pieces that are broken. The companies are aware that there are possibilities of fibre recycling but there is not clear information on what sort of materials can be recycled. For example, it was stated that there is no reliable information available for the companies about the effects of elastane in textile recycling and whether the elastane can be separated from for example cotton in the recycling process. Additionally, some interviewees stated that they do not know what happens to the clothes during recycling, or what can be done to old and used textile materials.

"And also, the fact how those materials can be utilised to be used again in a different way, like what are the different opportunities. At least I do not even know all possibilities" – Interviewee 16

The role of companies in the process of textile recycling was unclear to some interviewees as well. There is a clear willingness and urge to learn more about textile recycling. However, there was a lack of knowledge on how the companies can have an impact on textile recycling. The companies also wanted to be able to give their customers comprehensive guidance on how the clothing can and should be recycled after they cannot be used anymore. Unfortunately, it was clear that the companies do not have enough knowledge to provide such information. It was also mentioned that it would be easier if there was a one place where all textile waste can be collected, and the textile sorting would be done in the same place. However, the problem that was recognized would be expenses to hire enough employees and how the sorting can be arranged both efficiently and sustainably.

The practicalities of recycling rose concerns among the interviewees. The current recycling system in Finland where clothing is collected in containers from consumers outdoors was considered as unfunctional. The containers were presented as impractical as the clothing can get ruined by weather easily. Also, it is difficult to ensure that the products in the containers are clean and usable for recycling purposes. Zippers, buttons, and other smaller parts of clothing also raised concerns as they complicate the recycling process. Additionally, the overall quality of the collected textile material was troubling the interviewees as generally the material that is collected in Finland is very low quality. Therefore, the

quality of the recycled material would be low as well. Similarly, the lower quality of recycled fibres compared to virgin fibres was considered a challenge in textile recycling.

It was highlighted that in Finland there has been a possibility to create a textile waste treatment plant for several years. However, no one has taken this opportunity in the past even though the appliances have existed. It was reckoned that the reason behind it was simply the fact that creating the infrastructure would be difficult and complex. Another point surrounding textile recycling was that it is challenging for only a one company to have an impact on recycling.

5.2.2 Uncertain information

Generally, companies have a lot of knowledge of their own products and the production itself but the information on how they can close the loop and return the textile material back to the cycle is not considered to be easily accessible. Researching and gathering information about CE was experienced to be challenging and time consuming. The information that is available about CE was considered typically very technical and not easily understandable which poses challenges to the implementation of CE for companies. As the information is technical and relates to processes that are unfamiliar to the companies, it was stated that they have a hard time implementing CE practices to their own operations and ecosystem. Similarly, the interviewees stated that there is hardly any guidance on how CE can be implemented into their operations. Thus, the companies need to spend a lot of time resources to find the right information. There was also considered to be an abundance of information available which forces the companies to filter the right information themselves. There was a clear desire to close the loop by the companies, however, many lacked the knowledge and skills to implement measures to execute it.

> *"It is not simple as there really is not any guidance of it [CE] any-where. It requires a lot of thought, investigating and attempt to get the information." – Interviewee 10*

Moreover, it was mentioned that the information on different textile fibres claiming to be more sustainable options is often hidden behind the company that produces the material. This results in difficulty to compare the different options available and choose the best possible alternative. Some of the fibres available were also seen as rather similar but there is no clear information available of the actual differences related to the sustainability and applicability to CE available. It was mentioned that usually the data that is available of these new textile fibres is provided by the producers which can make the comparisons unreliable as there is not third-party evaluation. The difficulty in comparison emerged related to both textile fibres as well as packaging materials. It was also stated that the knowledge and interest on how different fibre combinations are produced and

how products are designed to be recyclable should not rely only on individual designers' preoccupation. Rather, it should be commonly known.

The interviewees recognised that customers are increasingly more interested on what happens to the products after they are worn out. There was a willingness to provide customers with such information, however, some interviewees acknowledged that they are not able to give the customers such information as they do not have it themselves. Customers were also recognised to be more and more aware of greenwashing which results them demanding for more information about the products and operations of the company. Gathering the information is also considered difficult. It was mentioned that one essential challenge is the terminology that can be understood differently internationally.

5.2.3 Difficulty in implementation

One essential challenge in the implementation of CE practices was the fact that the companies participating in this thesis operated in a small Finnish market. It was highlighted that when the market where the companies operate is small it makes it difficult to produce products in big volumes. Especially among companies that operate in B2B it was mentioned that customers may not be ready to pay more for an option that also supports CE. Related to this, to purchase certain sustainable materials it requires purchasing in big volumes. However, some interviewees explained that there may not be any guarantee that all this material can be used in production which makes purchasing the material unprofitable. Offering funding to companies that are implementing CE practices into their operation was suggested. It was highlighted that in current time having a lot of purchasing volume equals to having power to influence.

> *"The market today works a lot in a way that if you do not have volume you do not have power to influence. So how circular economy and sustainability concepts can be connected to this in future is interesting. Because in my opinion it is in some way also a question that relates to future generations and so on." – Interviewee 13*

Some interviewees explained that they currently use materials and blends of materials that cannot be recycled. Increasing amount of pressure from the consumers to use more sustainable materials was recognised. For example, there has been pressure to use certain materials or certain percentages of materials. One interviewee explained that the machinery that exists currently may not be able use such textile fibres which is challenging to explain to consumers. Generally, old processes slow the change and utilisation of new fibres. It was mentioned that currently there are a lot of new different textile fibres, innovations, and processes but to use these new inventions the machinery should be updated. The updating would require large investments. It was stated that in the past it was a lot more difficult to find for example recycled fibres that can be used in textiles. Currently, there are more operators and options to choose from. However, to get

the opportunity to purchase some of the newest textile fibres the suppliers need to be pushed and frequently asked to include these fibres.

The companies operating in the B2B market highlighted that one of the challenges they face in the implementation of CE are leftover materials from their customers. For example, when there is leftover textile from B2B customer, they may state that they do not want it to be sold forward. Additionally, if a B2B customers is changing their logo or name, all the clothing including the name need to be replaced and the old clothing cannot be used anymore. In the B2B market, there is also a challenge when materials are replaced with a more sustainable option. As the B2B customers are used to the older and common materials, changing to a new fibre requires a lot of testing to maintain the same qualities as the old fibre. Additionally, the new fibres may need to be washed differently compared to the old ones which may pose a challenge as B2B customers typically wash their clothing in laundries where staff may not be used to the new fibres.

5.3   Advantages of Circular Economy

This chapter discovers what are the advantages of implementation of CE practices based on Finnish textile companies' experiences. Two main themes emerged from the findings of this thesis. Firstly, the positive impact of new business models that have emerged from CE implementation are discussed. Secondly, the advantage of having sustainability as one of the main values of company related to CE implementation is discussed.

5.3.1 New business models

The companies participating in this thesis brought up new business models that they had developed which were linked strongly to CE. These business models generally aimed to solve problems related to excess materials from production and cutting waste. The excess material and cutting waste were sold to new customers through specific events, online platforms, physical stores, and collaboration with other companies. Some interviewees discovered that they were able to reach to new customer segments through selling excess materials and cutting waste as the products being sold were significantly different from their other products. They were also able to recognise that they could gain new customers if they expanded to sell other parts of clothing such as snap fasteners as well. Selling excess material and textile waste brought positive customer feedback which increased the brand image among some customers. It was stated that the customers were fond of the idea that the excess fabric had value as well. In some cases, the excess material and cutting waste was used in creating new smaller products for the company to sell. Especially during the COVID-19 outbreak, the cutting waste material could be utilised in creating face masks.

"We are aiming to have as little excess materials as possible but if we have excess materials, we will design new products using the excess materials." – Interviewee 8

The companies had discovered that excess material does not equal as waste anymore. It was mentioned that excess fabric for example has a great profit margin when they are sold. Therefore, it is not sensible to dispose excess material if they can be utilised in other way. All in all, implementing CE operations were considered to bring positive cash flow to the companies. By implementing CE practices, business can expand to new customer segments as the companies can offer an alternative option to traditional linear textile industry. It was explained that by implementing CE practices, the number of products sitting in storage can be reduced which is a clear saving for the company.

The companies participating in this thesis had also discovered models to sell lower quality clothing pieces instead of disposing them. For example, if some clothing pieces produced for B2B customers did not meet the quality requirements they could be sold to B2C customers with a lower price. B2B customers could also buy a service from the company that produced the clothing to return the used clothing pieces after they cannot be worn anymore instead of incineration.

5.3.2 Ease of Circular Economy

For most of the interviewees in this thesis the concept of CE was easy to understand, as discovered in 5.1.1. All the companies considered CE as a crucial part of sustainable textile industry. Some companies were founded with the goal to be a sustainable alternative to the textile industry. This resulted that CE was considered and implemented into the operations from the very beginning.

"Yes, it has. As this whole company has been founded basically on top of being ecological to which circular economy relates to strongly it has been (easy to implement)" – Interviewee 5

It was explained that as sustainability was already deeply implemented into the core values of the company, implementing simple CE practices had been relatively easy. Especially practices that were associated with buying sustainable materials and overall production of products were considered easier to implement than practices that would close the loop. Additionally, one interviewee explained that practising CE is not difficult after the processes that support it has been created.

5.4   Future of Circular Economy

In this chapter the perceptions of the future of CE by Finnish textile companies participating in this thesis are addressed. Firstly, the future and changes of the textile industry itself in relation to CE are considered. Secondly, the future role of consumers in CE implementation is presented. Lastly, this chapter covers the stance of Finnish textile companies on which operators of textile industry have the responsibility of CE implementation.

5.4.1 Industry change

The importance of CE in the future of textile industry was strongly emphasized among the companies. CE was considered as the sensible direction where the textile industry should be heading, and it was also highlighted that the current textile industry already should be implementing CE more than it is currently. It was mentioned that CE will be in the core of textile industry in future and there is no other option. As fast fashion and cheap production have been the dominating qualities of textile industry, the model was not considered sustainable. Thus, the attitude of the interviewee reflected that there should be more attention given to make the change. There was also confidence that the fast fashion model will be dispensed soon.

The companies highlighted that as the industry will change the textile recycling needs to improve as well. One interviewee explained that there should be a new system for textile recycling. They gave an example of a system that would resemble the current Finnish bottle recycling system where a collateral is paid by the consumer when they buy a bottled or canned beverage. After the customer has recycled the bottle or can, they will be given back the money as a voucher that can be used in the store. A system like this would, according to the interviewee, help customers realize the importance of recycling. Some companies also expressed that they are currently waiting and hoping for a breakthrough in textile recycling in Finland. They state that as there are multiple projects in Finland tackling this problem, they are hopeful.

> *"We have maybe thought about it in a way that we also wait until textile waste, waste recycling and other issues are in order. Or that we are waiting how and what is going to happen." – Interviewee 13*

Some interviewees expressed that the recycling should be arranged in countries closer to Finland, for example in Nordic countries or in Europe, rather than in Asia. There was also concern on how CE and sustainable consumption can be intertwined. If clothing can be recycled would it encourage consumers to consume even more? One interviewee highlighted that the EU's textile collection policy that should be adopted by the member states by 2025 only concerns consumer textiles but not B2B sector.

It was also stressed that it is inevitable by only population growth globally that people will wear more clothing in future. Not only clothing but textiles are used everywhere and across many industries. Additionally, one interviewee wondered whether all the materials that we are used to use today will be available in the same magnitude in the future due to the COVID-19 outbreak. Previously the price of fibres has been the most important quality, but will CE create a change? One interviewee highlighted that there is a lot of knowhow of textile production in Finland as previously there has been a lot of textile industry. As the people who used to work in these factories are getting older, now is the last chance to gain knowledge about textile production from them.

5.4.2 Role of consumers

Some interviewees emphasized that consumers are becoming more and more aware of sustainability and CE. As the consumers have more knowledge, they demand for more information and actions from textile companies. One interviewee predicted that this may result in companies being more honest rather than stating that they are sustainable or promoting CE only seemingly. The questions from consumers are very detailed as they have the knowledge to ask specific questions. There is also more information available about recycling which can encourage customers to ask how they can recycle their own clothing. It was highlighted that it is also crucial to guide customers how clothing should be washed and how to choose the right detergent as consumers also have a role in creating the environmental impact of clothing.

However, there was uncertainty among the interviewees whether consumers are ready to pay for recycled materials or not. It was mentioned that for example recycled cotton has often lower quality than regular cotton. One interviewee also doubted that consumers will drastically change their buying behaviour in the future as people still want to get new clothing and update their look. There was still hope for the next generations as they may be educated to buy more expensive and durable clothing at school. Meanwhile, companies need to try to utilise the materials that have already been produced.

> "…I don't believe that consumers will change their consuming behaviour a lot as people want new clothes and they want to update their own look and there are these fashions…" – Interviewee 12

There were concerns related to the recyclability and length of circulation of textile materials. This was related to the quality of the clothing that are currently being recycled as in Finland the quality of the materials is relatively low, according to one interviewee. Additionally, the way consumers use and take care of their clothing affects the quality of recycled clothing. Thus, consumers should be more aware of the issues of textile industry. That is a challenge for consumers to not buy lower quality clothing pieces to increase the quality of the recycled material.

5.4.3 Responsibility

The interviewees had differing outlooks on who has the responsibility in the transition from linear economy to CE. It was stated that to expedite the transition there should be support from the government and as many operators as possible should take part in the process. It was mentioned that collaboration between multiple stakeholders such as universities, government, and companies is needed. It was also stated that the EU directive of textile collection is a great regulation which forces stakeholders to improve their operations. Many emphasized that the whole textile industry has the responsibility to implement and support CE. However, the change should be supported and funded by the policy makers. It was stated that the policy makers should decide how resources are used in the development of fibre recycling and who supports it financially. If the responsibility is given only to companies producing the clothing, the change is going to be slow.

> *"In my opinion, all the operators in the industry should have the responsibility but also policy makers should have responsibility in deciding whether resources are navigated for example to fibre recycling and who will develop it and who will give financial resources."*
> *– Interviewee 8*

It was also emphasized by some interviewees that as they are a smaller company it is not possible for them to try to solve the problem of textile recycling themselves. As CE and recycling are associated with a lot of technical aspects, a smaller company does not have the resources to make the change. Additionally, regarding for example elastane recycling it was explained that there is not much a smaller company can do besides hoping that someone finds the solution. It was already stated that it would be more sensible for a bigger operator to arrange textile recycling rather than having smaller companies collecting the textile and collaborating with another operator with recycling the material. One interviewee also highlighted that in different projects in Finland that support the shift from linear economy to CE do not include enough bigger textile companies. Smaller companies are more likely to be part of these projects. It was also noted that the smaller companies can be a part of the innovation process to promote CE but they should not invest their resources too much as the smaller companies should not try to find the solution themselves.

Some interviewees recognised that textile companies have the responsibility in the transition. It was stated that companies should aim to produce more sustainable collections and products. Moreover, companies should work as an example to other stakeholders. It was also mentioned that it is a good question to ask who would take responsibility of the practicalities of the transition. Companies should be an active participator of the process and have responsibility to return clothing back to the circulation. In the meantime, there should be a fund for the companies from government to support the companies. One outlook was

that CE implementation should not require companies to make vast investments. However, it was considered that the companies are not alone as they have typically a large stakeholder network which should work with them and have the same goal in CE implementation.

It was also highlighted by the interviewees that the production of clothing is not typically in Finland anymore. It makes it harder for the companies to have an impact on the processes in the production countries as it requires changes in the legislation in the production country. Thus, there should be collaboration between countries as it does not have a big enough impact to only improve operations in Finland. Additionally, it was mentioned that in Finland and in other Northern countries consumers are generally more aware of the negative impacts of the textile industry compared to consumers in Southern Europe.

One interviewee mentioned that companies and consumers both have the responsibility to promote CE. Another point was that there should be pressure from the consumer level to companies. Additionally, companies should push consumers to change their buying behaviour and make the right choices. Consumers can also be part of the process by buying more sustainable clothing. There was also hope that society would become more receptive to CE and would help the transition by understanding what are the positive aspects that are brought by CE.

6   DISCUSSION

In this chapter the findings of this thesis are discussed in the perspective of the literature review presented in Chapters 2 and 3. The research findings are addressed in relation to the research question and sub-questions of this thesis. The aim of this thesis is to learn and understand what perceptions Finnish textile companies have in relation to CE. Additionally, this thesis seeks what challenges and opportunities the companies have experienced through the implementation of CE. Finally, this thesis explores how Finnish textile companies perceive the future of CE. The findings of this thesis suggest directions which will be helpful in future development and implementation strategies of CE.

6.1   Circular Economy implementation basis on production

The findings of this thesis suggest that the companies participating in this thesis comprehended CE more as reusing and recycling and reducing had less emphasis. The definition of CE given by the Finnish textile companies participating in this thesis have same key themes as the definition by Ellen McArthur Foundation (2012). The goal of CE, according to Ellen McArthur Foundation (2012), is to replace products' and services' end-of-life concepts by restoring resources, using renewable energy, avoiding toxic chemicals, and eliminating waste. The companies in this thesis focused in their definitions on restoring resources and mostly on eliminating waste. Kirchherr et al. (2017) also states that some scholars define execution of CE simply as recycling and some define it as reducing, reusing, and recycling. The 3R's principle (Ghisellini et al., 2016) is not fully comprehended by the interviewees as there was less emphasis on reducing compared to recycling and reusing in the definitions. CE was viewed by many of the interviewees as a cycle where materials circulate. Prieto-Sandoval et al. (2018) have stated that, generally, CE is outlined as a cycle. The findings indicate that the Finnish textile companies are generally aware of the key aspects of CE but the understanding of the concept of CE remained somewhat vague.

The implementation of CE among the companies participating in this thesis focused mainly on creating long lasting products and minimising waste. They also support the reuse of their products and offer their customers guidance on the maintenance of the products. Stahel (2016) describes that CE business models can be defined in two groups. One model supports product reuse and aim to extend product life by maintenance, remanufacturing, offering possibility for upgrades and retrofits. The companies in this thesis mainly fall into this category of CE implementation. However, it is clear that the companies are willing to implement the business model which Stahel (2016) also recognises. This business model can turn old products and services into new resources by recycling. At

least one company in this thesis settled to this business model and others may implement practices of this business model as the textile recycling improves and they gain more knowledge.

The interviewees of this thesis expressed that it was easier to adopt and implement CE operations related to production rather than closing the loop. Ormazabal et al. (2018) discovered similar results in their study among Spanish SMEs. Their study suggested that it is easier to adopt principles and measures that are related to supplier and sources selection rather than operations addressing closing the loop. Unlike in Ormazabal et al.'s (2018) study suggests, in this thesis the companies recognised that implementation of CE would increase their profitability and sustainability. However, it is important to note that the study by Ormazabal et al. (2018) addressed willingness of implementing CE among construction sector with high limitations regarding implementation of CE in the use phase. This comparison still creates a question on whether the differences between the results stem from differences in the two industries or two countries.

Different PSS business models were not widely implemented among the companies participating in this thesis. This is interesting because PSS business models have been considered to work as a great instrument to foster sustainability (Tukker, 2004), and the companies participating in this thesis identified themselves as sustainable. Tukker (2004) recognised three types of PSS which are *product-oriented services, use-oriented services*, and *result-oriented services*. Some product-oriented services such as offering advice on the use and maintenance of the product can be recognised among the companies participating in this thesis. However, further applications are not implemented. It was mentioned among interviewees that some use-oriented services such as clothing libraries have been considered. This is encouraging as the conditions of PSS modes in Finland have been considered favourable in the literature (Armstrong et al. 2015).

Many of the companies have implemented CE practices into their operations such as selling excess materials to customers which reduces textile waste. These practices have been promoted to consumers. Urbinati et al. (2017) have proposed a taxonomy of four modes in adopting principles of CE. The taxonomy is used to evaluate the level of CE adoption process among different companies. Most of the companies participating in this thesis cannot be placed in only one mode of the taxonomy as some of the operations of the companies are implementing *The Full Circular* mode and some remain linear. Additionally, CE adoption has not been implemented into all the operations of the companies which indicate them remaining as linear. One company participating in this thesis can be defined as *The Full Circular* fully as the company was founded with CE in mind from the very beginning which is adopted both internally and externally. This proposes that most of the companies in this thesis are starting to implement CE practices into their operations, but they have not been able to fully harness the concept of CE.

It was evident among the interviewees that there was knowledge on which materials may not be suitable for recycling even though there was a general uncertainty around the concept of textile recycling in Finland. For example,

elastane was recognised as a fibre that can affect the recycling processes. However, the role of design process and designers in relation to closed-loop textile recycling was not recognised in this thesis. Karell and Niinimäki (2019) highlight the importance of these roles in their study. Additionally, they indicated that designers have a limited ability to make decisions supporting closed-loop textile recycling. This statement can be confirmed by this thesis as the companies in this thesis lacked knowledge on the process of textile recycling in Finland. It is interesting that the link between designers and textile recycling was not particularly recognised among the interviewees even though the literature highlights the importance. However, one interviewee stated that availability of certain materials that companies are used to using now may be limited in the future due to COVID-19 outbreak. Karell and Niinimäki (2019) have predicted that as technologies and knowledge evolve the use of certain fibres, details and blends may become forbidden in the future limiting design choices. Arponen et al. (2014) also states that the scarcity of natural resources will make prices of raw materials go up and will make them harder to acquire. Even though the reasoning behind the limitations to the use of certain fibres are different among the interviewee and Karell and Niinimäki (2019) it is interesting that the limitations are acknowledged.

6.2 Importance of sharing information

The findings of this thesis display that the companies participating in this thesis recognise multiple challenges in the transition and implementation of CE. The companies expressed that there is a lack of reliable information around recycling and CE implementation for them to utilise. This included mostly actions towards closing the loop, which companies considered challenging to accomplish without adequate guidance. It was also highlighted that the current infrastructure and for example machinery complicate the transition to CE as updating machinery would involve large investments. There were also concerns towards consumers buying behaviour in future as they may not be ready to pay for recycled fibres due to their lower quality. Additionally, it was questioned whether consumers would consume less textiles in future as buying new clothing and updating their look will most likely be desirable in future as well. Lastly, there was hope that there would be more policy signals and funding supporting the transition towards CE. These results may indicate that the companies in this thesis considered that they were alone with the problems of textile recycling and therefore had a feeling that they cannot have an impact without support. These presented challenges are similar to the challenges that were identified by European Commission (2014) which included the lack of awareness, knowledge, or capacity by companies; current systems and infrastructures locking economies in linear model; prices not reflecting the true cost of products, and not having strong and consistent enough policy signals for the transition towards CE (European Commission, 2014).

The companies participating in this thesis have understood that minimizing waste is a crucial part in CE implementation and all of the companies have taken measures in reducing the textile waste through for example minimizing cutting waste and discovering other ways to utilise excess materials instead of disposing them. Textile waste is one of the key challenges that textile and clothing industry faces during the transition from linear economy to CE, according to Koszewska (2018). She indicates that textile waste handling faces challenges in minimizing waste streams.

In this thesis one interviewee emphasized that the knowledge and interest on production of different fibre combinations and how items can be designed to be recyclable should not rely on the interest and expertise of only a few designers. Rather, the information should be commonly known among designers. This is related to Karell and Niinimäki's (2019) study in which they state that knowledge in textile sorting technology and material knowledge in relation to different recycling methods is needed. Karell and Niinimäki (2019) indicated that to successfully close the loop in textile recycling, dialogue between recycling, sorting, and design is required. It was explained that designers' knowledge should be extended beyond processes and practices which only they are part in. The results of this thesis indicate that in Finland dialogue between designers, recycling and sorting needs improvement as already stated in Chapter 6.1.

6.3   Circular Economy creating positive cash flow

The findings indicate that the companies participating in this thesis recognise benefits related to the implementation of CE. All the companies had discovered that the CE practices that they had implemented generated positive cash flow. The new business models reached new customer segments as well as in some cases improved the image of the company. One company had identified a new possible customer segment that they could reach by creating a new business model related to CE. Additionally, the COVID-19 outbreak expedited the use of excess materials for one company as they recognised a new business opportunity by making face masks. The benefits recognised by the companies go hand-in-hand with the ones identified by Ellen McArthur Foundation (2015). They have estimated that by the year 2030 Europe could create a net benefit of €0,9 trillion more by implementing CE than what the current linear model generates. They also state that CE would be beneficial to companies and organizations by creating new profit opportunities, reduce volatility and create more security to supply, create demand for services, and improve customer interaction and loyalty.

There was also interest among the interviewees in offering clothing library or renting services to their customers. However, none of the companies participating in this thesis had adopted such services yet. Armstrong et al. (2015) have discovered that there is preliminary interest of PSS, in which clothing libraries

also include, among Finnish fashion-oriented women across wide range. Nevertheless, they found that Finnish consumers have most interest particularly towards clothing swaps, take-back services, and consultation. The companies in this thesis expressed interest in providing services that would receive old and used clothing pieces from their customers and some companies had already implemented such services.

6.4 Role of collaboration in the future of Circular Economy

All the companies participating in this thesis agreed that CE is a crucial part of the future of textile industry. It was mentioned that there is no other option but to expect CE to be in the core of textile industry in the future. Moreover, there was confidence among the interviewees that fast fashion model will be dispensed from textile industry soon. Arponen et al. (2014) have stated that countries that are the first ones to shift their linear model to CE will have the biggest financial benefits. They add that the countries will be able to create more jobs, solutions for exporting, and increase their equity ratio in terms of raw materials. This in encouraging considering the findings of this thesis as the interviewees saw the transition from linear economy to CE as crucial in the future.

The findings of this thesis suggest that Finnish textile companies highlight the importance of collaboration and information sharing across different actors. It was found that most of the companies thought that the whole textile industry has the responsibility to implement CE. On the contrary, a study by Staicu and Pop (2018) found that there is a low level of interaction between actors in CE and textile and fashion industry. They elaborate that each actor only sees the world with their own business agenda in mind, resulting low interest for what other industry actors are working on. The interviewees in this thesis emphasized that the information on CE and textile recycling should be shared more and be more accessible for companies. Staicu and Pop (2018) also state that collaborative dialogue would naturally move the awareness from individual interests to group and community interests which would motivate to stay connected and collaborate to solve problems. Stahel (2016) highlights the importance of future innovations in relation to CE which are needed at social, technological, and commercial levels. In addition, he emphasizes that communication and information strategies are crucial in raising awareness of responsible products. It is encouraging that both the findings of this thesis and the literature highlight the importance of collaboration between different actors of CE.

The interviewees of this thesis addressed concerns towards the current textile recycling network in Finland. Many stated that the responsibility of the CE implementation and textile recycling is spread among multiple stakeholders and requires collaboration. It was highlighted that single operators, especially smaller companies, have limited power to influence the current system. To increase the rates of textile recycling and reuse of textiles in Finland, vast changes

within the current system are needed in addition to engagement of all the stake-holders in the textile industry, according to Dahlbo et al. (2017) which support the insights of the interviewees of this thesis. Dahlbo et al. (2017) also state that textile collection needs more comprehensive networks for collection from existing as well as new operators. Moreover, they indicate that the promotion of waste prevention and reuse of clothing requires that companies produce more long-lasting products as well as educating consumers to reduce their consumption of natural resources. The companies participating in this thesis stated that they strive to produce clothing pieces that last time and wear, which results in less textile waste. Judging by the findings, the companies are already largely implementing measures that promote waste prevention and reuse of clothing. However, more knowledge on the recycling systems is needed to harness the full potential of these measures.

7   CONCLUSIONS

The final part of this thesis presents the aim of the thesis shortly and analyses the main contributions from this thesis to Finnish textile industry. Moreover, the trustworthiness of this thesis is discussed as well as the limitations. Finally, suggestions for future research taking account the findings and limitations of this thesis are given.

7.1   Takeaways from the thesis

This thesis explored the perceptions that Finnish textile companies may have in relation to CE implementation. In addition, the challenges, and advantages that Finnish textile companies have experienced during their process of transitioning from linear economy to CE were examined. Finally, this thesis analysed the outlooks of the future of CE from Finnish textile companies' perspectives. The concept of CE in relation to textile industry in Finland has not been touched in the literature profoundly. As transitioning from linear economy to CE is a crucial current trend it is important to examine textile industry's outlooks on the transition process. Thus, this thesis provides insights on what hindering factors affecting CE implementation Finnish textile companies are experiencing and how they can be supported in the transition process from linear economy to CE. The results of this thesis give important knowledge and tools for different operators in the Finnish textile industry to help expedite the transition from linear economy to CE.

     The results of this thesis show that the employees of the Finnish textile companies participating in this thesis have a good general understanding of the concept of CE. They focused their definitions of CE mostly on reducing waste and restoring resources. Moreover, in their definitions, concepts of recycling and reusing materials recurred. Additionally, CE was described as system that circulates materials. These definitions reflect the ones that are presented by the literature of the concept of CE. Thus, judging by the results of this thesis it can be argued that Finnish textile companies participating in this thesis have a similar understanding of CE as literature presents. These results are encouraging and propose that smaller companies in Finnish textile industry are aware of the concept of CE. This creates favourable conditions for promoting different CE operations and practices for the companies.

     Finnish textile companies have focused their CE operations mainly on their existing production procedures and reducing waste, according to the results of this thesis. These operations were for example prolonging the lifetime of products and reducing cutting waste from the production. Operations aiming to close the loop are considered generally harder to implement. It was expressed that

without adequate guidance, implementing practices closing the loop were considered particularly challenging for the companies. To achieve circular operations, it is essential to provide Finnish textile companies tools that help them to create practices and operations that aim to close the loop of their products' life cycles.

Multiple challenges in implementing CE were recognized by the companies participating in this thesis. There was a distinct lack of reliable information on CE and recycling which would be easily accessible for the companies. The interviewees expressed that the information available is not clear which creates confusion. Information on for example the ways of how different fibres and fibre combinations can be recycled were considered unclear. It was also expressed that different possibilities of CE were not clear for most of the interviewees which was a result of unclear information available. Some interviewees admitted that they are not aware of all the possibilities of how used materials can be utilised after recycling. This presents an unsettling question of whether the companies can create and design products that are recyclable in the future? Creating more education on recycling and gathering information on recycling in Finland into one reliable source would support the companies in their process of implementing CE. It should also be assessed whether the current education of designers addresses the importance of designing recyclable products or not.

The interviewees of this thesis also highlighted that the infrastructure and machinery related to textile recycling hinder the transition from linear economy to CE as updating them would require large investments. The interviewees hoped that in future there would be funding available supporting the transition from linear economy to CE. Moreover, it was brought up that the government should take responsibility creating policies that support the transition. It was expressed that the companies would need support in the future to implement CE practices instead of trying to find solutions by only themselves.

The results of this thesis highlight that the Finnish textile companies are committed and interested in transitioning from linear economy to CE. They recognise the potential financial benefits that CE would bring to their business. This is demonstrated by the fact that all the companies participating in this thesis had already generated profits from implementing CE operations. There is also a clear interest to know how other operators have developed their business in the directions of CE and to collaborate with other businesses and actors. The role of collaboration in relation to CE will increase in the future which should be considered by all the operators in the textile industry. Many interviewees expressed that the responsibility in the transition from linear economy to CE does not fall to individual companies and operators but rather the whole textile industry. The results also indicate that the companies recognise themselves having limited possibilities to have an impact on the transition. This also highlights the essential role of collaborations between different actors in the future of CE. The companies also expressed that they are currently waiting for a breakthrough in textile recycling in Finland. They are hopeful, as there are currently multiple projects in Finland tackling this problem.

The transition from linear economy to CE poses multiple different challenges to Finnish textile companies including uncertain information about recycling, lack of trust in the current textile recycling system, and lack of communication and support between different operators. These challenges need to be resolved in the future to help companies to transition their businesses to CE. Nevertheless, the positive effects of CE are recognised among Finnish textile companies and CE is considered being able to create profitable new business models. With collaboration and support, the future of Finnish textile industry looks bright and circular.

7.2   Trustworthiness & limitations of the study

This chapter evaluates the trustworthiness and presents the limitations affecting this thesis. Quality and trustworthiness assures the readers that the study is scientific in its nature, according to Eriksson and Kovalainen (2008). Lincoln and Guba (1985) include four aspects in their concept of 'trustworthiness' (as cited in Eriksson & Kovalainen, 2008). These aspects are *credibility*, *transferability*, *dependability*, and *confirmability* (Eriksson & Kovalainen, 2008).

Credibility evaluates whether the author of the study has familiarised themselves with the topic and whether the data collected is sufficient to merit the claims of the study (Eriksson & Kovalainen, 2008). Parkkila et al. (2000) also describes that credibility evaluates whether the interviewees have been documented sufficiently and the trustworthiness of the data (as cited in Tuomi & Sarajärvi, 2018). Credibility also evaluates whether the observations from the results are logical and whether other researchers can have similar interpretations while analysing the same data as in the study in question (Eriksson & Kovalainen, 2008). The process and steps of this thesis have been described in depth in Chapter 4. The research methods and chosen type of data analysis have been rationalized and kept logical with the research question of this thesis in mind. The interviewees of this thesis have been selected with diversity and suitability in mind which indicates that a vast range of contributors were included in the studied sample of this thesis. Moreover, the interviewees as well as the lengths of the interviews have been described.

Transferability deals with a responsibility to show a degree of similarity between other studies and the study on question (Eriksson & Kovalainen, 2008). The goal is to establish a level of connection between the studies. Transferability does not have the idea of replication but pursues to find similarities in other research contexts (Eriksson & Kovalainen, 2008; Parkkila et al., 2000 as cited in Tuomi & Sarajärvi, 2018). This thesis has sufficient transferability of the results to other studies. For instance, the existing literature addressed similar questions in the context of general CE implementation as well as CE implementation in global textile industry. As the scope of this thesis focused on Finnish textile industry the

results can be compared to similar studies in other countries if such studies are organised in the future.

Dependability is concerned with responsibility to offer information on the process of the study has been documented, logical and traceable (Eriksson & Kovalainen, 2008). Niiranen (1990) states that dependability of a study is ensured when an external individual verifies the process of the study (as cited in Tuomi & Sarajärvi, 2018). All the data of this thesis have been offered to the supervisor of this thesis in addition to the author. The supervisor observed and commented the thesis during the whole research process increasing the dependability of this thesis. The process of this thesis was also supported by a thesis group which included five students in total who were working on their own studies. Additionally, as this thesis was organised in collaboration with CICAT2025 project, the dependability of the interviews was supervised by in total of three researchers.

Conformability refers to the idea that the interpretations and data of the study are not only imagination which means that the findings and interpretations of the study are linked to the data (Eriksson & Kovalainen, 2008). Parkkila et al. (2000) defines that to ensure confirmability a neutral individual evaluates the data and interpretations of the study (as cited in Tuomi & Sarajärvi, 2018). As previously mentioned, the process of this thesis has been commented and observed by a supervisor who was provided by the University of Jyväskylä. Moreover, the methodology and the steps of this thesis are described profoundly in Chapter 4. The data of this thesis was transcribed by external company that specialises in transcribing recorded interviews which increases the trustworthiness and neutrality of the transcribing process. Finally, this thesis is fully available for anyone to read and evaluate.

This thesis has its limitations. The companies participating in this thesis were smaller operators in Finnish textile industry. Including a bigger operator would have made the results reflect the perceptions towards CE more comprehensively. This would be an interesting way of approaching the topic as one of the interviewees stated that bigger textile companies are not participating in projects that promote CE in Finland. However, due to the COVID-19 pandemic contacting especially bigger companies turned out to be challenging as the companies were too occupied to answer to emails and, therefore, bigger operators could not be included in this thesis. The sample of the companies participating in this thesis is rather minor which also reflects the difficulties to gain interviewees. Having more companies included in the thesis would increase the diversity of the sample. Nevertheless, the smaller number of companies was compensated with the number of interviewees. In total 16 interviews were conducted, and the interviewees included multiple different positions from the companies to create diverse data sample.

Another limitation of this thesis is the fact that it was conducted in the context of Finnish textile industry. Having companies for example from another Nordic countries or Europe would have as well increased the diversity of this thesis. Though, such modification would have changed the scope as well as re-

search question of this thesis. As the companies participating in this thesis operated in Finnish textile industry, the results can only be utilised and interpreted in Finland.

7.3 Future research

As the scope of this thesis is only limited to Finnish textile industry there are multiple potential and interesting possibilities for future research. The perceptions of CE implementation can be studied among other countries such as Sweden, Denmark, and Spain. These countries are suggested as all the countries are known from multiple textile and fashion companies. Comparisons between Sweden and Finland would also interesting as they are geographically close to each other. As Ormazabal et al. (2018) discovered interesting results in CE implementation among construction sector, it would be valuable to gain information whether a study within Spanish textile industry gave similar results to this thesis. Staicu and Pop (2018) indicated in their study that actors in textile industry are not interested in other operators' progress in CE which was in contradiction with the results of this thesis. Therefore, more comprehensive research on the topic of collaboration and level of interest in collaboration on CE within other countries would offer interesting perspectives.

Additionally, as this thesis does not include bigger operators in the Finnish textile industry a study with a larger data would be justifiable in future research. To test the results of this thesis a quantitative study could also be conducted which would allow the data sample to be larger and the results to be generalized to Finnish textile industry. Moreover, researching the perceptions of CE implementation within other industries in Finland would indicate whether companies in different industries experience similar challenges and advantages in the process as textile industry.

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APPENDIX 1   List of interview questions

INTERVIEW QUESTIONS – TEXTILE INDUSTRY IN FINLAND (Translated from Finnish)

1. General information
   a. Who are you and what do you do for work?
   b. How is sustainability related to your work? Does sustainability show in your life outside of work as a private consumer?
   c. How would you define the concept of sustainability – what does it mean to you?
   d. How would you define the concept of circular economy – what does it mean to you?

2. Sustainability at own work
   a. How do you work sustainably in your work? Examples?
   > b. What works well?
   > b. Where do you have challenges? Personal challenges? Organizational challenges? Why?
   b. How do your co-workers work sustainably in their work? Examples?
   > a. What works well?
   > b. Where do they have challenges?
   c. Are there any differences in how you and your co-workers work sustainably? Examples?
   d. How do you work sustainably together? Examples?
   > a. What works well?
   > b. Where do you have challenges? What kind of challenges? In which situations? Why?

3. Sustainability practices in organization
   a. How do you implement sustainability in your organization's operations?
   > a. Goals? Measures?
   b. How is environmental responsibility implemented? How have you succeeded? Where is room for improvement?
   > a. Examples of environmental responsibility (recycling, micro plastics prevention, climate change prevention)
   c. How is social responsibility implemented? How have you succeeded? Where is room for improvement?
   > a. Examples of social responsibility (salaries, work times, taking care of the employees, employees in Finland, employees outside Finland,…)
   d. How is economical responsibility implemented? How have you succeeded? Where is room for improvement?
   > a. Examples of economical responsibility (tax and salary payments, charity donations,…)

4. Circular economy practices in organization

 a. How does circular economy practices show in your organization's operations? Can you give any examples?

 b. Have you recognized any benefits from implementing circular economy practices in your organization?

  a. If yes, what benefits?

  b. If no, can you tell why that might be?

 c. Has implementing circular economy practices been easy in your organization?

  a. What challenges have you faced in the implementation process?

 d. How have you succeeded in circular economy? Where is room for improvement?

 e. Do you think that circular economy will be in an important role in improving sustainability of textile industry?

  a. If yes, how?

  b. If no, why?

5. COVID-19

 a. How does the ongoing pandemic affect sustainability work in your opinion?

 b. What kind of long-term changes you believe evolves due to the pandemic? (sustainability, remote work, online stores)

6. Ending

 a. Do you have anything to add? Is there anything else we should talk about?

<div align="center">Thank you!</div>